Industrial Pollution Prevention Planning

Meeting Requirements under the New Jersey Pollution Prevention Act

The New Jersey Department of Environmental Protection
Office of Pollution Prevention and Permit Coordination

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Note: Some tables, inserts and footnotes in the original published document have been omitted in this version.

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INTRODUCTION

Why Pollution Prevention?

Across the country, businesses are discovering that responsible environmental management goes hand in hand with financial growth. Pollution from industrial facilities is a problem, but it can also signal opportunities for profitable investments in **pollution prevention**. Pollution prevention reduces unwanted hazardous substances at their source. Chances are, it can reduce pollution at your facility, *while improving the bottom line*.

The Features of Pollution Prevention

Pollution prevention has a number of unique features. Pollution prevention

always:

- is preventive, because it avoids pollution;
- addresses all environmental media;
- reduces long-term liabilities;

usually:

- is profitable (often highly so);
- reduces consumer and worker risks;
- increases product yield;
- results in improved product quality;
- is supported by customers and the public;

often:

- is fast and easy to implement;
- requires little or no capital investment; and
- results in reduced energy and/or water consumption.

Several studies have been done of businesses that are experimenting with pollution prevention already. They indicate that a pollution prevention program offers nearly every industrial facility the opportunity to reduce its environmental impact while bolstering its competitiveness and growth. In New Jersey, facilities that have implemented pollution prevention have already realized positive returns on their investments.

The Barriers to Pollution Prevention

Researchers have also found that despite its benefits, pollution prevention is not widespread in any industry group. Apparently, there are barriers to this promising approach that keep companies from realizing the prevention potential at their facilities. The barriers do not appear to be technical, economic, or regulatory. Instead, they are usually internal to companies, as part of the corporate culture. Frequently identified barriers include:

- a lack of a clear definition and focus on pollution prevention;
- a belief that current process operations are already optimally efficient;
- a fear that any change will affect operations adversely;
- a concern over customer acceptance;
- a lack of a pollution prevention policy and goals;
- an absence of senior management oversight of the policy;
- a failure to involve production process management in overseeing the policy;
- a lack of incentives for employee involvement;
- a lack of knowledge about sources of hazardous substance loss;
- a failure to account for the total costs associated with a production process; and
- a lack of data to track progress toward pollution prevention goals.

Traditional government environmental quality and pollution control programs contribute to internal corporate barriers by focusing on end-of-the-pipe results. These programs have made giant strides in improving environmental quality, but have led to a regulatory framework where industrial environmental protection is usually designed to manage air, water and hazardous wastes *only* at the end-of-the-pipe. One outcome of this is that managers are wary of new approaches like pollution prevention because they see such changes as a threat to their compliance status.

To help overcome these problems and to encourage pollution prevention in New Jersey, the New Jersey Pollution Prevention Act (the Act) was enacted in August of 1991, the result of a combined effort by the Legislature, the Governor, industry, environmental groups, and the New Jersey Department of Environmental Protection and Energy (the Department).

In contrast to the many pollution control statutes enacted by Congress and state legislatures which focus on treating *releases*, the Act encourages the identification and implementation of techniques that minimize the need to use and generate hazardous substances in industrial activity. The Act directs the focus of government programs away from end-of-the-pipe clean-up methods that deal with waste after generation toward pollution prevention as the best method for achieving environmental goals. To help accomplish this objective, the Act established an Office of Pollution Prevention within the Department to work with the Department's other environmental programs, to create incentives for pollution prevention, and to develop rules to implement the Act. These rules, entitled the Pollution Prevention Program Requirements (the Rules) , took effect March 1, 1993. They are available from the Office of Pollution Prevention by calling 609/777-0518.

The Rules are designed to overcome the barriers to pollution prevention that exist at industrial firms. Because many of these barriers are institutional, the Rules' approach is to have firms work through a planning process to help them discover pollution prevention opportunities at their facilities. Through this process, firms will locate their hazardous substance use and see how hazardous substances become pollution. They will also determine whether choosing pollution prevention can save them money.

Better management of hazardous substances is one side of the pollution prevention coin. The other is profitable investments for business. Total cost assessment is a managerial accounting tool which is briefly explained in this guidance document. It directs attention to the less obvious labor, storage, testing, monitoring and liability costs which result from using and generating hazardous substances. Total cost assessment assigns those costs to production processes and products. Accurate cost assignment can demonstrate the profitability of pollution prevention investments. Total cost assessment is a decision-making tool that systematically isolates the components of overhead, showing whether these costs are reducible through investments in pollution prevention. In short, total cost assessment can show a facility how its inefficient use of hazardous substances is like money down the drain.

Twelve Steps to a Successful Pollution Prevention Program

In this report, we have identified twelve steps that can help your firm identify and achieve pollution prevention opportunities. These steps can be used by almost any firm producing or using hazardous substances. Firms with an effective pollution prevention program already in place may be familiar with several of these steps. Companies without such a program are likely to find many opportunities as they build this system into their operations.

The twelve steps presented in this document are:

1. Understand pollution prevention.
2. Establish a pollution prevention policy.
3. Choose a leader and establish a pollution prevention team.
4. Identify processes and sources.
5. Group similar processes and sources.
6. Inventory use and nonproduct output (Part I of a Plan).
7. Target production processes and sources for further analysis.
8. Find and analyze pollution prevention options (Part II of a Plan).
9. Develop numerical goals.
10. Summarize your planned actions.
11. Track and report your progress.
12. Update your planning documents.

This document approaches each step assuming that facilities are starting their pollution prevention program from scratch. Your firm may have already initiated a program and may be on the way to achieving significant amounts of pollution prevention. In that case, there is no need to " re-invent the wheel" by repeating all of these steps. If your firm has an effective pollution prevention planning program, you will find that you are likely to have fulfilled most of the requirements of the NJ Pollution Prevention Act. You will, however, have to summarize your plans and goals and report your progress toward them.

The twelve steps are presented as independent activities to be performed sequentially. Realistically, your firm may be involved with several activities at once, or may return to earlier steps based on information uncovered in later ones. Pollution prevention is an iterative and ongoing process, so use this document as a guide to weave pollution prevention into your business's management and environmental strategies.

Planning Under the New Jersey Pollution Prevention Act

Because every facility is different, the same pollution prevention opportunities will not apply universally. Even for firms subject to the Rules, there is no set type or level of prevention that must be achieved. The Act requires facilities to develop Pollution Prevention Plans to show that there are business opportunities in pollution prevention, but it does not mandate that facilities implement any of them. With the exception of Plan Summaries and Plan Progress Reports, which must be submitted to the state in a specified format, your firm can meet the planning requirements using the methods and management approaches that best fit the culture of *your* firm.

Plans, and Plan Summaries, must be completely revised by July 1 of the fifth year after initial preparation or submission and by July 1 of each fifth year thereafter. As explained in later chapters, reports describing each facility's progress in achieving pollution prevention must be submitted annually by July 1 after the initial submission of the Pollution Prevention Plan.

This guidance document is designed to unite the benefits of pollution prevention with the requirements of the New Jersey Pollution Prevention Act and the Rules. It should help any facility to find pollution prevention opportunities, and includes specific information and guidance for those preparing a Pollution Prevention Plan to comply with the New Jersey law.

Covered Facilities and Chemicals

Facilities that are required to file at least one Form R under the federal Emergency Planning and Community Right-to-Know Act (EPCRA) statutes must complete a Pollution Prevention Plan in New Jersey. There are two groups of facilities, differentiated by Standard Industrial Classification (SIC) codes, which begin reporting on their pollution prevention planning at different times.[4]

- Covered facilities in the following five Standard Industrial Classification (SIC) codes should have prepared a Plan and submitted a Plan Summary by July 1, 1994: 26 (paper products), 28 (chemical and allied products), 30 (rubber and miscellaneous plastics), 33 (primary metals), and 34 (fabricated metals). The first Progress Report was due on July 1, 1995. The next five-year Pollution Prevention Plan must be prepared and the Plan Summary submitted by July 1, 1999.

- Covered facilities having manufacturing SIC codes 20 - 39 other than the five listed above should have prepared their Plan and submitted their Plan Summary by July 1, 1996. The first Progress Report for this group of facilities was due on July 1, 1997. The next five-year Pollution Prevention Plan must be prepared and the Plan Summary submitted by July 1, 2000.

- Under the latest federal TRI rules (40 CFR Part 372, May 1, 1997), facilities in the following additional SIC codes are subject to the TRI reporting requirements, and thus to the New Jersey Pollution Prevention Planning Rules:

  1.SIC codes10 (metal mining) and 12 (coal mining), except for facilities in the following industry codes: 1011 (iron ore mining), 1081 (metal mining services), 1094 (uranium-radium-vanadium ore mining), and 1241 (coal mining services). Any facility having SIC codes 10 or 12 must refer to 40 CFR 372.28 for applicable exemptions.

  2. SIC codes for electric utilities, 4911, 4931 or 4939 (each limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce). These codes refer specifically to electric services (4911), electric and other services combined (4931) and combination utilities, not otherwise classified (4939).

  3. SIC code for commercial hazardous waste treatment, 4953 (limited to facilities regulated under the hazardous waste management standards of the Resource Conservation and Recovery Act, Subtitle C, 42 U.S.C. section 6921 et seq.).

  4. SIC codes 5169 (chemical and allied products- wholesale),

5171 (petroleum bulk terminals and plants (also known as stations) - wholesale) and 7389 (solvent recovery services -limited to facilities primarily engaged in solvent recovery services on a contract or fee basis).

Any facility having these codes must refer to 40 CFR 372.22 (b) for applicable criteria. Covered facilities having these codes must prepare their Pollution Prevention Plan with 1999 as base year and submit their Plan Summary by July 1, 2000. The first Progress Report for these groups of facilities is due July 1, 2001.

The **chemicals** that must be considered in pollution prevention planning are those listed under SARA 313 for Toxic Release Inventory (TRI) reporting under EPCRA. This list can be found in [Appendix A]. Any TRI chemical used, processed, or manufactured in quantities greater than given thresholds (10,000 pounds for all but those given for persistent bioaccumulative toxics, PBTs, in Appendix A) is subject to pollution prevention planning and reporting. EPCRA's 25,000-pound manufacturing threshold for Form R reporting does not apply to pollution prevention planning. However, if your firm does not use *any* chemicals in quantities that require the facility to file a Form R, then you are not required to do pollution prevention planning.

Exceptions

There are a few situations that will remove pollution prevention planning requirements from your firm. Chemicals that are *used or manufactured in quantities below annual thresholds* do not need to be considered in a Pollution Prevention Plan. Facilities with *fewer than the equivalent of 10 full time employees* are not required to do pollution prevention planning because they do not have to report under the TRI.

Finally, the *parts of a facility that are dedicated to research and development*, as well as *pilot plant operations*, are exempt from pollution prevention planning and reporting requirements.

The Parts of a Plan

The Act requires that covered facilities prepare three documents. The first is a Pollution Prevention Plan which is kept on site. The specific contents of these Plans are explained by this document in Step 6 (Part I: Inventory Your Sources of Process Losses) and Step 8 (Part II: Find and Analyze Your Pollution Prevention Options). Second, a covered facility must prepare a Plan Summary and submit it to the Department. Finally, facilities must submit Progress Reports annually on a form that integrates pollution prevention information with the Release and Pollution Prevention Reports (formerly known as the DEQ-114) under the New Jersey Community Right to Know Act.

Obtaining Information and Assistance

This document contains an index which should help you find answers to specific questions. *Actions that are required by the Pollution Prevention Program Requirements will be specifically identified as such and highlighted in "Rule Boxes."* Several appendices have been included, which provide extra detail on a number of topics.

There are many places to turn for help with your Pollution Prevention Plan beyond this document. Appendix C contains a list of these sources. You can also get assistance by contacting the Office of Pollution Prevention (609/777-0518) within the Department or the state's non-regulatory technical assistance program, NJTAP, located at the New Jersey Institute of Technology (201/596-5864).

Should you encounter a situation where state regulations prevent you from implementing a pollution prevention option, please contact the Office of Pollution Prevention. Wherever possible, this office will work to overcome such barriers.

CASE STUDY: Introducing a Fictitious Company

To better illustrate the planning process, this document will follow a fictitious company as it develops a Pollution Prevention Plan and Program.

Top Shelf Wallcoverings started its original operation in 1970 with ten wallpaper production lines and 51 employees. Soon after operation began, it became obvious that the facility had excess production capacity. As time went by, however, Top Shelf increased its market share and eventually, in the late 1980's, decided to add four new production lines. The project was completed in 1989 and has proven successful in spite of a difficult economy because the new machines are more efficient than the old ones, making them cheaper to run. As a result of its expansion, Top Shelf hired seven additional workers in spite of a statewide lay-off trend. At present, there are 58 people employed at Top Shelf. The facility can make many different kinds of wallpaper, and can make most of them on each of their production lines. Two of the new lines, however, are dedicated to latex-based wallpaper production.

John Stevens is the owner and president of Top Shelf. His management team includes a Vice President, a Plant Manager, a Sales Manager, and an Environmental Coordinator. The hazardous substances that the firm uses include methyl ethyl ketone, acetone, methyl isobutyl ketone, toluene, and nitropropane. The firm uses each of these substances in excess of 10,000 pounds and files a Form R for their releases every year. Therefore, the facility is covered by the Rules and must prepare a Pollution Prevention Plan that covers every process that involves one of those substances.

STEP 1

Understand Pollution Prevention

Major gains in pollution prevention depend on a clear understanding of what pollution prevention is. To get the most out of a pollution prevention program, your company's leaders need to have a firm grasp of what is and isn't pollution prevention. Then, they should concentrate on making it their first priority in environmental management.

Success in **pollution prevention** depends on understanding what defines this policy and on incorporating practices that promote it into corporate management. A precise definition is necessary because widely different systems have been called pollution prevention and because many different concepts have been given similar names, such as "waste minimization." Programs based on a faulty or fuzzy definition are likely to fall back on traditional, costly, end-of-the-pipe pollution control methods and mistakenly call them pollution prevention.

Pollution prevention is reducing or eliminating the need for hazardous substances per unit of product, or reducing or eliminating the generation of hazardous substances where they are generated within a process. This means minimizing the use and generation of hazardous substances within production processes so they never have the chance to be released into the workplace or environment.

The legal definition of pollution prevention in the Rule refines this basic definition. It assigns boundaries for what methods can and cannot be considered pollution prevention. With a few exceptions (see What Is Not Pollution Prevention, below), the activities a facility undertakes to reduce **nonproduct output** are pollution prevention under the Rule. Typically, these activities fall into one of five categories: substituting hazardous substances with non-hazardous or less hazardous ones; product redesign; production process efficiency improvements; in-process recycling; and improved operation or maintenance. Material substitution and product redesign can eliminate a hazardous substance from a process. Process changes, in-process recycling, and improved maintenance can substantially reduce the need for hazardous chemicals, though they seldom result in the complete elimination of a nonproduct output stream.

These changes will reduce or eliminate the risks that hazardous substances pose to employees, consumers, the environment and human health. When hazardous substances are avoided through prevention, the costs and risks associated with disposal and treatment may never arise. These features make pollution prevention economically and environmentally superior to pollution treatment and disposal.

What Is *Not* Pollution Prevention

Understanding what pollution prevention is *not* can clarify what it is. First, any kind of pollution treatment is not pollution prevention. Second, because pollution prevention operates at the production process level, recycling that takes place outside of a process is not pollution prevention. Third, because pollution prevention reflects improvements in an operation rather than changes in market conditions, if a waste becomes a marketable co-product through shifting market conditions, its reduction is not pollution prevention. Finally, the Rule explicitly states that pollution prevention never increases or transfers risk between workers, consumers, and the environment.

Specific activities that do not qualify as prevention include increased treatment, out-of-process recycling, and disposal. Sometimes these are the only options available, but while they may be appropriate, they can never be pollution prevention. This difference provides a key to distinguishing pollution prevention from other forms of hazardous substance management: a reduction in the amount of a hazardous substance generated is usually considered pollution prevention; dealing with these same materials once they exist, no matter how effectively, is not.

In-Process Versus Out-of-Process Recycling

It is important for your firm to understand the difference between in-process and out-of-process recycling because these two environmental management techniques exist at the boundary between what is pollution prevention and what is not.

In-process recycling **is** pollution prevention. It occurs when a hazardous substance that would otherwise be generated as nonproduct output is returned to a production process using dedicated, fixed, and physically integrated equipment so that nonproduct output and multimedia releases are reduced. Accumulation of material prior to any in-process recycling activity must occur on the same production schedule as the product. These types of recycling systems are more typical for "continuous" processes. Nevertheless, some forms of recycling in "batch" or "campaign" operations are also in-process recycling.

Consider a batch production process which uses cyclohexane as solvent and yields an easily separable product. After the product is separated, the cyclohexane is transferred by hard pipes to a storage tank. After four batches, all the cyclohexane in the tank is transferred via hard piping to a still and is recovered by distillation. The recovered cyclohexane is then piped to another storage tank, from which it is piped back to the original reactor as needed. This activity would meet the definition of in-process recycling.

Certain activities and equipment cannot be part of an in-process recycling system. Containers, such as 55 gallon drums, that are directly handled by workers, cannot be used. Pipe connectors and fittings cannot rely solely on friction or other non-mechanical means. All connections must be fixed (i.e., soldered, bolted, or positively connected in another way).

Out-of-process recycling *is not* pollution prevention. It includes both on-site and off-site activities where nonproduct output is transferred, stored, and recovered for use in processes that are not directly connected with fixed equipment that is physically integrated with the recovery system and the process where the nonproduct output was generated. An example of an off-site activity is sending a chlorinated solvent used in degreasing to an outside vendor who reclaims the material. In that case, the facility's need for the solvent remains undiminished. Likewise, regenerating sulfuric acid off-site and returning it to the facility is out-of-process recycling, because the facility's sulfuric acid needs remain the same. Such recycling is valuable, but it is not pollution prevention.

On-site out-of-process recycling activities include any on-site recycling or reclamation activities that do not meet the definition of in-process recycling. An example is a central distillation process where different solvents are transferred in drums, stored prior to reclamation, and are used in other processes after reclamation.

Out-of-process recycling is an excellent environmental management technique that has many, but not all, of the benefits of pollution prevention. The Department recognizes the importance of out-of-process recycling in meeting the environmental and economic goals of industrial facilities. This guidance document, however, is designed to help companies find pollution prevention techniques before they settle on out-of-process recycling systems. After the opportunities for pollution prevention have been fully investigated and implemented where feasible, out-of-process recycling is the best environmental option.

If, during any part of the planning process, you have any question about whether a new or existing system is in-process recycling, you can contact the Office of Pollution Prevention.

Different Types of Output

There are generally two types of material that leave a process: product and nonproduct output. **Product** is the desired result of a process, to be directly packaged, if necessary, and sold. Processes may have more than one product. Sometimes, this definition is expanded with two other terms to accurately describe what happens at a facility or in the marketplace. **Intermediate product** describes the case of a desired result at the end of a process that requires further work before it can be sold. **Co-product** describes output from a process that is sold only part of the time and that is nonproduct output during the rest of the time.

Nonproduct output encompasses the rest of what leaves a process. Reduction in nonproduct output **per unit of product** provides a consistent year to year measure of progress in pollution prevention. It is a useful measure because it tracks hazardous substances at their source, that is, before out-of-process recycling, storage, and treatment. It also includes fugitive releases.

Reducing the amount of nonproduct output that a production process generates per **unit of product** is one way of measuring progress in pollution prevention. It is a useful measure because it is always determined before out-of-process recycling, storage, and treatment and because it includes fugitive releases. Note that a chemical which is the desired result of a process is still nonproduct output if it leaves the process in any way other than in a product stream, such as in a fugitive release or as a small amount of product lost in a waste stream.

The definition of nonproduct output hinges on what " product" means. **Product** is the desired result of a process, to be directly packaged, if necessary, and sold. Processes may have more than one product. Sometimes the definition of product is not sufficient to describe what happens at a facility or in the marketplace. The Rule defines two other terms to cover these situations. First, the term **intermediate product** describes the case of a desired result at the end of a process that requires further work before it can be sold. The second term is **co-product**, which describes output from a process that is sold only part of the time and which is nonproduct output the rest of the time. A firm can reduce the amount of nonproduct output it generates by finding a market for it and selling it as a co-product, but, by definition, this is not considered pollution prevention.

Environmental Management Hierarchy

The final element of understanding pollution prevention is to see how it fits together with other environmental management techniques. These techniques form a nationally recognized hierarchy for contending with hazardous substances, which categorizes environmental management options as follows (in descending order of importance):

The Environmental Management Hierarchy

Pollution Prevention
Out-of-Process Recycling
Efficient Treatment
Safe Disposal

Therefore, when a manager considers how to cope with nonproduct output, pollution prevention should be the first option on his or her list. Out-of-process recycling is next best and should be considered when viable pollution prevention options run out. Once these possibilities are exhausted, safe and efficient treatment or disposal remain as acceptable options.

The goal of this pollution prevention program is to make pollution prevention the environmental protection system which facilities consider first. The Rule does this by directing industrial efforts to the very top of the environmental management hierarchy. Businesses can do this too, by emphasizing pollution prevention in their corporate decisions and policies. By doing so, companies can expect improvements throughout their operations, accompanied by good news on the bottom line.

New Jersey's pollution prevention program also makes it a goal for the Department to look to pollution prevention first in formulating its rules, policies and individual permit decisions. If businesses and the Department jointly begin to focus their efforts on the top of the hierarchy, pollution prevention can pave the way for establishing a smarter, more efficient and cooperative program for environmental regulation.

CASE STUDY: Top Shelf's President Has a Look at Pollution Prevention

John Stevens, President of Top Shelf Wallcoverings, had been hearing a lot about the possible economic benefits of something called pollution prevention at the trade association meetings that he regularly attended and decided to find out more about the subject. One of the speakers recommended several different references that he could easily obtain. He found out that this was probably not just a passing fad, but might be a helpful approach for his business. He talked the issue over with his management team at their weekly luncheon meeting, and they decided to explore the approach. While Top Shelf management always prided itself on its quality manufacturing process, the company was using several tons of materials on various government hazardous chemical/pollutant lists, and meeting ever more stringent environmental requirements was getting very expensive. In fact, it had been some time since anyone reviewed carefully how these hazardous chemicals were being used at the plant and how waste containing them was being generated. Maybe, they thought, a modest effort at reviewing their use and process losses of these materials would be worthwhile. So they decided to commit the company to one round of pollution prevention planning.

STEP 2

Establish a Pollution Prevention Policy

This Step deals with corporate **pollution prevention policies**. The experience of many firms has proven that a written and formally adopted policy is a key to successfully accomplishing prevention goals. While there are no specific requirements for a written policy statement in the Rules, the owner or operator of a facility must certify that it is the policy of the facility to achieve the goals established in the Pollution Prevention Plan.

An effective pollution prevention effort needs to have top-level corporate commitment. A simple and effective way of demonstrating commitment is by adopting a pollution prevention policy. Policies will differ from company to company. Some firms may have existing policies such as total quality management that pollution prevention should be coordinated with. Nevertheless, there are a number of features that belong in every firm's policy. They should be gathered together in a pollution prevention policy statement.

Contents of a Pollution Prevention Policy Statement

There is a lot to consider when planning the form and content of a pollution prevention policy. Usually, the best policies are simple and straight-forward, but there are several items that should be included. They are:

- A focused definition of pollution prevention and emphasis on it as the firm's primary environmental management option (see Step 1)
- Clear evidence of high level of corporate commitment (see Step 3)
- A statement of the objectives of the policy
- A plan to go beyond compliance
- A commitment to progress
- Accountability for progress (see Step 3)
- A demonstration of appropriate leadership (see Step 3)
- Employee involvement and incentives (see Step 3)

Some additional features to consider include:

- Reasons for the policy;
- Coordination with energy conservation, water conservation, total quality management efforts, and initiatives to reduce the generation of non-hazardous waste (see Appendix D); and
- A description of how progress will be reported (Step 11).

Pollution prevention policies are most effective when they are formally considered and developed to mesh with the firm's overall management style. Notice and review of the policy should follow the same procedures used to disseminate other corporate policies. For example, some businesses use an employee handbook to keep their workers up to date. Others use company newsletters, while still others circulate copies of policy statements at staff meetings. The important point is that everyone at the facility should know that the firm has a strong commitment to pollution prevention.

Policy statements demonstrate to employees and the public that the firm is serious and plans to take action to reduce hazardous substance use, nonproduct output generation, and hazardous substance release. Effective policies clearly identify pollution prevention as the company's preferred approach to environmental management, to be fully explored before recycling, treatment, storage, or disposal are considered.

The policy should explain the company's prevention efforts in terms of continuous improvement in production processes rather than a one-time review of the facility. Your firm might also want to consider including a commitment to cut non-hazardous substances as well as hazardous ones in your policy. Perhaps the policy will relate pollution prevention efforts to other programs such as quality management, water conservation, or energy conservation. Such initiatives have a direct relationship to pollution prevention, often involving the same type of process inspection, organization, and commitment to ongoing progress. Appendix D briefly discusses these concepts. Although pollution prevention should be coordinated with other programs, do not lose sight of the primary importance of reducing the use and generation of hazardous substances.

CASE STUDY: Top Shelf Writes a Pollution Prevention Policy Statement

John Stevens decided to start things rolling by making pollution prevention company policy. He asked the Plant Manager, Sarah French, to help him draft a pollution prevention policy that would supplement their existing corporate policy.

Together, they decided that Top Shelf had a good environmental record, but had never formalized it into a program. After several drafts, they settled on the following as a statement of their pollution prevention policy:

" Top Shelf Wallpaper, Incorporated, is committed to a policy of protecting the environment. Our management and employees are dedicated to and responsible for carrying out this policy. Pollution prevention is a way for this company to take our commitment to the environment beyond permit compliance, by adopting techniques within our production processes that reduce the company's need to use and generate hazardous substances. Therefore, we will work together to implement pollution prevention wherever possible. We will systematically and regularly look for pollution prevention in existing processes and through new process design, new maintenance procedures, and product research. These measures will provide a safer environment for both our workers and our community by reducing hazardous substances in the workplace, in the air, in the water, and on the land."

Anticipating Obstacles to Your Pollution Prevention Policy

Pollution prevention often involves fundamental changes in the way parts of your firm operates. Usually, these changes have surprising benefits that include cost reduction and product improvement. Nevertheless, you may encounter internal resistance during your program's starting phases, beginning when you circulate a new pollution prevention policy. Good planning and creative thinking can overcome such resistance.

Typically, skeptics are concerned that:

New operating procedures may reduce the rate of production— It is unusual for a pollution prevention change to significantly lower the production rate. If this does occur, it may be related to start-up and the production rate may increase as familiarity is gained with the new operating procedures. Finally, reduced operating costs achieved through pollution prevention often overcome losses from a slightly slowed rate of production.

Changes in the product may change customer acceptance— It is often possible, with good research and development, to reformulate a product without significantly changing its characteristics. Working with customers during the development process is one approach to gaining final acceptance. Showing customers how the new product is manufactured in a more environmentally safe manner is often a selling point. Sometimes, an environmentally safer product is requested by consumers.

There are no process alternatives— There are many resources for finding alternatives. Publications are available that present ideas that are specific to certain industries. If you are not sure where to look, the New Jersey Technical Assistance Program would be a good first stop in hunting for alternatives that can work at your facility.

Changes will alter our compliance status— If there is a question as to how a pollution prevention change will affect an existing permit or how it will impact compliance with another law (such as the federal Clean Air Act), call the Department's Office of Pollution Prevention (609/777-0518) for clarification.

You may encounter problems like these as you develop your Pollution Prevention Plan, but they can be overcome with careful planning, analysis, and creative thinking.

STEP 3

Leadership and Staffing

This Step describes the staffing and leadership of your pollution prevention program. The way a pollution prevention program is structured and staffed has a large impact on its success. There are no mandated staffing elements in the Rules.

While an appropriate pollution prevention definition and policy are needed to focus your program, it is people, more than words, that bring about high levels of achievement. There are five elements of the people component:

- Top management leadership;
- Senior management oversight, including process managers;
- Incentives and involvement of employees, especially operators;
- Planning by a multi-disciplinary team; and
- Accountability for the different parts of the program.

Top Management Leadership

The level of commitment of the President, Chief Operating Officer, and/or Chief Executive Officer can make or break a pollution prevention program. Ideally, the program will be initiated from the very top or at least have strong support at that level. As a first step, the company policy should be issued by or strongly endorsed by management to demonstrate its commitment to pollution prevention. Ongoing support will be needed throughout to reinforce the initiative of those implementing the program.

Senior Management Oversight of the Program

After your company's management has developed a policy (see Step 2), your program should have a clear leader (or leaders) who will spearhead the program. For your program to be effective, it needs to be led by someone who has knowledge of pollution prevention principles and environmental management, coupled with knowledge and responsibility for your facility's production processes.

Pollution prevention planning should be a formally assigned part of the leader's job so that he or she can devote the time necessary to develop an effective program. In order to fulfill this new responsibility, the leader should have sufficient authority to put together a pollution prevention team, to gather needed information, and to make decisions about what pollution prevention options to implement.

Employee Involvement

The leader's first task should be to involve employees from all parts of the facility in the pollution prevention program. Since they are directly involved with production, process operators are often especially valuable sources of ideas for reducing nonproduct output (NPO). The method of encouraging employee involvement should conform to the culture and management style of your firm. Some firms may integrate pollution prevention into "total quality management" (TQM) teams, others may use worker-management teams. Incentives, such as awards programs or bonuses, are also good ways to spur employee involvement.

CASE STUDY: A Team Leader Looks for Volunteers

The President of Top Shelf posted the newly developed policy around the facility. Sarah, the Plant Manager, was assigned the task of forming a Pollution Prevention Team and setting up the program. As a follow-up to the posting of the written policy, she presented the policy at a communications meeting. Communications meetings are a common forum at Top Shelf for exchange between managers and production workers. John, the President, expressed his enthusiasm for the program in his introductory remarks at this meeting.

After describing the new program, Sarah explained that she was putting a team together to implement the program. She hoped to assemble a diverse group and asked for interested employees to volunteer to participate. After the meeting, she answered questions and pointed out to several people that their participation could only help their prospects for advancement at the company.

Your Pollution Prevention Planning Team

Efforts to encourage employee involvement should coincide with the formation of a pollution prevention planning team. The pollution prevention team is a group of company personnel who will take charge of the pollution prevention activities at your facility. A list of their possible responsibilities appears in the box at right.

The size of the team you select will depend on the size of your facility. A small facility may find that a "team" of two people is sufficient. All firms should strive to have more than one person on the team in order to get a mix of insights and perspectives. A large facility will benefit from a broad, more diverse group of people and may also find it useful to create separate expert assessment teams to deal with particular processes or sources of nonproduct output.

Your team should have representatives from every facet of your facility's operations. Team members should include people familiar with the company's products and production processes, people familiar with current environmental practices, people with technical expertise in areas related to pollution prevention, people with an understanding of environmental regulations, people involved in your company's finances and marketing, and people with good interpersonal skills. At a smaller facility, one person may represent several of these categories.

Finally, your facility may benefit from using outside consultants or experts from a different facility in your company who can offer new and different viewpoints and ideas. However, pollution prevention planning is most effective when managed in-house, since no one knows the facility's processes better than those who work with them every day.

CASE STUDY: The Team Assembled

Employees at Top Shelf read the posted memos stating the Pollution Prevention Policy and asking for Pollution Prevention Team members. They discussed the Plant Manager's presentation, and several interested employees volunteered. The President also asked several other managers to join the Plant Manager on the team. The assembled team included the following:

1. **Plant Manager** (Sarah French) - As leader of the pollution prevention program, the Plant Manager heads up the pollution prevention team. She has been with the company for close to twenty years. It was decided that she would lead the team because pollution prevention is closely tied to production processes. She will, however, have to work closely with the Environmental Manager.

2. **Environmental Manager** (Thomas Brown) - Since he is responsible for ensuring that the firm is in compliance with environmental regulations, the Environmental Manager is very familiar with release, permit, discharge, Right-to-Know, hazardous waste management and other data. He is the team member who is most familiar with the Rules.

3. **Supervisor of Maintenance and Facilities** (Travis Fox) - This member of the team has worked his way up through the ranks of the company over the years. His insight on the facility will be a valuable tool for information on the facility's current processes.

4. **Sales Manager** (Emily Cruz) - This member is responsible for more than just sales, she is the facility's "finance whiz." She has a great deal of information on current costs and has raw material purchase and product sales records at her fingertips.

5. **Production Workers** - (Jerry Davis and Samantha Sweeny) Two production workers joined the team. These members can provide accurate descriptions of current production practices as well as suggest ideas on new approaches to implement the Pollution Prevention Plan. They are the ones who fill out batch sheets on the factory floor. They will be most able to gauge the Pollution Prevention Plan's compatibility with current work practices and supply feedback on front line effects of the changes.

Production Management Accountability

It is unlikely that your firm's pollution prevention program will succeed without the means to measure progress and to make your production managers accountable for the pollution prevention effort in their area. They are the ones that will be responsible on a day-to-day basis for implementing pollution prevention initiatives and for identifying additional initiatives on a continuing basis. With this increased responsibility, there should be rewards for pollution prevention accomplishments— most of which will improve the company's profitability.

Pollution prevention works because creative thinkers can find opportunities to protect the environment and save money at almost every facility. People are what provide the driving force that uncovers opportunities at your facility. Assembling a group of creative people with diverse backgrounds and knowledge is half the battle in doing pollution prevention.

STEP 4

Identify Your Processes and Sources

In this step, your pollution prevention team will locate where hazardous substances are used or generated throughout the facility. This will lead your team to the **production processes** and **sources** that belong in your Plan. Once the relevant processes and sources are found, the team will need to identify and describe them, usually by developing a **process flow diagram**, so they can be easily understood in later steps in the pollution prevention planning process.

Effective pollution prevention, like pollution control, depends on how familiar planners and designers are with the system in which it will operate. Facilities that release hazardous substances usually have pollution control equipment which treats the nonproduct output from the production process. When production processes were installed or treatment equipment was added, a designer decided how hazardous substances would leave the production process and built a system to collect those substances and treat them. An effective pollution control system requires accurate data on the types and amounts of hazardous substances it will be treating.

Pollution prevention planning requires a similar depth of knowledge about a facility's **production processes**[1], because pollution prevention usually takes place at the process level. To establish that knowledge base, your team must identify the processes that use and generate hazardous substances throughout the facility and the exit points, or **sources**, where nonproduct output leaves.

What Is a Production Process?

A **production process** is one or more activities that lead to one or more products (or intermediate products). Processes can either create a product directly, create an intermediate product, or produce a result that is necessary for production to continue. Processes may produce co-products incidentally, but co-products alone do not define processes. For the purposes of the Plan, your team should divide production activities into the simplest activity-product combinations available. Specifically, processes that lead to isolated intermediate products should be thought of as separate from the processes that use the intermediate product. If your team does not divide its operations into simple component processes, it risks hiding opportunities for pollution prevention inside the engineer's " black box."

Identifying Production Processes

Usually, common sense will lead your team to the best process identifications for pollution prevention planning. By starting with a list of your products and working backwards from that list, your team will be able to trace processes from end to beginning. Doing this will reveal the product/activity combinations that delineate production processes for pollution prevention planning purposes. Include intermediate products in your team's list of products so they can also be used to identify processes. Intermediate products should be easy to find since they are inputs (raw materials), that are made at the facility, rather than purchased and brought-on-site. Identify the activities that lead to intermediate products as separate processes.

Process flow diagrams (PFD) are a valuable tool for identifying and describing processes since they display input and output information in a visual format. Obtaining or creating such diagrams now will simplify process identification and the PFD will prove useful throughout the rest of the planning process.

Simple block diagrams of each process which show the flow from production step to production step will serve your team well. Piping and instrumentation diagrams (P&ID) or schematic equipment diagrams are useful, but if your team does not already have access to them, there is no need to create them now. The necessary components of a process flow diagram are **raw material inputs, products,** and **nonproduct output** streams connected by blocks that provide an explanation of the **steps** that turn input into product and nonproduct output. At this stage, quantities for these streams are not vital since they will be determined later using **materials accounting** in Step 6. Pay special attention to hazardous substance inputs since your team will be tracking them through processes to the point where they are consumed or exit as a component in a nonproduct output or product stream.

Each separate production process has its own identifier, a name or number which is used as a reference. As your team completes its process identifications, it should assign identifiers and record them together with a description of the process and a flow diagram. The team will add to this information as planning continues.

If there are processes whose flow diagrams, inputs, and products are similar to one another, they may be good candidates for **grouping**, the next Step. Grouping allows similar processes to be collected together and considered a single process for the purposes of the Plan, thus streamlining data collection and recording. Processes that have been grouped together have their own separate identifier in the Plan. Therefore, if it appears that your team will be grouping production processes later, it may make sense to wait before assigning identifiers to processes that are likely to be grouped.

If you are required to prepare a Plan under the Rules, your team must identify every process that uses or generates a hazardous substance that the facility uses or produces above the thresholds defined in the Rules (see Covered Facilities and Chemicals, in the Introduction). Processes that do not use or generate a covered hazardous substance may be included in the Plan, but this is not required by the Rules. Identifications made in this Step will be used throughout the Plan to understand processes, to gather source information, to group sources and processes into manageable sets, and as a basis for learning the more detailed information needed to find pollution prevention opportunities.

What is a Source?

In the vocabulary of pollution prevention, **sources** are points or locations in a production process through which hazardous substances exit. Whenever nonproduct output leaves a process, it goes through a source. This view is different from the conventional one of sources as places where a permitted release leaves a facility and enters the environment. Sources are where nonproduct output leaves a production process *prior* to treatment. Pipes or ducts from a process to a treatment system are sources, as are leaks which allow fugitive emissions. One location may host different sources during the steps that make up a process. For instance, a single vent might release one substance during one step of a process and another substance during a later step. Pollution prevention might operate in different ways for each substance, so two sources would be identified even though they occur at the same place.

Pollution prevention may take place at both the source and process level. A spray coating operation is a process which might be ripe for pollution prevention in the form of a switch from an organic solvent to a non-hazardous aqueous solvent. At the same time, planners could consider the individual sources within the coating process for pollution prevention as well. One such source might be a spray booth, the location where coating takes place. If a different spray nozzle arrangement could be devised to minimize overspray at that location, then that would be pollution prevention at the source level. Source identification puts such possibilities on the table.

Finding Sources of Nonproduct Output for Pollution Prevention Planning

By creating process flow diagrams, your team has taken a step toward finding **sources**, since flow diagrams show both product and nonproduct output leaving the process. Wherever nonproduct output leaves a process, there is a source, so the team can consider each nonproduct output stream and write down what is known about how it leaves the process. For instance, nonproduct output may be piped to a large combined treatment system, or treated in a wet scrubber dedicated to a particular process. It is likely that some nonproduct output escapes through valves and other fittings as fugitive releases.

Your team can do a qualitative materials accounting check to ensure that it has not overlooked a nonproduct output stream completely. Make a qualitative (rather than a more complicated quantitative) determination of whether the substances that are inputs to a process show up in either product, pass through a source as nonproduct output, or are consumed. When input substances are consumed (i.e., chemically altered) in a process, the team should still be able to find evidence of the consumed input in either the product or as a nonproduct output stream at a source. Doing this provides some assurance that you have found the needed components for a later materials accounting or mass balance.

CASE STUDY: Identifying Production Processes at Top Shelf

While a small company, Top Shelf had 101 product lines, with different pattern combinations that allowed them to expand to over 2000 different wallpapers. They decided not to spend much time analyzing 13 of these product lines, because they were latex based and only used a small amount of one hazardous substance. Two of the facility's 14 printing machines are dedicated to making latex based wallpaper. Reducing hazardous substances was part of the reason the company began using latex.

The remaining 88 product lines all used solvents that were covered hazardous substances. Therefore, all of the production processes that made these product lines had to be addressed in the Plan.

To make these products, combinations of five different organic solvents are used to prepare various inks. The inks are pumped into the printing machines and applied to PVC sheets in attractive patterns. The machines vary in age and, therefore, in design. The ten oldest are original to the facility and were built in 1970. Four new machines were added in 1989. Two of the new machines are the ones dedicated to latex wallpaper production. The other twelve are used on an "as needed" basis to make any wallpaper that requires an organic solvent. Products from any product line can be made on any machine. Short runs are made on newer machines because they are more flexible and can handle several different product lines efficiently, while the older machines need a longer run to be efficient.

Top Shelf's pollution prevention team realized that although all the printing equipment was different, the steps in almost every production process were the same, although the inputs and outputs might change. They wrote a description of a typical process and drew a simple process flow diagram (see Figure 4.1). Their description and diagram identified several sources of nonproduct output, including: open mixing drums, ink reservoirs and troughs, pumps, the "coppers" which apply ink to PVC sheets, and "doctor blades" which wipe excess ink from the coppers after they have been dipped in an ink trough.

Finally, the team realized that the facility did produce one intermediate product, a cotton gauze backed PVC wallpaper sheet. This sheet was made through a separate process which glued cotton gauze to regular PVC sheets before sending them on to be printed as usual. The glue was 60% MiBK, so it had to be identified and described in the Plan.

Facility Walkthrough

The information, which the team gathers from process flow diagrams and their own knowledge of the facility, may present a clear picture of the facility's overall hazardous substance involvement, but it may not. Information on sources can be especially difficult to collect on paper since fugitive sources of nonproduct output are inherently unrecorded. Often, the best way to truly understand process information is to walk through the facility and follow each process from one end to the other. This also gives people on the pollution prevention team who do not routinely visit the production processes a chance to get a feel for what is involved at each one. If several similar processes are run using the same machinery, then a walkthrough that follows one of them from beginning to end may stand in for the others, as they will probably be **grouped** in Step 5.

A facility walkthrough is most effective when it follows operations from the point where hazardous substances first enter the facility through to where products and nonproduct outputs are generated and then moved off site. This may mean observing operations at several different times to get a complete picture.

Before a walkthrough, the team should:

- Develop a list of information that it would like to have.
- Determine the best times to visit all phases of the operation.
- Prepare to talk to individual workers throughout the facility.
- Plan for whatever safety measures may be necessary on the plant floor.

During a walkthrough, the team visits as much of the facility as it can, asking questions of the people who work with the production processes every day, taking note of where one step of an operation stops and another begins, and getting a feel for the facility's processes. A walkthrough is especially valuable for understanding information, which is confusing on paper, correcting flow diagrams, and discovering unknown sources.

Areas where nonproduct output leaves the process in an unusual way, such as leaks or open solvent vessels, should be carefully noted. These sources are of the type that are not planned for and therefore do not show up on process flow diagrams. They should be added to the relevant diagrams when the walkthrough is complete.

CASE STUDY: Top Shelf Conducts A Walkthrough

The team members decided to conduct a walkthrough to check the process and source identifications they had made. They had all reviewed the process flow diagrams and many of them assumed that all the sources were identified. However, Jerry and Samantha, who worked with the machinery every day knew of some sources, which were not indicated in the diagram. They wanted to show the rest of the team these additional sources and to look for others as well.

The team planned their walkthrough to take place over three days because in that time period, they could see every activity at the facility, including receiving new raw materials and shipping product. They also prepared questions for the people on the shop floor. Emily, who worked in the sales office, got a refresher on safety procedures, which everyone attended.

The team, led by Jerry and Samantha, found several sources which were not recorded as outputs in the flow diagram, including:

There was almost always ink remaining in troughs and reservoirs at the end.

Evaporated solvents were concentrated around ink troughs and mixing drums. The nonproduct output from these sources was vented to an afterburner.

Appreciable amounts of acetone and MEK were used to clean the printing machines between runs.

After a run, ink that was not used as an input, was usually sent back to storage. Upon investigating the store room, the team found several containers of leftover ink, which were dried up from sitting too long.

The last two activities, cleaning and storage, did not seem to fit logically as a step within the process, although they were significant sources of nonproduct output. At that time, the team decided to identify cleaning the machinery as a separate production process and to deal with storage later. The team made process flow diagrams for the processes they found and updated the existing diagrams in light of the source data they had found (see Figure 4.2).

At the end of the walkthrough, the team discussed how to analyze the afterburner being used to treat some of the hazardous nonproduct output. They decided to analyze its operations separately.[2]

Unusual Activities

At the end of the facility walkthrough, your team members should understand the mix of products, inputs, outputs, and activities that make up the processes at your facility. Nevertheless, your team may have observed some unusual activities that do not fit neatly into either the definition of production process or source. For example, it may be necessary to use hazardous substances to periodically clean some machinery. The machinery is part of a larger process, but cleaning it may not seem to be part of that process, even though cleaning is occasionally necessary. Hazardous substances are used to clean periodically, but doing so does not create any product. What is the best way to describe such a situation?

There are two ways to handle this. First, identify the cleaning activity as a process by itself. Instead of a product, the process creates a " desired result," cleaned machinery. Second, the cleaning operation could be considered a **source** which is part of the process machinery that is cleaned. When looked at this way, cleaning the machinery is a periodic step in the overall process.

Each way of identifying such unusual activities will result in a different basis for measuring pollution prevention progress later. As discussed in the Introduction, pollution prevention progress is recorded through a ratio that measures how efficient processes are in utilizing hazardous substances **per unit of product** (see Step 6), with a goal of diminishing the amount of hazardous substance used or generated as nonproduct output for each unit of product made. If activities like cleaning, storage, material transfer, or maintenance are identified as processes, then progress is measured for each time the activity occurs. Measuring progress this way can hide the advantage of reducing the number of times the activities occur. If, however, they are identified as sources within larger processes, then the use and nonproduct output resulting from activities like cleaning will be measured by the amount required to produce a unit of product for the whole process, thus showing that reducing the need for such activities is a worthwhile pollution prevention technique.

Notes:

1. See *N.J.A.C. 7:1K-1.5* for the legal definition of production process. In this document, production process is sometimes shortened to " process."

2. This decision is consistent with the N.J. Pollution Prevention Program requirements, which require that treatment processes either be excluded from Pollution Prevention Plans or be treated as separate processes. See N.J.A.C. 7:1K-4.2(d).

STEP 5

Grouping

Grouping makes pollution prevention planning easier by combining several similar processes or sources and treating them as a single aggregate process or source throughout your Pollution Prevention Plan.

In the previous step, product/activity combinations were used to identify and define "production processes." Then, sources within those processes were found by locating the exit points for nonproduct output. While the numbers of processes and sources found may be large, many of them may be very similar. The same or similar raw materials may be used to produce several **similar products** in separate "batch" production processes or in parallel continuous production lines. These processes may also use the same or similar equipment. For example, one mixing vessel can be used to produce several different kinds of fragrances with only minor differences in the mixes of the same raw materials.

At the same time, nonproduct output may escape from **similar equipment** within production processes, such as through many valves of the same design. These situations indicate that there are production processes and/or sources that can be gathered together to make planning easier. It makes sense to treat similar processes and sources as if they were a single process or source.

Combining similar processes or sources together into a composite process or source is called **grouping**. Grouping focuses your attention on whether your similar operations are being run consistently. You may find that techniques, which work well in one area are not being followed elsewhere. It can also highlight other pollution prevention opportunities for specific uses of hazardous substances. For example, you may find that a hazardous substance is used only for cleaning in between batches of different products. If similar products could be identified and run in sequence in a "group," you could reduce the amount of times cleaning is required and reduce your use of that substance. Finally, grouping reduces the workload surrounding pollution prevention because it shrinks the number of processes and sources the team must study by identifying "grouped processes" or "grouped sources" that represent their component processes or sources in the Pollution Prevention Plan. Grouping does not eliminate anything from consideration in the Plan, but it does organize what must be considered in a more manageable way.

Grouping is not a required step in pollution prevention planning, so your team should use it judiciously. Beware of inappropriate grouping since badly grouped processes and sources will make later work confusing rather than streamlined.

Grouping Processes

As your team worked through the previous step (Identify Your Processes and Sources), production processes were defined around a product, intermediate product, or some other desired result. Products and desired results are the place to start looking for opportunities to group as well, because processes that produce similar results often can be grouped successfully. If those processes also use similar raw materials, then successful grouping is even more likely. Other similarities, like the function of a specific chemical (as a "reactant" or "catalyst") or the use of similar equipment, can confirm the decision to group processes together.

Be aware that inappropriate grouping may cause problems. When grouping, the object is to collect several processes together which are similar enough in terms of their products, material use, and process steps to be treated as a single process. Grouping simplifies process evaluation by minimizing the number of times data needs to be collected or recorded and by encouraging the discovery of pollution prevention techniques that will work for all the components of the grouped process. Logically grouped processes allow this; poorly grouped processes create situations where the data collected for a grouped process does not apply to some of its components. Keep in mind that once you have grouped processes together, they will remain grouped throughout the Plan.

As an example of grouping processes *inappropriately,* consider a paint manufacturer that produces several colors of both oil-based and latex-based paints. Using color as the only criterion for grouping would be inappropriate. It could lead to "yellow oil-based paint" and "yellow latex-based paint" being in the same grouped process. Logically, the latex and oil products should be in separate groups since they are manufactured using different types of chemicals. Color could be a criterion to further group the processes, within the latex and oil groups, to address any concerns with heavy metal content of the pigments, which may vary by color.

Another example of *inappropriate* grouping could involve a chemical manufacturer making organic polymers by adding different functional groups to a base polymer. It would be inappropriate to include a product whose active ingredient was added through an alkylation step with one that is added through sulfonation. The raw materials in these reactions are sufficiently different that these processes should be treated separately.

The Rules prohibit grouping production processes together with treatment or control processes. Pollution treatment processes are special because grouping them with production processes can blur the line between treatment and prevention. This is the only restriction on how your team can group. *Let the rule of common sense prevail.*

CASE STUDY: Top Shelf Deals With 1056 Production Processes Through Grouping

Top Shelf's team had completed three generic process flow diagrams that described wallpaper making, gluing cotton gauze to PVC, and cleaning process machinery. However, the diagrams were more depictions of the basic tasks or steps at the facility than they were schematics of actual processes, which involved may details that were not pictured. To continue its planning, the team knew it would need more detail than that. To fill in detail for the wallpaper making process, the team could consider the way every product in their catalog was made as a separate process, it could assume that the differences between products were inconsequential to their manufacture and consider only one simplified process, or it could look for a level of detail between these extremes. Grouping plays a big part in setting that level of detail.

Sarah considered the options. The first option (considering each product separately) might apply to a facility that made a smaller number of less similar products, but at Top Shelf it would mean analyzing hundreds, if not thousands of processes, many of which would be very similar. The second option (identify the facility as only one process) had some appeal since it might mean less work, but upon examination, this did not seem to be so. If all the product manufacturing techniques were aggregated into a single process, that process would not only make different products, but would use drastically different hazardous substances at different times to do so. She believed that this would make analysis of the process complicated and might hide opportunities for pollution prevention.

That left her with the task of finding grouped processes for the team to analyze. She enlisted the help of Travis, the maintenance supervisor, in finding these groups, since he was very familiar with the quirks of the facility’s machinery and the problems associated with making several of their products. Initially, they thought of ink color, solvent type, design pattern, equipment (printing machines), and brand of dye resin.

Travis felt strongly that the groups they ended up with should differentiate between the two generations of printing machinery at the facility. While the two sets worked very similarly, the older one was generally less efficient, which indicated that there were opportunities for pollution prevention in the older equipment (short of replacing the machines altogether). Sarah agreed that their grouping decision should differentiate between machines.

Sarah's main concern, however, was with the way the facility used hazardous substances themselves. She wanted to do substance specific analysis in her planning because she suspected that the facility could optimize some of its solvent mixtures to reduce use, nonproduct output, and costs. The facility used five organic solvents to solubilize dye resins. There were close to four dozen separate formulation recipes for different dyes, but as Sarah and Travis examined the different solvent mixtures, patterns emerged.

For instance, all of the mixtures of only methyl ethyl ketone (MEK) and methyl isobutyl ketone (MiBK) had a ratio of between 3:1 and 5:1, MEK to MiBK. Other mixtures also had only small variations in the ratio of solvents. By assuming that slight variations in the percentages of solvents in similar mixtures did not make a significant difference in finding pollution prevention options for those mixtures, they were able to break out three solvent combinations that generalized the solvent use for formulating dyes at the entire facility. These three combinations accounted for all but two of the dye formulations. These two formulations, designated D23 and D37, were so dissimilar that they had to be tracked separately. (See Table 5.1 for formulation mixtures.)

With the decision to group solvent mixtures as well as equipment, Sarah and Travis had completed their grouping decision, and they had done so in a way that made sense at their facility. Their work yielded ten grouped processes by dividing different subsets out of the overall task of wallpaper making. First, they’d separated the older generation of equipment from the newer, and then they'd separated different solvent combinations from one another (Figure 5.1). There were also two non-papermaking processes that were not grouped: gluing cotton gauze to PVC and cleaning process machinery. These processes, like D23 and D37, would be examined separately.

Sarah sent a memo to the other team members explaining the process definition and grouping decisions and asking for their comments. Thomas looked over the memo and decided that the grouping decision made sense and was consistent with the grouping criteria laid out in the Rules.

Grouping Sources

In some instances it may be practical to group sources. Sources, as discussed in the previous Step, are the locations within processes where nonproduct output exits. The advantage of source grouping is similar to that for process grouping; several sources may be grouped together and treated as a single source. As with processes, grouped sources are treated as a single source.

The Rules set up pollution prevention tracking at the process level, so sources need to be related to processes to be tracked. Therefore, when sources are grouped, they must be grouped within the boundaries of a process or grouped process. This insures that the sources can be tracked, and that their nonproduct output can be consistently counted. There may be equipment at a facility that could be grouped as sources, but because it is necessary to track pollution prevention at the process level to measure progress, such grouping must not be attempted. To keep tracking simple, it is done at the process level. Source-level tracking would allow grouping across process boundaries, but it would complicate tracking and reporting incredibly.

Except for the restriction limiting source grouping to the sources within a process, the criteria for grouping sources are the same as for processes. The emphasis, however, is more on **equipment** similarities than on chemical similarities. To get a feel for the utility of grouping via sources, consider a source grouping example for an oil refinery. At such a facility, there are many processes that produce many similar products. Some of these processes will have sufficient similarities to justify grouping them. Within one of those grouped processes, there could be hundreds of sources, but many of them will stem from very similar equipment, perhaps from a certain kind of valve. Some of the valves may be unusual in some way, but the rest could all be grouped together and treated as a single source within the grouped process for the rest of the Plan. As such source grouping is repeated where appropriate, the number of sources for this process becomes more and more manageable.

Some source grouping can be tricky. For instance, similar vents should make up more than one group if their functions are significantly different, even though they may use nearly identical equipment. Analyzer vents may not present the same pollution prevention opportunities as flare vents or combustion vents. Reduced sample size, a typical prevention technique for analyzer vents, is obviously not applicable in the other two cases. Common sense indicates that these sources need to be grouped separately.

A final issue related to grouping is how it affects the work your team has completed. It is a good idea to revisit your process identifications and update them in light of the grouping you've done. If there is a process flow diagram, update it to show that your grouped processes and sources have replaced the processes and sources they are composed of.

In summary, the key to grouping is that processes or sources should be very similar if they are to be treated the same in the Pollution Prevention Plan. If your team keeps this idea in mind, it should have no trouble making sound grouping decisions.

STEP 6

Inventory and Record the Firm's Use and Nonproduct Output (Part I of the Plan)

In this step, your pollution prevention team will find **throughput** data for the facility and for the processes identified in Steps 4 and 5. Facility-level data provides your team with a general understanding of how hazardous substances move through the facility. Process-level data focuses more closely on the places where pollution prevention opportunities will be found. Process-level data can be found through **materials accounting** or **mass balancing**. These techniques track substances through each step of a process, and may locate unknown sources of nonproduct output along the way. Your team will also assess the **total costs** of using and generating hazardous substances at the process level. As the first elements of good pollution prevention planning, the components in this step make up Part I of a Pollution Prevention Plan under the Rules. Appendix E includes a checklist of items that must be included in Part I of a Plan.

Pollution prevention opportunities arise through understanding how and where hazardous substances move and function through the facility and its processes. In Step 4, your team tracked hazardous substances qualitatively to identify the processes that belong in your Plan and to find sources of nonproduct output within those processes. Qualitative information, however, is not adequate for pollution prevention planning; amounts are needed. The quantities of hazardous substances that enter a facility are spread among various processes as inputs. These inputs travel through process steps and leave processes as nonproduct output or as part of a product. Unless pollution prevention intervenes, that nonproduct output is either recycled out-of-process, treated, or allowed to escape as a fugitive emission. Regardless, hazardous substances eventually leave the facility, completing a throughput cycle. This data will do three things: (1) confirm or improve the understanding your team has of facility operations; (2) provide a sound way of prioritizing processes for more detailed analysis; and (3) establish core data on which to base a more detailed analysis. The data is found by accounting for every hazardous substance as it moves through its throughput cycle, starting with the whole facility and working down through processes. These technical elements of good planning make up most of Part I of a Plan under the Rules.

Financial information collected early in the planning process can help focus the program. A comprehensive financial analysis may show that costs which are usually attributed to general facility overhead would be better accounted for as the price of using and generating hazardous substances in a particular process. Pollution prevention can reduce those costs. This financial analysis will complete Part I of your Plan.

Elements of the Pollution Prevention Plan— Part I

The best pollution prevention plans all contain certain information that has proven effective in identifying cost-effective pollution prevention opportunities. The Department's Rules on pollution prevention planning require facilities to collect that information, *but any effective plan will contain it*. The Department does not prescribe how your facility should collect the information nor its format in your Plan. The elements of Part I of a Plan can be broken down into six categories:[1]

1. Personnel information: an identification of those responsible for pollution prevention planning at the facility, and their certification of the Plan.
2. Facility-wide data: what hazardous substances the Plan covers and how those substances flow through the facility. This throughput data is also reported on the Release and Pollution Prevention Report. See Step 10.
3. Process identification: what are the processes at the facility that involve hazardous substances (as found in Steps 4 and 5), how much of what product do they make, and what is a unit associated with this amount.
4. Process-level inventory data: the use of each hazardous substance, the generation of nonproduct output, the amount recycled, and the amount released for each process.
5. Hazardous waste information: the wastes generated at each process and how they are handled.
6. Estimates of the real costs of using and generating hazardous substances.

Your team is likely to use available information for many of these categories. Other elements, notably those in categories 4 and 6, are specific to pollution prevention planning and may require special effort, direct measurement, and analysis to obtain. The remainder of this Step explains each of the six categories in more detail.

1. Who Is Responsible For the Plan

Top level company officials (often the plant manager and the CEO, president, vice president, or owner) should understand and endorse the Plan and its goals. Ideally they have followed the pollution prevention program throughout the planning process, perhaps as members of the pollution prevention team. These officials must certify their knowledge and acceptance of the Plan and its goals. The name of an employee representative is also recorded in this section.

2. Facility-Wide Data

The facility-level information on the overall use and generation of nonproduct output for each hazardous substance at the facility shows your team the big picture. It demonstrates where the largest hazardous substance use and generation is, which focuses process and source-level analyses. It also gives your team a gauge for measuring how successful it has been when subsequent process-level analysis is complete.

Where will the team find facility-level information? Many of the records the company maintains will provide facility-level information. Therefore, the team need not make direct measurements at this point, although that option is certainly available. Some typical information sources include:

Bills of Lading - the logs of material brought on site over the past year, and the product and waste shipped off site.

Blueprints - plans of the facility include original design specifications, such as storage capacities.

Compliance Data - discharge monitoring reports, VOC inventories, hazardous waste manifests, and hazardous waste generator reports.

Release and Inventory Reporting Records - current and previous release and throughput inventory reporting forms (TRI Form R and New Jersey's Release and Pollution Prevention Report). See Step 10.

Purchase Records - the type and amounts of hazardous substances brought on site as determined by what the company paid for.

Process Flow Diagrams - detailed schematic diagrams that show typical hazardous substance flows.

Sales Records - the amount of product sent off site as recorded through invoices.

Waste Hauling Invoices - the amount and type of hazardous waste sent off site as recorded by haulers.

With data like these, the team can start assessing the throughput of each hazardous substance at the facility. Assessing throughput means tracking **inputs** through to where they become outputs. For a whole facility, **materials accounting** is the best way to do this.

Materials accounting means finding a general balance between the inputs and outputs of each separate hazardous substance at the facility, based on the premise that all the materials entering a facility must come out in some form or another. By examining existing records, exercising engineering judgement, and gathering new monitoring data as necessary, your team should account for each hazardous substance going in and coming out of the facility during a reporting year.

The Rules define four ways a hazardous substance is counted as facility inputs during a reporting year.[2] Hazardous substances are inputs when they are:

1. **Stored at the facility on the first day of the reporting year.** To account for inventory from year to year, the amount of a hazardous substance stored at a facility when the reporting period begins is considered an input while the amount left in storage at the end of the period is considered an output. Beginning inventory should therefore equal the ending inventory of the previous year.
2. **Brought on site as non-recycled raw materials.** The amount of new substance that your facility brings on site to use in its operations is an obvious input.
3. **Manufactured as products, co-products, or nonproduct output.** Creating a hazardous substance on site is conceptually the same as bringing it to the facility from off site.
4. **Recycled outside of processes and used on site as raw materials.** Materials that are recycled, either on site or off site, and used in facility operations are essentially the same as non-recycled raw materials. In measuring input, the origin of a substance doesn't matter; any material used as a raw material is an input. A goal of pollution prevention is to develop lean, efficient processes that use and produce the minimum amount of hazardous substances necessary. Out-of-process recycling, while reducing

the amount of a hazardous substance that a facility purchases as raw material, does not reduce the *demand* for that substance within the facility.

The second half of facility-level materials accounting involves measuring outputs. The Rules define four ways a hazardous substance can be counted as facility outputs during the reporting year. Hazardous substances are outputs when they are:

1. **Stored at the facility on the last day of the reporting year.** The difference between the amount stored on-site on the first day of the reporting year and the amount stored on the last day accounts for changes in inventory over the reporting period.
2. **Consumed at the facility.** Hazardous substances that are molecularly altered are said to be consumed. When a hazardous material is consumed, it no longer exists at the facility, and must be counted as an output. The material(s) it becomes may be inputs of another hazardous substance (see **Manufactured as products, co-products, or nonproduct output**, above).
3. **Shipped off site as a product.** Hazardous substances that are shipped as product leave the facility as an output. If a substance is molecularly altered to become a product, however, it should be counted as consumed, not shipped as a product.
4. **Generated as nonproduct output.** Hazardous substances that are not consumed or part of a product are considered nonproduct output.

Quantifying facility-level nonproduct output. Nonproduct output, the last type of output, is a quantity most facilities do not routinely measure. Traditionally, their regulatory compliance has been based on what is released to the environment after treatment, rather than on nonproduct output, which is what leaves processes prior to treatment. Nonproduct output, however, is a quantity that managers should become familiar with because tracking it reveals trends in both environmental management and operating efficiency.

Nonproduct output can be determined in several ways. First, it can be measured directly as it leaves processes. However, it is usually difficult to use this method to find all the nonproduct output generated at an entire facility. Other methods infer nonproduct output from known facility-level data. If no recycling is taking place, nonproduct output can be estimated by relating emissions to the efficiency of the treatment system used. A disadvantage of this method is that it does not account for fugitive emissions, since they are not treated.

Another method uses information already reported to the U.S. Environmental Protection Agency on the federal Form R. In the Form R, facilities must report the quantities of a hazardous substance that are released as fugitive emissions, treated on and off site, recycled on and off site, and used for energy recovery on and off site. These are the components of nonproduct output, so their sum is the facility-level nonproduct output total. The accuracy of this quantity is dependent on the accuracy and completeness of the components.

A final method is to infer nonproduct output from the materials accounting. If the materials accounting has been accurately completed for everything but nonproduct output, then the difference between the inputs and the known outputs should provide a reasonable nonproduct output figure. The Department recommends that your team calculate nonproduct output several different ways to find a consistent answer.

When nonproduct output is known, the total inputs and total outputs for each hazardous substance at the facility should roughly equal one another, completing the materials accounting. In a facility-level accounting, inputs and outputs should be close, although this approach is not as exacting as a mass balance. Your team mustchoose the level of accuracy that will satisfy your firm's needs. If there is a gross discrepancy between inputs and outputs, then your team has lost track of some of your hazardous substances. Perhaps there is a large source of nonproduct output that was overlooked in Step 4 or quantities consumed were counted a second time as being shipped in product. If the reason for the discrepancy cannot be found easily, process-level analysis may locate the problem later.

Quantifying facility-level use. Your team can also estimate the facility-level use of each hazardous substance from its material accounting data. Facility-wide use includes more than the amount of a hazardous substance purchased as raw material; it is the amount of the substance entering the facility as any of the four inputs discussed above (stored on day one, brought on site, manufactured on site, and recycled) minus the amount of substance left in storage at the end of the reporting period.[4] Note that the materials accounting equation for nonproduct output (all inputs minus the amount stored, shipped in product, and consumed) is very similar to the *use* calculation (all inputs minus the amount stored). In fact, if none of a hazardous substance is consumed or shipped in product, *use* equals nonproduct output. Ideally, many solvents which a facility uses for cleaning will be accounted for in this way, since they are not involved in chemical reactions or product formulation.

This calculation of use highlights a difference between out-of-process recycling and pollution prevention. Out-of-process recycling can reduce the amount of raw materials that the company purchases, but it cannot reduce a process' appetite for those materials. In other words, out-of-process recycling allows a facility to self-generate or regenerate some of the raw material it needs, but it does not reduce the demand for raw material per unit of product. Pollution prevention *can* reduce those needs by making processes more efficient.

After the facility-level accounting has been completed and the results are recorded in the Plan (see Appendix E for a checklist of recorded quantities), the team should meet and discuss what the data imply about the company's use of hazardous substances, its record keeping, and its priorities for reducing the use and generation of hazardous substances. As your team moves through this step and on to process- level questions, keep in mind that the process-level data should add up to equal the facility-wide totals.

CASE STUDY: Top Shelf Collects Part I Facility-Level Information

Thomas was ready, at this point to develop use and nonproduct output figures. He worked on the nonproduct output of toluene first, using a materials accounting method. First, he summed up all the facility-level inputs that the facility was reporting for the year (starting inventory, quantity brought on site, quantity manufactured on site, and quantity recovered from on-site out-of-process recycling). The quantities manufactured on site and recycled on site were both zero. Second, he subtracted the sum of the known outputs (ending inventory, quantity shipped in product, quantity consumed), from the summed inputs. The quantity shipped in product and the quantity consumed were both zero. The result of subtracting known outputs from the inputs was the only unknown output, nonproduct output.

Thomas repeated this operation in the same fashion for the other hazardous substances. One exception was MiBK. The process that glued cotton gauze to PVC sheets used MiBK as a solvent. Approximately 15 percent of that MiBK was trapped in the glue and shipped in product. Quantities shipped in product are not nonproduct output. Thomas adjusted the facility-wide totals for MiBK to account for the amount shipped in product and recorded the facility-level nonproduct output for all substances (see Table 6.1).

Next, he worked on use numbers, once again starting with toluene. Since toluene was used as a solvent which was not incorporated in product, he assumed that none of it was consumed and that only inconsequential amounts were shipped as product. The facility did not recycle any toluene on site. With these variables zeroed out of the use and nonproduct output equations, use should equal nonproduct output. The assumptions held true for all the hazardous substances except MiBK. Although the MiBK shipped in product was not counted as nonproduct output, it did count toward use. Thomas counted the MiBK shipped in product in the facility-level use totals.

Finally, as a check, Thomas compared the facility-level nonproduct output numbers he'd calculated against the total of the quantities he recorded in EPA's Form R. The answers to these questions, he realized, were the components of nonproduct output (the quantities treated, recycled, used for energy recovery on or off site, and the quantities released). The total of the components was within ten percent of the nonproduct output he'd found using materials accounting. This was close, but meant that there were minor accounting problems since the two results of methods should theoretically equal one another. Right off the bat he thought of two possible sources of error. First, fugitive air emissions were sometimes used as a catchall to account for discrepancies that may not be caused by actual leaks. That leeway made tracking less precise than it would have been if there were no fugitive emissions. Second, there were several large waste streams that were not sampled systematically. Questionable data on the hazardous substances within those waste streams could easily introduce a wobble in the nonproduct output amounts. Thomas believed that the analyses the team would do later at the process and source level would close the ten percent gap, so he presented the materials accounting data to the team and explained his findings.

3. Process Identification and Assigning Units of Product

In Steps 4 and 5, your team divided the operations at the facility into processes and grouped processes. The team described them, perhaps with a flow diagram, and assigned them unique identifiers. That information is the beginning of the required process-level information of Part I of the Plan, and should be recorded in the Plan at this point, if this hasn't already been done. Two other sets of information must also be recorded about each process, (1) whether and how the process was grouped, and (2) product data.

If your team has grouped any of the facility's processes, then your Plan must include a description of the grouping decision. The description gives your team a way of linking the grouped process in the Plan to the physical processes of which it is composed.

Your team used products to identify processes; products are also the key to meaningful process-level analysis and reporting. Identify your processes' products and record a **unit of product** for each in Part I of your Plan. The unit of product is what makes nonproduct output and use comparable from year to year because it separates changes due to pollution prevention from those due to increasing or decreasing production. When the use or nonproduct output of a process is reported on a *per unit of product basis*, an efficiency ratio is established. Your team will be able to reliably measure the effect of pollution prevention using **efficiency ratios** because they eliminate fluctuations in use and nonproduct output that are caused by shifting production levels. Regardless of production levels, pollution prevention will reduce the amount of hazardous substance used or generated per unit of product since the process is functioning more efficiently.

Choosing a unit of product is a long-term decision. The Rules require that production units remain the same from year-to-year. Changing them would make year-to-year pollution prevention measurement inaccurate. The unit of product must therefore consistently reflect what a process does. Choose one for every product and intermediate product your covered processes produce. While this seems simple in the abstract, it can be difficult for certain kinds of processes. The simplest type of product to define a unit for is one that is discrete and can be counted. Aluminum cans are an example. Measuring hazardous substance use or nonproduct output per can makes sense.

Sometimes, the nature of a process makes it difficult to define an appropriate unit. For instance, it may not make sense to define a unit of product for an electroplating process as "items plated" if the items vary in size and shape. Instead, the most appropriate unit might be the number of square feet of material plated, which, unfortunately, is more difficult to measure and track. The Office of Pollution Prevention is preparing packages to assist industry groups, like electroplaters, with problems that are specific to their operations. If your team would like assistance in finding an appropriate unit of product, please call the Office of Pollution Prevention at 609/777-0518.

Activities that do not make a product directly, but which take place during facility operations, are another special case. If your team identified such an activity as a source in another process, then it is part of that process and does not have its own unit of product. If your team identified the activity as a separate process, then a unit of product is needed. For instance, a cleaning activity could have "cleaned coating machines" as its unit of product. That unit of product would establish a meaningful efficiency ratio for measuring the use and nonproduct output of each hazardous substance used or generated through the activity.

Finally, units of product should measure what the process actually produces and should be consistent with units of input. Units of product that are based on money are generally poor, since they introduce fluctuations due to the value of money and explain very little about the process. Likewise, units of product that are inconsistent with units of input make it difficult to relate the amount of product to its components. If a product contains a hazardous substance, which was measured in pounds as an input, then measuring the unit of product in gallons clouds materials accounting. Make these units as consistent as possible.

CASE STUDY: Unit of Product

Sarah, the Plant Manager, assigned units of product to each of the production processes the team had identified. For the ten grouped processes, this was quite simple; each of them produced wallpaper, which the facility measured and sold by the yard, at a standard width of sixty-two inches. The production process that glued cotton gauze to PVC sheets was also easy to find a unit of product for. Sarah decided that the intermediate product of that process was cotton backed PVC sheets, which was measured in yards, just as was finished wallpaper.

Choosing a unit of product for the two cleaning processes was more difficult. Top Shelf did not sell the result of these processes, nor did they create anything that went on to become a product the company sold. Their unit of product, therefore, would have to be unconventional. She thought this over and decided that "cleaned machines" might be the best way to measure the result of these processes. Nevertheless, she had begun thinking about production process efficiency, and realized that " cleaned machines" would only help measure how efficient the cleaning process was, but would not measure improvements achieved if the team found ways of cleaning the printing and gluing machines less frequently. The solution to this, she reasoned, is to divide up the cleaning processes and include their hazardous substance use and generation in the numbers of the processes they clean. Doing that redefined the cleaning activities as sources within the printing and gluing processes. Reductions at those sources would be measured per yard of wallpaper or cotton backed PVC. More efficient cleaning would still show up as reduction in nonproduct output and use, and increased efficiency from cleaning less frequently would also show up.

Sarah discussed this idea with the rest of the team, who backed her strategy. They revised their process definitions by deleting cleaning activities as separate processes and adding them as sources in the other processes.

4. Gathering Process-Level Chemical Specific Data/ P2-115 Form

The Rules now require that process-level data be gathered and reported in the Pollution Prevention Process–level Data Worksheet (P2-115 Form) that becomes part of the Plan kept on site. This form may also be submitted as an option in lieu of the Pollution Prevention Progress Report (Sections C and D of the Release and Pollution Prevention Report, RPPR or DEQ-114). (See Appendix B-2.)

Process and source data are the mainstay of pollution prevention planning. Obtaining it can lead to cost-effective pollution prevention investments. **Materials accounting** and **mass balancing** are two methods of gathering this data. The Rules require that facilities complete a materials accounting for all production processes. Mass balancing can be used as a second stage to clarify complex processes and to fill in any information gaps left by materials accounting. If there are any **grouped processes** or **grouped sources**, use them in materials accounting and mass balancing since this is the work that grouping is designed to simplify. Like facility-level materials accounting, process-level data gathering tracks individual hazardous substances as they move through processes.

Stage 1: Materials Accounting at the Process Level

Materials accounting at the process level parallels materials accounting at the facility level. Begin with existing process-specific records, including: measured rates of flow in and out of a continuous process, batch sheets, product yields, and product specifications. Using a process flow diagram as a guide, find values for the inputs and outputs to each process. A successful materials accounting will establish a general balance between how much of a hazardous substance enters a process and how much leaves the process as output. If necessary, your team may want to account for nonproduct output by finding the material flow through **sources**, however, the detailed analysis could be delayed until later. Your team should choose the level of accuracy that will satisfy your firm's needs.

Your team should seek nonproduct output in the process inventory as components of the facility-wide nonproduct output that has already been measured. In other words, for each hazardous substance, the nonproduct output found in all processes should add up to the total facility-wide nonproduct output. Process-level nonproduct output information is used to target processes for further analysis in the next step. The portion of total nonproduct output contributed by each process will be an indicator of which processes to target for further analysis in the next step.

Sometimes, your team will find that nonproduct output which is indicated by the known inputs and outputs cannot be found leaving a process. It is important to hunt down these unexplained losses because they often are opportunities for pollution prevention. If hazardous substance inputs do not show up in the product stream, are not consumed, and cannot be accounted for as nonproduct output, then your team should look for additional sources that may have been overlooked in Step 4.

Stage 2 (Optional): The Process-Level Mass Balance

A second stage of the process-level analysis that your team might use is a detailed **mass balance** of the flow of hazardous substances through your processes. Mass balances offer greater accuracy, but also require greater work, than materials accounting. In a basic form, mass balances are defined by the statement:

[Mass in] = [Mass out] + [Accumulation].

In other words, anything that goes into a process and does not remain, must exit the process. This statement is similar to the general balance that your team tried to achieve through materials accounting, but a mass balance requires closure of the statement. Closure means that inputs must equal outputs (plus accumulation).

To achieve this accuracy, samples and measurement replace existing records and estimation. Closure also means that the entire process should ultimately be balanced on a pound for pound basis, rather than accounting for each substance alone as in materials accounting.

Mass balances can be time consuming. They often require direct measurements and sampling, and always require some expertise to determine how the reactions of inputs lead to known outputs. Because of the resources a mass balance requires, some facilities choose to rely on materials accounting which, while not as accurate as a mass balance, may provide adequate information for process evaluation. Later, after your team has targeted some processes as the ones for which pollution prevention is likely, it may be worthwhile to conduct a mass balance for those targeted processes.

If your materials accounting yielded questionable information, however, it is a good idea to do a mass balance now. The careful measurement required in a mass balance should clear up problems in the materials accounting. The process of sampling and measuring flows itself sometimes leads to improvements in process control and efficiency while yielding the data needed for a mass balance. If so, remember to record those improvements as pollution prevention in Step 8. Appendix C, Sources of More Information, includes a short bibliography of mass balance texts and articles.

At the end of this stage, your team will have collected almost all of the Part I information. Only a few elements remain.

CASE STUDY: Part I For Processes

The team members found the facility-level use and nonproduct output numbers revealing. Most of them were surprised to learn how high the totals were. Nevertheless, they knew that if it they wanted to reduce the amounts of hazardous substances the facility was using and generating, they would have to do it at the process level. They needed reasonable estimates of what happened to hazardous substances at each of the processes they'd identified. The team was skeptical about whether they could produce a representative process-level picture without collecting lots of extremely detailed information. Thomas and Sarah decided to work together to find out.

The data on hand that best explained how hazardous substances were used in production processes were the solvent formulas used in grouping. By using the solvent formulas, Sarah and Thomas felt they could get reasonable use and nonproduct output estimates by back-calculating from the amount of product made at each production process. They invited Emily Cruz, the firm's financial manager, to join their mini think tank. Emily had already started developing a spreadsheet that would take order/production figures and categorize them by the processes which made them. There were two components to achieving this task. The first was easy; each product could be assigned a solvent formula that corresponded to the process. The second component was more difficult. Emily needed to know whether an order was completed on new or old equipment to decide which production process to assign the order to. She was worried about finding this information since any wallpaper could be made on any machine.

Fortunately, when an order came in and was sent to the plant floor, the Plant Manager assigned a tracking number to it that was used to move the order through the printing process to the warehouse, and from there to the customer. The number included customer identification, a design code, and a code that routed the order to a specific machine. The Plant Manager coded these orders this way as part of production scheduling, which was always hectic since Top Shelf sometimes worked with a just-in-time inventory system. When an order came off a printing machine and was sent to the warehouse, its tracking number was recorded electronically. All Emily had to do was search a spreadsheet of completed orders to find the numbers that ended in either 11 or 12; they had been completed on new machines.

With Emily's spreadsheet, Sarah and Thomas believed they could relate the solvent formula and production data to find process-level **use** estimates, using the following formula:

$$\text{Haz substance used} = (\text{yds of product}) \times (\text{lbs of solvent/yard}) \times (\text{\% haz substance in solvent})$$

However, they did not know what the pounds of solvent per yard of product quantity would be for each production process. They decided to estimate the amount for the next batches of wallpaper made on both the new and the old equipment. These batches gave them the numbers they needed for the two types of equipment: 0.025 pounds per yard for the old equipment and 0.02 pounds per yard for the new equipment. Plugging these values into their formula gave them the annual use numbers they were looking for. (See Table 6.3.)

Next, the team needed to find process-level nonproduct output numbers. nonproduct output was a new reporting concept for which they had no data at all at the process level. However, they believed that nonproduct output would equal use since there was no recycling and, except for the gluing process, no hazardous substance shipped in product. They adjusted the nonproduct output numbers for MiBK in the gluing process to account for the 15 percent MiBK that was always left in the product.

To check their work, Thomas summed up the process-level estimates for each hazardous substance and compared the sums to the facility-level totals. The sums for three of the solvents were in rough agreement with the facility-level totals, but acetone and MEK fell short by close to 30 percent. Thomas could not figure out why, so he asked other team members for their thoughts. Travis knew off the top of his head that MEK and acetone were used for cleaning. He pointed out that the method they'd used to find process-level data focused only on production and did not account for cleaning, even though they had decided to include cleaning as sources within the production processes. He told the group that the missing MEK and acetone must have been used for cleaning, but that he was surprised that they used as much as 30 percent for this activity. He had always thought the number was closer to 10 percent. The team divvied up the solvent quantities into the processes that used them, based on the level of production for each process. They revised their process-level estimates for acetone and MEK and recorded them in the Plan (see Table 6.4).

5. Hazardous Waste Information

This category covers how **hazardous waste** is managed at both the facility and process level. Since nonproduct output often results in hazardous waste, this information is important to your planning. Under the Rules, your team must record the amount of hazardous waste produced during the year for each process and for the facility as a whole. It must also record how that hazardous waste is handled, either through **recycling**, or by a treatment, storage and disposal facility (TSD). Most of the information required for these categories is already reported by the facility in the manifests for hazardous waste shipments and in annual hazardous waste generator reports. The process-specific data should show up through materials accounting or mass balances. See Appendix E for a checklist of quantities that must be recorded.

6. Financial Analysis of Current Processes

When it has gathered information for the previous five categories, your team may have a new appreciation for the company's involvement with hazardous substances. It is beneficial to find a measure of the real costs of that involvement as well. Your team already knows basic financial data, through the business records that contributed to the process-level hazardous substance inventory. Purchase prices and disposal fees are part of those records and tell part of the story, but your team may be surprised at how many other costs are attributed to general facility overhead which would be more realistically accounted for as a cost of hazardous substance use and generation at a particular process. Assessing these hidden costs will help the company make better investment decisions. These costs are intended to be included with the costs normally assigned to a process, such as raw material costs, energy costs, labor, etc.

Finding these costs gives your team a basis for analyzing the cost effectiveness of pollution prevention options. Knowing these costs is the first step in completing a total cost assessment, which is recommended, though not required, by the Rules. Total cost assessment is a managerial decision-making tool that can evaluate the return that pollution prevention or other investments will have on a process. An advantage of total cost assessment is that costs that are seldom counted in other financial analyses are built into this system.

All the costs which are directly linked to hazardous substance management and generation should be considered in a total cost assessment. These include all those required by the Rule, plus some others (see Appendix G). In some instances, like hazardous waste disposal, the costs are accounted for, but may be detached from the specific processes that cause them. Allocate those costs to the processes that generate them. Any reasonable formula for assigning nonproduct output costs to specific processes is better than lumping them together in a single overhead account, because overhead costs hide opportunities for savings.

Some types of hazardous substance costs may not be recorded anywhere. These are costs to your facility that are caused by one process, but are accounted for as a cost of a different process. Untangling such accounts will both demonstrate the total costs of nonproduct output at the facility and pinpoint where the most profitable opportunities for pollution prevention investments may be.

Your team's sources of cost data will be found all over the facility, including: purchasing, materials man-32agement, financial management, environmental protection, and production. While it may be difficult to disaggregate the costs from each department and associate them with individual processes, the time spent finding nonproduct output costs now will save time and dollars later in the Plan when your team considers pollution prevention investment options. The Rules require that facilities estimate the cost of using and generating hazardous substances for each production process.

Relation to On-Going Reporting

A facility and process-level inventory should be kept up to date and available in the future. The sources used to gather data for Part I analysis should be built into a framework that can be used repeatedly for reporting to the Department through Plan Summaries (see Step 10) and Release and Pollution Prevention Reports. Once your pollution prevention program is in effect, progress toward achieving reductions in nonproduct output generation and hazardous substance use will be recorded in a companion section to Part I called Part IB. This is the same data which is reported to the Department in the Pollution Prevention Plan Progress Report. Once the Plan has been in effect for a year and progress has begun, this data is recorded. Step 11 Tracking and Reporting Progress explains the relation of the Plan Progress Report to Part IB of the Plan.

STEP 7

Targeting

Targeting means prioritizing your processes and sources to determine which ones to examine in Part II of the Plan. Many factors will enter into your decision, including: the prospects for reducing your use, nonproduct output generation and release of hazardous substances; the opportunity for significant cost savings; and the relative ease of dealing with one source or process over another. The Rules require that, together with any other considerations that enter into your decision, you target at least 90 percent of your use, 90 percent of your generation, **or** 90 percent of your release of hazardous substances.

Your team may not have the time or resources to undertake the rest of the planning program for every covered process and source. **Targeting** is how the team will decide which processes and sources have the greatest potential for pollution prevention. These are the ones your team will work on for the rest of the Plan. In later planning cycles, the facility may pick up processes and sources that were not targeted this time around. If there are only a few processes at your facility, or if you are very enthusiastic about pollution prevention, you can choose to target all of your processes. Otherwise, this Step will allow you to set some aside for now.

In Step 6, your team compiled inventory information that should give it a general picture of how the company's processes use and generate hazardous substances. The team also developed a better idea of the total process-level cost of using and generating hazardous substances. Based on this information, consider what your firm's objectives for pollution prevention are, and where reductions in your hazardous substance involvement would serve those objectives best.

The primary goal of pollution prevention is to minimize any negative impact that industrial activity has on the environment; however, there are also fiscal and management goals which pollution prevention supports. By targeting problem areas for pollution prevention, you also target them for change and improvement. The process of targeting selects the processes and sources for which your team will develop detailed information and seek pollution prevention options. Your team's targeting should go beyond environmental protection to reflect the company's plans for growth, but should focus first on making a positive environmental impact.

How To Target

Nonproduct output, use, and release of hazardous substances are three yardsticks for measuring pollution prevention and environmental impacts. Each of these criteria provide a reasonable basis for setting priorities among your facility's processes. Target by first selecting the criterion where your team would like to have the largest impact. Next, choose processes which have a large impact on that criterion and designate them as targeted processes.

Other company objectives may have an impact on the choice of which criterion your team will use. For instance:

If the facility uses very expensive ingredients, your team might target **use** to cut down purchase costs;

If the facility has some inefficient processes, your team might target **nonproduct output** as a way of tightening them up;

If releases are causing problems for a publicly owned treatment works, or raise concerns in the surrounding community, then **release** may be the best targeting criterion.

It is important to note that whichever criterion your team chooses (use, nonproduct output generation, or release), pollution prevention will probably improve all three. If the use of a hazardous substance drops, nonproduct output and release will probably drop also, and vice versa.

Targeting in the Rules is set up around the three criteria mentioned above. Covered facilities must target a set of processes and sources that contribute to at least 90 percent of the total use, nonproduct output generation, *or* release of hazardous substances at the facility. Your pollution prevention team must pick *one* of these criteria for the entire facility. Note that these criteria apply to the *total* use, nonproduct output generation, or release of all covered hazardous substances at the facility, not the use, nonproduct output, or release of each hazardous substance.

For example, suppose a pollution prevention team chose to target using the nonproduct output criterion. If the team identified 10 processes and each contributes 10 percent of the facility-wide nonproduct output, then nine of these processes must be targeted for further analysis, since nine would be necessary to add up to 90 percent of the facility-wide nonproduct output. If the team had chosen a different targeting criterion, the selection process would be parallel to this one.

The Impact of Targeting

The targeting criteria are a way of deciding what processes and sources you will concentrate on in later pollution prevention planning steps, but they do not define the scope of those steps. By targeting a process or source, you are committed to looking for pollution prevention options for it, but you are not guaranteeing that you will find any. Businesses with pollution prevention programs have usually found a pollution preventionoption for the processes and sources they target, but if a facility looks and does not find any viable opportunities, then it has not incurred any additional regulatory responsibility.

The most common method of targeting is process targeting. When a process is targeted, it means that your team must collect data on the flow of nonproduct output through each of the sources leaving that process, collect other detailed data, look for pollution prevention opportunities within the process, and set goals for reducing use and nonproduct output at that process (see Step 8). The team can expand its search for prevention investments to include all or some of the sources leaving the process as well.

Source targeting can also be used, but it is less common because of the way pollution prevention is tracked. When your team targets a source, it has committed to looking for pollution prevention options at that source. Goal setting and reporting, however, must be done for the process that creates the source because the Rules do not have a mechanism for reporting on sources alone. Therefore, the team will have to report at the process level, and will have to report on the nonproduct output flowing through all of that process's sources.

You should target where it makes the most sense at your facility and not worry about the number of pollution prevention opportunities that will turn up later. Nevertheless, your team should almost certainly target sources and processes where pollution prevention will be simple or where process changes are going to happen anyway; pollution prevention can be incorporated into those changes. Your team is encouraged to go beyond compliance in its targeting decision. For instance, your facility could target more than the percentage required by the Rules. The team could also add non-hazardous substances or processes not required by the Rules to the group it is targeting. Your firm might choose to do this because finding pollution prevention is usually profitable.

CASE STUDY: Top Shelf Targets

The next step was to target the processes where the team would look for pollution prevention. The team decided to target based on nonproduct output because the team members agreed that it was a quantity that told them a lot about wasted materials at the facility. The team wanted to know how much each of the processes and grouped processes they had identified contributed to facility-level nonproduct output. The team got a handle on this by dividing the process-level totals by the facility-level total for all hazardous substances (Table 7.1).

They saw that several of their processes were responsible for more of their nonproduct output than others. The team decided to target these immediately. At this point, Thomas reminded the team that the Rules required that enough processes be targeted to account for 90 percent of the hazardous substances used, generated asnonproduct output, or released by the facility. Emily considered the nonproduct output numbers and pointed out that they could turn the criterion around and find combinations of processes that contributed less than 10 percent of the nonproduct output, such as a set of processes that made some of their less popular, niche products.

Jerry noticed that even though processes which made less popular products could be put in a set that contributed to less than 10 percent of the facility nonproduct output total, those products were made with the same equipment as all the others. This meant that any pollution prevention changes to the equipment would result in nonproduct output reductions for all the processes that used that equipment. This fact dissolved much of the advantage of leaving a few smaller processes out of the Plan.

There was, however, one process that they might advantageously set aside during this planning cycle. The gauze gluing process was very different from the wallpaper making processes. By not targeting it, the team could concentrate entirely on the possibilities presented by the wallpaper printing equipment, and not split their resources between different kinds of equipment. In the end, the team agreed with this plan and targeted all of the wallpaper printing processes, and not the gauze gluing process.

Table 7.1 Relative Percent of Hazardous Substance Nonproduct Output.

Process Identifiers	Total Hazardous Substance Non-product Output	Percentage of Total Nonproduct Output
M1/E1	71,267	32.45
M1/E2	11,830	5.39
M2/E1	46,781	21.30
M2/E2	10,096	4.60
M3/E1	51,167	23.30
M3/E2	9,149	4.17
D23/E1	7,895	3.60
D23/E2	1,419	0.65
D37/E1	5,409	2.46
D37/E2	789	0.36
Gauzeglue	3,800	1.73
Total	219,601	100.00

STEP 8

Finding and Analyzing Pollution Prevention Options

In this step, your team will think creatively to devise, analyze and choose pollution prevention options for processes or sources it targeted. Your team may need to develop additional detailed information for the targeted processes and sources to find prevention options and to pick the ones that are technically feasible and fiscally sound. Step 8 deals with **Part II** of the Plan under the Rules. Appendix F includes a checklist of items that must be included in Part II of a Plan.

Part II of the Plan is about finding and implementing investments in pollution prevention. Most of the data your team will need has been developed in the previous steps. However, there is some information, specifically source-level nonproduct output data, that your team will want for targeted processes, which is not necessary in Part I. Also, if your team chose to put off mass balancing before, doing it now can expand the number of pollution prevention opportunities it is likely to find.

Quantifying Source-Level Nonproduct Output

In completing the previous Steps, your team identified, grouped, and collected data on sources. Sources, as the points where nonproduct output leaves processes, are excellent places to look for pollution prevention opportunities, but your team will need to know a good deal about them. Your team has already identified them, and the hazardous substances that pass through them should be known from process- level materials accounting. However, the annual quantities of nonproduct output that are generated at each source are probably not known.

The Rules require your team to find source-level hazardous substance quantities for the targeted processes. Knowing these amounts will lead to pollution prevention where it can do the most good. Also, knowing the quantities of nonproduct output generated at each source will be necessary if your team decides to conduct a mass balance for its targeted processes.

Mass balancing is not required by the Rules, but if you apply a mass balance method to your *targeted* processes and sources, you may find more pollution prevention options than if you do not. This tool gives your team a detailed view of your targeted processes that is not matched by any other kind of analysis. Mass balancing was discussed in Step 4. If you intend to do a mass balance for pollution prevention planning, it is recommended that you do it before continuing this step.

Your team does not have to use a mass balance do find its source-level nonproduct output— it can use the simpler materials accounting system. The advantage of a materials accounting approach is that it is simpler; the disadvantage is that it is less accurate. Once source-level nonproduct output has been determined for all the sources in each of the production processes being examined in Part II, the team can begin to brainstorm for available pollution prevention options at those sources and processes.

CASE STUDY: Top Shelf Completes Its Data Collection (Sources)

The Plant Manager called a lunchtime meeting of the team to start the ball rolling on Part II of the Plan. She turned the meeting over to the Environmental Manager to explain to everyone where they were in the planning process.

Thomas explained, " At our last meeting, we targeted ten processes based on the amounts of various solvents they use. We're going to look for pollution prevention options for those ten processes, so we'll need detailed data on how hazardous substances leave them as nonproduct output. We're required to quantify the amount of nonproduct output generated at each source in these targeted processes. I've talked this over with Sarah, and she has an idea about how we'll get source-level numbers."

Sarah explained her approach, " There are basically two forms of nonproduct output flowing through the sources in our targeted production processes: liquids and air emissions. The liquids are easier to find and easier to measure. Let's quantify this large, easy-to-find nonproduct output first, then we'll move on to the rest. If we have good numbers for the liquid nonproduct output sources, I think Thomas and I will be able to come up with decent estimates of air nonproduct output source data."

The team agreed with Sarah's approach. They reviewed process flow diagrams for the targeted processes (refer back to Figure 4.2) and listed the liquid sources of nonproduct output, which included: mixing vats, dye reservoirs, pump liners, piping, and ink trays. Because the steps of each process were essentially the same, the sources were qualitatively similar, but varied in composition and quantity of substances used, and needed to be quantified separately.

The team had to estimate the hazardous substance nonproduct output from the sources in each targeted process. They chose to do so by calculating amounts based on representative runs of some of the processes. These runs required more detailed analysis than was conducted previously in Step 6. Now, the team would need to do some actual measurements for the sources they identified. Travis, who sometimes bore the brunt of Sarah's production schedule headaches, asked that they minimize the amount of time the team spent on the plant floor measuring liquid nonproduct output. He suggested that they could probably estimate the amounts they needed if they measured four runs on both the new and old machines: a long one, a short one, one using the highest vapor pressure solvent formula, and one using the lowest vapor pressure solvent formula. Then, the unknowns could be inferred from the other measured data. Sarah said she couldn't guarantee that they'd have all the data they needed without checking out some other runs, but she promised they'd take the measurements when there was a lull in orders.

Over several weeks they collected data for the runs Travis had recommended. For each run, the team was careful to measure the liquid residue from both production sources and cleaning sources. When all the representative runs were completed, the team was able to make inferences and calculate liquid nonproduct output amounts for all the targeted processes. Fortunately, the volatility of solvent mixtures did not have a significant effect on the amount of liquid nonproduct output leaving each source.

When the liquid nonproduct output measurement phase was completed, the team met again to see if, as Sarah hoped, they could infer air source data now that they had other source numbers. The team agreed that the numbers for the liquid sources were quite good, so the difference between the liquid sources and the total solvent used in the runs they'd measured should approximately equal the amount of nonproduct output leaving the process from air sources. This assumption was bolstered by their discovery that the volatility of the solvent formulas did not seem to make a significant difference in the amount of liquid they measured in otherwise similar runs. Therefore, they did not have to worry about very different evaporation rates between solvent mixtures.

The team agreed that the largest of the three air sources was drying wallpaper once the ink had been applied. During that step of the process, the object was to drive solvents out of the paper, leaving only ink. While the team agreed that this was the largest of the air sources, it also seemed to be very difficult to estimate its magnitude directly.

At this point, Thomas remembered that the air permit applications for the printing equipment were based on source specific information. He gathered them together. Applications for the new equipment were up-to-date and contained data on emission rates in pounds per hour both before and after treatment. He realized that the " before treatment" data was actually the nonproduct output information he was looking for. In reviewing the calculations, he saw they were based on exposed surface area, and the " worst case" high vapor pressure solvent. He was able to use the other solvent mixes and time per batch to come up with reasonable estimates of the nonproduct output for each hazardous substance generated in the targeted processes.

The team recorded the measurements and estimates they had for each process in Part II of the Plan (see Figure 8.1 for the estimates the team made for M1/E2 & M1/E1).

When the data was recorded and the team had a chance to look it over, it appeared that nonproduct output was generated in two ways. First, some nonproduct output was generated in constant amounts every time a run was completed, regardless of the run's size. For instance, the pump liners usually had a constant amount of liquid left at the end of each run, except for the processes run on new machines, which consistently had approximately 50 percent less left in the liner. In fact, the team realized that 15 of the 17 sources were a function of the number of batch changeovers. Second, the remaining nonproduct output was generated in a direct relation to the size of the run. Drying wallpaper was one of these second kinds of sources. Only two air sources (PA2 and PA3) were related to the yards of wall paper produced.

Next, the team used data from the representative runs to calculate annual quantities of nonproduct output generated from each source. They realized they needed to use different methods to calculate nonproduct output for the different sources. For most sources related to the number of batch changeovers, the team needed information on the batches run for each process. Emily was able to use the new production data for each process. The new data was used in the calculations. The two air sources that were directly related to the yards of wallpaper produced were easy. All they had to do was multiply the nonproduct output per yard developed in the representative runs by the total yards of wallpaper produced for the process.

By adding together all the source data for each process, the team developed new process-level data. They compared the new process-level data to the original estimates from Step 6 (Table 6.4). Most of the estimates were close, but the new estimate for acetone in the old equipment was much smaller than the original.

At this point, the team realized there was an important difference in the estimates. In Step 6 the team based their estimates on production while in Step 8 they used the number of batches for each process. This highlighted a trend in their production scheduling. They know the new equipment was more efficient and usually scheduled shorter batches on one of the four new machines. This made the average batch size for the new equipment much smaller than the old. At the same time, this meant that many of sources in the new equipment generated more nonproduct output per yard of wallpaper produced than the older equipment. The original estimates, which essentially assumed that batch sizes were the same for all processes, significantly overestimated losses for the old equipment, while the estimates for new equipment underestimated those losses.

The team felt that the new estimates were more accurate and used them in their next steps as they prepared to look at developing pollution prevention options for each source.

After the necessary data was collected, Thomas prioritized the sources by the amount of nonproduct output generated at each targeted production process. He distributed copies of this data to the team members and asked them to use them to prepare for the next meeting by thinking up pollution prevention options for those sources.

Generating Options

The exciting part of pollution prevention planning begins here. This is where your team stops collecting data and begins actively looking for ways to reduce your facility's involvement with hazardous substances. New Jersey's Rules reflect this natural break; it is where **Part II** of the requirements for pollution prevention planning begins. Appendix F is a checklist of the requirements for Part II of a Plan.

Think about how your team will find pollution prevention options. A good way to get started is to have a member of the pollution prevention team present each targeted process or source to the rest of the group, perhaps together with a schematic or process flow diagram. From this starting point, the team will develop its ideas. Their understanding of how the targeted production process or source functions is vital to developing potential pollution prevention options. Detailed narrative descriptions of the targeted processes or sources provide this understanding. These descriptions include information about any activity that occurs in the process, the overall methods used to achieve the desired result, and the specific techniques used in that method. Once the descriptions are complete, gather your team together to begin identifying pollution prevention options.

Think creatively. . . and fundamentally. Pollution prevention techniques fall along a continuum from fundamental changes of processes and sources to increased efficiency in what already exists. Your team should look for ideas all along this continuum. At one end, there are options that address fundamental questions about your firm, like: What do you sell? Who are your customers? Do you sell a general product to a wide array of users or do you deal with a set of customers, providing them with specific supplies that might be interchanged with something similar or better? Depending on the answer to questions like these, you may be able to eliminate some of your sources (or even processes) altogether by reformulating products or by selling your customers another product your firm makes that does not involve the targeted source or process, but which will serve their needs.

For instance, a paint manufacturer could achieve major pollution prevention progress if it moved away from oil based paints toward water based latex paints. That kind of pollution prevention comes from asking fundamental questions about your firm. In the case of the paint manufacturer the question might be " Do we make paint or do we make oil based paint, and what is the difference to us and our customers?"

If it is impossible to make this type of fundamental change, there are many pollution prevention options that leave processes essentially the same, but alter the hazardous substances they use. For instance, a process that uses an organic solvent might function just as well using a non-hazardous aqueous solvent.

Finally, at the other end of the continuum are options that involve the same chemicals in the same process, but use them more efficiently, thus reducing the use and/or nonproduct output in the process. Equipment modifications, changes in operating parameters and improved maintenance ("housekeeping") fall into this category.

From these general methods, your team needs to find specific prevention measures for the targeted processes and sources. The team can use any problem-solving system, including answering some targeted questions, conducting a brainstorming session, and looking to outside sources of information. As your team looks for options, start the search using the work that has been done in the previous Steps. The nonproduct output, process, and source data which has already been collected is an important and useful base from which to begin looking for available pollution prevention options at the facility.

The answers to a series of questions about your facility may lead to pollution prevention options. Such questions can help the team think fundamentally about pollution prevention and how it relates to a targeted process or source under consideration. Some of these questions include:

Can we meet our customers' needs with an altered product that generates or uses less hazardous substances?

Why must we use this particular material?

Are there simple changes in operations which will prevent pollution?

Can we substitute less hazardous or non-hazardous substances for ones we are using now?

Are there equipment modifications or upgrades we can make to reduce nonproduct output?

After discussing the issues and recording the ideas raised by these questions, your team can consider questions directed toward more specific pollution prevention techniques:

Are our maintenance procedures and schedules optimized?

Do the equipment operators use the most efficient procedures or would retraining be appropriate?

How efficient are our housekeeping procedures?

Are raw materials delivered in optimum quantities at optimum times?

Do production runs and schedules optimize material usage?

Questions like these will focus your team's thinking on topics that will lead to pollution prevention ideas. They will also lead to new questions that apply more closely to the processes at your facility.

Employees who work with your targeted processes and sources should be encouraged to submit their pollution prevention ideas or to get actively involved in the brainstorming sessions. Develop an easy way for them to make suggestions and offer a bonus for workers who come up with ideas that are used. Or publicize your pollution prevention efforts with an event, like a facility-wide pollution prevention contest.

Brainstorming is an excellent way of tearing down the obstacles to employee involvement and creative thinking. Bring your pollution prevention team together with the individuals who work with the targeted process or source. The basic principle of brainstorming is that everyone gets an opportunity to suggest "outlandish" ideas and that those ideas are not eliminated before there is time to realize that they may not be so outlandish after all. Each person in the session should come up with as many ideas as possible to share with the rest of the group. Every idea is written down, but ideas are not evaluated at this point. Evaluation is put off until later to ensure that nothing stifles creative thinking during the brainstorming.

Finally, there are many places to get started with **seed ideas**. The EPA and the New Jersey Technical Assistance Program have descriptions of options that have worked at facilities similar to yours. Industry trade groups are also a good place to turn. These sources will provide your team with assurance that it has not overlooked a simple proven technique already used by another firm. (See Appendix C for outside sources of information.)

CASE STUDY: Top Shelf Finds Its Available Options

Sarah and Thomas prepared for the next team meeting by assembling a folder for each team member. The folders held flow diagrams and tables of process specific and source specific nonproduct output data for each hazardous substance at the ten targeted production processes. They wanted the team to be able to refer to these data during the next meeting, when it would brainstorm for pollution prevention options.

At that meeting, Sarah announced that the team would work through the ten processes and their sources, and record any option that might qualify as pollution prevention. The team had prepared for this meeting by noting ideas they had come up with during the preceding weeks. Jerry pointed out that his ideas applied to all the printing machines. He suggested that the team didn't need to go process by process since so many ideas applied universally. Sarah said she wanted to go through the targeted processes one by one because there still could be ideas that applied to only certain solvent formulas, such as raw material substitutions and product reformulation. Nevertheless, she agreed that some ideas were broadly applicable, so they'd be marked on her master copy of prevention options and automatically carried over to each targeted process.

Starting with process M1/E1, the team came up with ideas to reduce nonproduct output at the sources in each targeted process. They also had some ideas which reduced nonproduct output at all the sources in a process, such as production schedule changes and raw material substitutions. Table 8.2 summarizes the options generated, the processes they apply to, and *the specific sources that the options improve.*

During brainstorming, every idea was noted and the processes and sources it applied to were recorded. The ideas were not discussed during the session, but afterwards Thomas said that he did not think ideas 4, 13, 15, or 18 would qualify as pollution prevention because they involved out-of-process recycling. The other ideas were pollution prevention and a revised table became the list of available options in the Plan, which shows what options might be feasible at each targeted production process.

Analyzing Your Options

When your team has found all the pollution prevention ideas it can, it should begin to evaluate those ideas. The first step is to screen them to be sure that they represent true pollution prevention techniques. People often have different understandings of what pollution prevention is, so your team may have included in its list of options some concepts that do not fit the definition of pollution prevention your facility is working under. For instance, most kinds of recycling and reuse are not pollution prevention under the New Jersey Act.

Do not discard the ideas which do not fit the definition of pollution prevention. Set them aside; your team may implement them outside of the Pollution Prevention Plan or they may be worked into the Plan if viable pollution prevention options are not found for a targeted process or source.

All the options that do meet the definition of pollution prevention must be recorded in the Plan as **available options**. The team will choose the options they believe the company should invest in from the available options list.

When the team has a list of true prevention approaches, go through the individual alternatives, discuss each one, and eliminate those that are fanciful or plainly unworkable. If your team is unsure about whether to eliminate an option, carry it over to the next step where a more detailed analysis will reveal the answer.

To decide which alternatives among those remaining will be implemented, a **feasibility analysis** is required for each one. A feasibility analysis for pollution prevention planning consists of two parts: technical analysis and economic analysis. These analyses may be conducted at the same time, although information from the technical analysis may provide cost data for the financial analysis. If the team has found an option that is obviously worthwhile which it plans to implement, it is not necessary to do a detailed feasibility analysis.

Technical Feasibility Analysis

Is it possible? That is the first question you need to answer about a pollution prevention option. A more complete form of the question is, "Will our facility be able to use this in our process and will it reduce our use and/or generation of hazardous substances?" This can be easy to determine for ideas that involve changes in procedure, but for a process or equipment change, laboratory research and pilot plant level testing may be needed before you know whether an idea will work.

People from all phases of plant operations should be involved in the technical analysis. They will be the ones who design tests and experiments to show whether an idea will work and what its effect on use and nonproduct output will be. Throughout the technical analysis, financial managers will collect cost data to feed into the next phase, determining financial feasibility.

A first step in answering the question, "Is it possible?" is to know what "it" consists of. An identification of the pollution prevention option, which describes how it relates to the processes and sources of nonproduct output it affects, will tell your team what the repercussions of the option could be. For instance, one option that appears in the wallpaper case study is installing a closer fitting roller trough on an older piece of equipment. A description of this option shows that this would require several new pieces of equipment, changes in procedure, and personnel retraining. There might also be new maintenance procedures. Other options could involve different energy needs or space configurations on the shop floor. Your team should learn if your facility can accommodate these kinds of changes. Impractical options should be abandoned.

At the end of your technical analysis your team will have a list of changes that could be made at the facility if money were of no concern. In the next section your team will work out which of them the company can afford to implement. The answer may be all of them or it may be only a portion of them.

Financial Feasibility

For those projects. which prove to be technically feasible, the next step is to measure their financial feasibility. The essential question here is, "*Will this project be profitable.*" This is where the benefits and costs of an option are translated into concrete financial terms, the language which top management is accustomed to hearing. Then a choice will be made among the many investments competing for limited capital. A comprehensive financial analysis is required by the Rule at this point[5]. Such an analysis, which compares to that done for each process in Part I, will highlight the potential for savings through pollution prevention. The results of this comparison must appear in your Plan.

Appendix G is a description of how to conduct a **total cost assessment** for each potential project. Note that the Rules do not require that a total cost assessment be done. Total cost assessment is a financial tool which compares pollution prevention options against the way things are done now and against other prevention possibilities. This tool extends the boundaries of project financial analysis to account for the less tangible, indirect and longer term costs and savings typical of pollution prevention investments. This tool also allocates these costs and savings to specific processes and product lines. Total cost assessment uses three types of information for each potential project:

1. Current operating costs for a specific process or source, including both direct and indirect, obvious and less obvious costs.
2. Capital costs for the alternative technology, including all necessary changes upstream and downstream of the direct process change.
3. Operating costs and savings over the life of the proposed project, again including both direct and indirect, obvious and less obvious costs and savings.

Much of the data for number one is already in your Plan from the financial analysis done at Step 6. By combining these costs with those the team finds for two and three above, your team will have a basis for calculating several indicators of profitability. These range from a simple payback period to the more complicated, but much preferred, internal rate of return (IRR) and net present value (NPV).

These values are ones which your firm's management may already use to measure against a threshold or "hurdle rate" when it decides whether to make any kind of investment. They are seldom applied to environmental management projects, however, because such projects are thought of as something necessary to remain in business (by staying in compliance with the law) rather than as an opportunity to turn a profit. *Pollution prevention often does turn a profit, so a business needs to think about pollution prevention investments differently from mandatory pollution control investments.* Total cost assessments can show your firm's management which prevention projects are most worthwhile and how they stack up against each other and against other capital investments the facility is considering.

Management always uses its own best judgment in making capital budgeting decisions, guided by their experience and intuition about what the long term effects of a proposed investment will be. This is particularly true for pollution prevention projects for which many costs and savings sometimes are difficult to quantify. (See the list of environment related costs in Step 6.) Approaches to quantifying such costs and handling uncertainty are discussed in the total cost assessment appendix.

With a completed financial feasibility analysis, your team is ready to choose among a set of pollution prevention options which the firm’s technical staff can implement and which the firm’s financial managers are satisfied with.

Selecting Options to Implement

The options that made it through the feasibility analysis should all be worthwhile investments. The technical analysis shows that they are possible, and the financial analysis shows that they meet the company's requirements for profitable investments. Ideally, the firm would do all of them, but usually the options need to be given the OK by the company's managers before any action is taken.

Sometimes, management needs to choose between options that cannot be implemented together. In that case, a decision needs to be made about which one to do. A completed feasibility analysis gives managers criteria with which to pick among the options. The magnitude of nonproduct output reductions, the amount of money an option will save, the time it will take to realize a payback, and any other issues stemming from the feasibility analysis can inform their decision.

If options cannot be done simultaneously, because the company does not have the resources to do all at once, a good way of dealing with them is to wait to decide on them until Step 9, where an **implementation schedule** may provide a way around such resource conflicts. Finally, remember that the Rules do not require a facility to implement any pollution prevention at all, although most companies will implement the options that turn a profit.

CASE STUDY: Top Shelf Chooses Investments From Its Options Using Feasibility Analysis

When the team had run out of ideas and had confirmed that the ones they had were pollution prevention, it was time to pick among them, based on whether the techniques would fit into the facility’s operations and finances. There were 16 techniques that qualified as pollution prevention, although some techniques helped at several sources and were counted as an option at each source (see Table 8.2). The next meeting started their feasibility analysis.

The first question on the agenda was whether any techniques were obviously impossible. Everyone agreed that each idea had potential for success; some, in fact seemed obviously worthwhile. For instance, Travis asked whether they could skip detailed analysis of the new coppers cleaning system (option 16 on Table 8.2). It seemed obvious to him that it would reduce nonproduct output, improve worker safety, and clean more quickly than the current method. He pointed out that the manufacturer’s specifications showed the amount of solvent a cleaning run would use, which compared favorably to the source information from their current operations and gave the data necessary to set numerical reduction goals. Finally, he noted that cost comparisons could be made against current hazardous waste shipping charges since all the waste from the cleaning processes was manifested separately. Thomas reminded the team that the Rules required them to have an analysis made up of certain elements in the Plan. Travis replied that he was sure he could estimate those numbers in under a day. The team took him up on this and adjourned until the next day.

At the next day’s meeting, Travis distributed what he called a “focused feasibility analysis,” based on existing information. The team reviewed it and noted that the new cleaning system would reduce use and nonproduct output by about 2000 pounds a year, resulting in a savings of raw material purchases and waste disposal costs. The team decided to recommend to Mr. Stevens, the president, that the facility invest in the cleaning system.

They couldn’t make such easy decisions with the other options; they needed more information. For instance, several options would change equipment at different steps in the production processes. Individually, none of the options appeared to be disruptive, but the team was worried that collectively they might adversely affect production. Sarah decided that Jerry, Samantha, and Travis should work together as an assessment team to analyze these options. They would look at the impact of these techniques on product quality, production speed, turn around time, worker training, use and nonproduct output reduction, and anything else that could impact production. Travis would call up some equipment manufacturers and metal fabricators to see if their ideas could be put into practice. He’d also get cost estimates and evaluate the savings the facility could realize by making these investments.

Assessment teams seemed to be a good way of doing other feasibility analyses. Every option was assigned to a lead person who was chosen because he or she was an expert on the most important issue associated with the option. For particularly complex options, others worked with the lead person. The color matching computer would be a huge capital outlay, so Emily took the lead on it. Jerry and Samantha had been working on different dye formulations, so they took the lead on raw material substitution. Optimizing production schedules turned out to have so many cross-cutting issues that Sarah took the lead on it, herself. In this way, every option would be assessed by somebody.

They agreed on what information was necessary on each option and decided that it should all be presented in the same format to simplify comparison. They also decided that the same information should be found for their current practices. Each lead person would be responsible for assembling the necessary data. They also decided that when finance numbers were murky, the assessment teams would carry out some form of total cost assessment to clarify things.

After they'd had a chance to collect their data, another meeting was called. It was clear from the beginning that two of the options, the color matching computer and substituting raw materials, could not be assessed quickly or without deeper technical investigation. The team agreed to continue working on these options, but not write them into their Plan yet. If their investigations proved the ideas worthwhile, the options could be added through a Plan modification or at the five year revision. Several team members were very interested in these options and asked that the team formally investigate them, and include a time schedule for the activities needed to come to a decision within the Plan.

The other assessments yielded more concrete results. Travis's team felt the team could make decisions on several of the options. For instance, the source-level data collected during representative runs showed that pumps in the new equipment produced 50 percent less nonproduct output than the pumps in the old equipment. Option 1, refitting the old pump liners with new, smaller ones could reduce nonproduct output by thousands of pounds of solvent per year which would save the facility over $50,000 each year. Replacing the pump liners was a one time cost of $250 liner. The group agreed with the assessment team that this was an obviously worthwhile investment.

The other assessment teams reported their findings to the group, which then decided whether or not to recommend that the company invest in each option. The pollution prevention team chose to implement some options which eliminated others from further consideration. For example, mixing ink directly in the pump reservoir made separate mixing drums unnecessary, so the options treating mixing drums differently dropped out.

Finally, Sarah reported on her investigations into alternative production scheduling. She said that every time they changed products on a machine, a set amount of nonproduct output was always generated. Sarah had estimated that every time equipment was set up for a new product, about 10 to 13 pounds of nonproduct output was generated. Anytime they could avoid a changeover, nonproduct output would be reduced by about that much. If they could reduce the number of changeovers by 5 percent, then they could reduce their nonproduct output by thousands of pounds. To reduce changeovers, the facility would have to make longer runs of the same products and possibly dedicate some lines to certain products, as had been done with the latex products lines. The downside of such changes was that they would reduce the facility's capacity for fast turnaround on niche products and would increase their inventory of popular products.

Sarah could tell that this idea made the team nervous. Everyone was used to the facility's just-in-time production system. Many of the facility's systems were designed to serve the needs of just-in-time production. No one wanted to abandon that system, because it allowed them to carry niche products and serve more customers. Emily, however, had sales figures for the last 5 years and pointed out that the facility had consistently over 100,000 yards of their three most popular products each year.

For one product, batch size varied from 700 yards to 7,000 yards and the average batch size was less than 1400 yards. Sarah estimated that if production planning were improved, the average batch size for these popular products could feasibly be doubled. This would, of course, reduce nonproduct output for the product tremendously.

The team was nervous about this option because it was difficult, if not impossible, to predict market demand. Yet, the numbers were compelling and, theoretically, it wouldn't require revamping their present system. The idea was to expand the production planning window to combine several small orders into one large batch. The members decided to test the idea with a couple of the more popular products. The only real danger was that a popular product would stop selling and wind up in storage for a while, and warehouse space for a few products would not present any significant problems.

The team summarized their discussions by listing the pollution prevention investments they wanted to implement along with the expected nonproduct output reductions and cost savings (see Table 8.3). Of the 20 options the team had generated (see Table 8.2), six remained which they planned to implement. They would present their findings to the President, John Stevens, whose final approval would set things in motion.

STEP 9
Develop Numerical Goals

Numerical goals can be the driving force that rallies the company around the pollution prevention program. The development of these goals is dependent on which options, among the feasible ones identified in the last Step, the company implements. Since the goals are based on a five year planning cycle, an **implementation schedule** impacts goal-setting. The Rules require that facilities have goals for reducing the use and nonproduct output of each hazardous substance, per unit of product, which the facility uses or manufactures above the threshold. Your team will have completed its Plan when it has chosen pollution prevention options to implement and set up goals based on those options.

Every option that made it through the complete feasibility analysis in Step 8 is an investment opportunity in pollution prevention. Each option is not only physically possible, but fiscally worthwhile. The facility would theoretically benefit by adopting all of the techniques that have made it this far. Nevertheless, resources, time, and capital may keep the facility from adopting such a wholesale approach. In this Step, your team will decide when to make these investments, and, based on that decision, set goals for achievements in pollution prevention.

Scheduling Options Implementation

At least two things constrain companies from investing in every pollution prevention option that appears promising: (1) the availability of capital and (2) the timing of pollution prevention implementation as it relates to scheduling other activities at the facility. Fortunately, like many quality management programs, pollution prevention is done in cycles, so over the long run good ideas that are superseded by others can be implemented eventually. **Implementation schedules** are a way of planning around resource and timing problems. If the facility gets ahead of schedule, or decides to supplement its pollution prevention program, it can modify its Plan to include new options between required five-year Plan revisions.

First Constraint: Money

While each pollution prevention idea that gets to this stage is economically feasible, your firm may not have the capital to do all of them at once. If the firm is in a position to make such a wholesale investment, then the issues of timing that appear below are what will govern implementation. Unfortunately, some businesses will not be able to commit money to every pollution prevention opportunity at once. Fortunately, many pollution prevention opportunities are inexpensive to implement. In fact, some changes, like changes in procedure, may be virtually cost-free.

The case may arise, however, when your team needs to choose between options that each require enough capital to make them mutually exclusive in the near term. When this happens, the firm may still be able to implement several of the options in one planning cycle by staggering them in your implementation schedule (see below); otherwise, management will have to decide which ones to implement during the current five-year planning cycle. To help make this decision, your team may need to revisit information on the selected options, such as a total cost assessment, which will show the relative economic benefit of both options, and the technical feasibility analysis, which will show the relative environmental benefit.

Second Constraint: Time

Time is another factor which may have an effect on what to do in the near term and what to begin later in the cycle (or in the next cycle). For instance, if an option requires changing a component in a production line, it may mean temporarily shutting down that line. Finding the right moment to do that will affect your team's decision on when to implement certain options. Fortunately, some investments are simple and quick to implement. For instance, a change in the way hazardous materials are handled and stored to reduce spills could be implemented through on-the-job employee training. Other measures, however, may be more complicated, requiring research and development and structural changes on the shop floor. These changes might delay production schedules or pull people away from other projects at the facility. They should be coordinated with planned equipment maintenance or changes in production " campaigns."

Your team needs to factor these constraints into its pollution prevention program decisions. An implementation schedule provides a framework for making those decisions. Simple investments, which require little or no capital and time, will almost naturally be the first ones undertaken at the facility. These can help build confidence in your program because they usually provide quick, tangible, and money-saving results.

A useful procedure is to sort the prevention techniques your team would like to adopt into a hierarchy that accounts for their expense and complexity, factors which may relate to whether they are people oriented solutions (changes in procedure) or machine oriented solutions (changes in processes). Table 9.1 presents some hierarchical categories and some examples of prevention solutions that fall into each.

Your team can use a hierarchy such as this to develop an effective and fiscally responsible implementation schedule for the facility. Estimate the time and capital it will take to install each option and schedule its installation to avoid disrupting other processes at the facility. Record the schedule in the Plan.

When the implementation schedule is completed, your team can estimate when the benefits of pollution prevention will appear as reduced use and nonproduct output generation of hazardous substances. Those estimates are the basis for your team's pollution prevention goals for the facility and for processes, which are required by the Rules.

CASE STUDY: Top Shelf Sets Its Implementation Schedule

The team at Top Shelf knew their first Pollution Prevention Plan was almost complete. The feasibility analyses of the pollution prevention options were completed, giving the team a list of options which the facility could profitably invest in (see Table 8.3). Although all of the options looked good, the team knew they would need an implementation plan to see them through to completion.

The team decided the first start date for their implementation schedule would be in two months, on July 1. That would give them time to secure the approval of top management. It also coincided with the date the Plan Summary was due to the Department and was traditionally a vacation time, when the facility reduced its workload and did yearly maintenance on its equipment, a good time to install pollution prevention equipment. They began scheduling.

The first item they looked at was money. Most of the options were inexpensive and could be started with current operating funds. The copper cleaning system, however, was an unbudgeted expense. Emily examined her accounts and decided that the company could allocate the capital for the system by late September without pinching other parts of the budget. According to the supplier, the system could be in place and running five months after the order was made.

The other scheduling concerns were time constraints. One option, optimizing the production schedules, was an ongoing challenge for Sarah which she would start right away and continue to work on throughout the planning cycle. The remaining four options involved equipment modifications. Because the same people would be working on implementing these options, the team decided to split them up. Refitting the ink tray and changing procedures to begin reservoir mixing could probably be finished in three to four months, so the team decided to start equipment modification with them. Based on that schedule, they set the start date for recutting the coppers and refitting the pump liners for November when the first modifications would be finished.

Recutting the coppers and refitting the pump liners would take months to complete, because the coppers could not be replaced all at once and the pumps had to be sent away for the refit. See Figure 9.1 for a chart of Top Shelf's implementation schedule.

Pollution Prevention Goals

Why should facilities have goals? Because goals excite people. During the time since the pollution prevention policy was established and your team was formed, the employees may not have heard much about the pollution prevention program. An official announcement of the options to be implemented and the goals that the facility plans to achieve through those options is an excellent way to rekindle support and excitement for the program. The Rules require that Plans include both process-level and facility-level goals for each hazardous substance at the facility.

Goals should be easily understood, easily measured, supported by the people they affect, and realistically achievable. The baseline information from Part I (Step 6) may have shown that there were inefficiencies in particular processes which could be improved through pollution prevention, but, until Part II was completed, there was no way of estimating what realistic goals for reducing use and nonproduct output at those processes might be. Also, there was no way of combining the separate process-level reduction goals into a hazardous substance reduction goal for the entire facility. Now, your team knows what options it will implement and has scheduled their implementation; it can set reasonable five-year goals. Over time, goals will facilitate the measurement of progress. If the facility falls short of a goal, that will indicate where more work might be directed.

Setting Production Process Use and Nonproduct Output Reduction Goals

The Part II technical analysis should provide a good estimate of the pounds of annual use and nonproduct output generation each pollution prevention technique is expected to reduce (see Table 8.3). These expected reductions can translate into goals at the process level. Look at the implementation schedule to see when process and source improvements will manifest themselves as use and nonproduct output reductions. Base the process-level goals on the annual use and nonproduct output levels expected at each production process after five years. If every feasible option will be implemented during the five year planning period, then the total of the expected nonproduct output and use reductions found through the feasibility analysis in Step 8 for each process, will be the five year goal for that process. If some of the options are not implemented, or will not have an effect until after the five year planning cycle is over, then the effect of those options should not be included in the process-level goals. Since the goals are not legally binding, your team can be realistically ambitious. Goals that indicate high expectations will encourage continuous improvement of pollution prevention ideas.

Process-level goals are indexed to the unit of product that your team chooses for each process in Step 6. In Step 6, the team developed data for the quantities of hazardous substance used and generated as nonproduct output at each process. The goals your team develops in this Step are based on reducing the amount hazardous substance used or generated as nonproduct output for each unit of product produced at each process. This indexing separates changes in use and nonproduct output due to pollution prevention from changes due to fluctuations in production levels. Ultimately, your team will express its production process goals as percent reductions in use and nonproduct output, insulated from changes in production. The case study in this Step demonstrates how to make such calculations.

Setting Facility-Level Use and Nonproduct Output Reduction Goals

Hazardous substance reductions at the facility level are an important indicator of how well process-level pollution prevention is working. Therefore, facilities must set goals for the whole facility as well as for processes. Facility-level reduction goals are expressed as the amount the facility plans to have reduced its annual use and nonproduct output generation of each hazardous substance after five years of pollution prevention. These goals are expressed two ways. First, they are expressed as the difference, in pounds, between the quantity of a hazardous substance used or generated during base year and the quantity used or generated during the last year of the five year planning period. Second, they are expressed as the percentage of the base year use or nonproduct output generation which has been reduced by the end of the five year planning period for each hazardous substance. Note that these reductions are based on the cumulative effect of pollution prevention implemented at each targeted production process over the five year planning period. However, the process-level goals cannot be added directly to calculate the facility goals because they are based on pounds reduced *per unit of product* to account for changes in production at the process level.

However, your team should recognize that there is a relationship between the process-level goals and the goals it chooses for the whole facility. To calculate the facility goals, your team can multiply the quantity of product produced at each process during the base year by the process-level goal (expressed in reductions per unit of product). This will give your team the expected reduction in annual use and nonproduct output generation at each process after five years. Gathering these expected quantities for each hazardous substance at all targeted processes will allow your team to assemble facility-level goals for each hazardous substance.

The level of production chosen to find the facility-level goals can impact the accuracy of the goals. Usually, the base year level of production is used, because it is difficult to predict what production will be five years out. Since production is likely to change, the Plan Progress Report will use a production index to help account for these changes in production (see Step 11). If production levels change drastically, the facility can always revise its goals during the planning period.

CASE STUDY: The Team Decides on Goals

The team met to wrap things up for this planning cycle by choosing goals for the Plan. The team was pleased with the work it had done, and was excited about presenting a complete Plan to the President and the rest of the company. The goals they would come up with during this meeting would show what the team expected pollution prevention would accomplish at the facility.

Fortunately, the goals followed directly from the work the team had already done. The team had tables analogous to Table 8.3 for each targeted process. These tables showed the reductions that each pollution prevention technique was expected to bring about. The tables also categorized the reductions by hazardous substance. The implementation schedule showed that all of these reductions should manifest themselves before the end of the five year planning cycle, so they should all be included in the goals. For each hazardous substance, the team added together the five year expected reductions in use and nonproduct output at each source within each process. These totals, when expressed on a per unit of product basis became the team's goals for each process. Thomas pointed out that the goals would actually be reported as percent reductions from the base year use and nonproduct output per unit of product to the goal year use and nonproduct output per unit of product (i.e., a 35 percent reduction in acetone per unit of product, etc.). However, they needed the raw numbers to calculate the percentage reduction and to develop a facility-level goal.

Ultimately, the team arrived at 38 NPO process-level goals, one for each hazardous substance used at each of the 10 targeted production processes. In this case, all of the NPO process-level goals can also be used as use goals because the hazardous substances are " otherwise used" and NPO generation is equivalent to use. (See Table 9.2.a)

The team based its five facility-level goals (one for each hazardous substance) on successfully achieving the pollution prevention it planned at each process. They used the process-level goals for each hazardous substance (MiBK, MEK, Nitropropane, Toluene, and Acetone) and converted them back from the per unit of product basis since facility-level goals were reported as raw reductions. The team converted the goals by multiplying them by the production at each process during the base year. Finally, they added the results for each hazardous substance together. These totals represented the amount that annual use and nonproduct output for each hazardous substance would be reduced after five years if production remained at the base year level. Sarah looked this over and was concerned because she knew that production would fluctuate (she hoped it would go up). If this happened, then the facility would almost surely fail to meet its goals, since use and nonproduct output are linked to production levels. Thomas, however, had been examining the Progress Report Forms he'd have to fill out and realized that they included a production index which would allow the facility to track its goal against the base production levels. He explained this to the other team members and they settled on the facility-level goals (see Step 10 for information on how the goals are reported in the Plan Summary).

Since Top Shelf does not generally consume or produce hazardous substances on site, its nonproduct output reduction goals are usually the same as its use reduction goals. (This is true for most cases involving hazardous substances that are " otherwise used" , e.g., as solvents or processing aids.)

There is one exception for Top Shelf. MiBK is incorporated into a glue gauze in one nontargeted process. While there are no process-level goals, this use as a formulation component results in facility-level use of MiBK being greater than the quantity of nonproduct output generated. (This is true for most cases involving hazardous substances that are manufactured or processed.) In Table (c) and (d) below, note that MiBK use differs from NPO generation at the facility level, whereas, use and NPO reduction goals are identical for all other hazardous substances.

STEP 10
Summarizing the Plan

A Plan Summary provides a convenient way of showing the public, management, and regulators what pollution prevention planning the facility has done without revealing all the details of the full Plan. The Department has developed Plan Summary forms that must be filled out by covered facilities, creating a consistent format for reporting summary information. A markup of the Plan Summary is contained in Appendix B.

Your facility's pollution prevention planning is important to many groups, including senior managers, stockholders, the Department, and the neighboring community. Nevertheless, they do not need to see the complete Plan to understand and appreciate what the facility is doing to protect the environment (and save money) through pollution prevention. A summary of the Plan is a valuable tool for briefing people inside and outside the facility. A public summary is also a concrete demonstration of the firm's commitment to protecting the environment through pollution prevention.

The Department will provide covered facilities with Plan Summary forms to complete. The Plan Summary consist of information that your team uncovered when it analyzed pollution prevention options (Part II of the Plan): the pollution prevention methods selected, the schedule for doing them, and the five-year reduction goals for use and nonproduct output both at the process and the facility level. To put this information in context, Plan Summaries include ranges for reporting the amounts of hazardous substances used in the targeted processes, and generic descriptions of all the covered production processes and targeted sources at the facility. This information presents a picture of the business conducted at the facility, but can do so without giving away confidential information. Likewise, the process-level goals in the summary are not reported as the raw numbers your team found in Steps 6 and 8, but as percent reductions per unit of product instead. If your team believes that the generic process descriptions and the reporting of process-level goals as percent reductions will still reveal sensitive information, there are provisions in the Rules that allow the facility to make this information confidential.

Completing a Plan Summary Form

There are four sections on the Department's Plan Summary. They cover administrative information for the facility, facility-level goals for each hazardous substance used or manufactured above threshold at the facility, process information for each process involved with a covered hazardous substance, and pollution prevention information and goals for each targeted production process.

The person who fills out these forms for the facility will be familiar with the administrative information, which is required on other Department reporting forms. There are, however, other elements on the Plan Summary form that are new. The forms ask for the reduction goals for the hazardous substances used and generated as nonproduct output at both the facility and process levels. Your team established these goals in Step 9. Your facility will submit these goals on a separate facility-level information section for each hazardous substance. On that same section, facilities may optionally report numerical data on pollution prevention for the hazardous substance implemented between 1987 and the base year and qualitative descriptions of pollution prevention achievements before 1987.

Generic nomenclature is also used in the process description section to describe every process that involves a covered hazardous substance at the facility. The descriptions will give those who use the Plan Summary an understanding of what the facility does, without revealing too much about specific operations. It will also put your team's targeting decision in the context of the processes that could have been targeted.

The process-level goals are reported in the Plan Summary as well, in a section that includes both the goals and a schedule for starting and completing the pollution prevention techniques used to achieve those goals. The schedule uses the generic nomenclature of the EPA's Form R to describe the pollution prevention techniques.

Detailed instructions for the Plan Summary will be included in the reporting package that covered facilities will receive before the summaries are due. Nevertheless, when questions arise concerning the forms at any time, facilities are encouraged to call the Office of Pollution Prevention for assistance at 609/777-0518.

Confidentiality On-Site and in Summaries

Preparing a Pollution Prevention Plan sometimes raises confidentiality concerns. The Plan should be available to the pollution prevention team and to the managers whose processes are affected by it. It may, however, contain confidential information as part of its inventories or process descriptions. It's possible that such information is not together in one place anywhere else at the facility, so it makes sense to protect any sensitive information it contains. At the same time, the Plan must be available to the Department inspectors, who are required to treat any information in a Plan they review on site as confidential information.

Like the actual Plan, a Plan Summary may contain data that the facility feels should be kept confidential. If your team is creating a summary on its own for senior management or stockholders, then it can control what goes in it, but the summaries that covered facilities prepare for the Department must contain specific information. If your team or managers believe that any of the information you would submit in a Plan Summary is so sensitive that it should remain secret, then the firm will want to file a confidentiality claim with the Department to prevent this information from becoming publicly available.

A confidentiality claim allows a facility to submit a preliminary public copy of its Plan Summary (or Progress Report) in which potentially confidential information is blacked out or deleted. The facility also submits a complete summary as well. The blacked out version is what will be made public, while the other is kept as confidential information by the Department. Confidentiality claims may not be filed for information pertaining to a hazardous substance's releases into the environment or into a waste water treatment system. If a confidentiality claim is filed, the company should be able to show that it has taken all reasonable measures to protect the secrecy of the information, that disclosure of the information would be likely to cause the company economic harm, and that it has met the claim substantiation criteria at *N.J.A.C. 7:1K-9.3(a)*. Please call the Office of Pollution Prevention with any questions about confidentiality or for more details on the claim process.

Case Study: Thomas Summarizes the Plan For the Team

Once the implementation schedule and goals had been chosen, it fell to Thomas to complete the Plan Summary forms. He completed the administrative data for the facility easily. Next, he had to fill out a facility-level summary for each covered hazardous substance, one for MiBK, MEK, Nitropropane, Toluene and Acetone. These sections focused on the facility-level goals the facility had established in Step 9.

The next section was a description of each process and grouped process the team had identified by the end of Step 5. This meant filling out a section for the gauze gluing operation, which the team had not targeted, as well as a section for each of the targeted processes. The summary includes both a narrative description and a description using nomenclature contained in Appendix C of the Rules. Thomas used the narrative description to provide an overall picture of each process, and then carefully described the steps of the processes using the Department's generic nomenclature. The nomenclature included terms like formulating, printing, drying, and cleaning which Thomas felt accurately described the steps of the process as the team had defined them through process flow diagrams.

Finally, Thomas filled out goal sheets for each of the targeted production processes, a large subset of the processes he'd described in the previous section. For each process, he reported the facility's goals for use and nonproduct output reductions, and an implementation schedule for starting and completing those options. See Appendix B for a copy of the forms Thomas filled out for the facility and two of the ten targeted processes. (Note that there may be some alterations in these forms before they are distributed to facilities.)

STEP 11

Tracking and Reporting Progress

Progress Reports can be valuable tools for keeping your pollution prevention planning effort on track and keeping company managers, the public, and the Department up to date on whether your program is meeting its goals. The Department will provide Progress Report forms that covered facilities must complete each year after submitting their Plan Summary. The Department has combined the Pollution Prevention Progress Report with the Community Right to Know Release and Pollution Prevention Report (formerly the form DEQ-114).

Is it working? Your firm has made a commitment and allocated resources to pollution prevention. Once the program is underway, the team must answer a question from top executives, the public, and the Department: is the program meeting its goals? The Progress Report will help answer that question. The Department's Progress Report form is built around the goals your team reports in the Plan Summary. Learning your facility's progress toward those goals means tracking reductions (or increases) in nonproduct output generation and hazardous substance use. Although it is not part of the report submitted to the Department, financial progress should also be tracked so facility managers will know whether the investment potential of pollution prevention is being reached. Such information can guide adjustments to the Plan, possibly paving the way for more pollution prevention in this planning cycle, or focusing your team's search for new techniques in the next cycle. Facilities will receive Progress Report forms from the Department before July 1 of each year of the planning cycle.

By tracking progress, the team can show how changes due to pollution prevention relate to the goals the firm has set. If the reductions fall short of the goals, then the team will need to find and report the reasons for the lack of progress. Perhaps there has been a delay in the equipment modifications your firm undertook or planned process changes were not properly carried out by personnel. In this way, progress reports will feed back into the pollution prevention program, allowing the team to make adjustments as the Plan is carried out.

Completing the Progress Report Form

The Progress Report forms cover administrative data, facility-level data for each hazardous substance, facility-level pollution prevention reductions in use and nonproduct output of hazardous substances, targeted process reductions in use and nonproduct output of hazardous substances, and conditions that would trigger a Plan modification. As with the Plan Summary, the administrative information in the Plan Progress Report will be familiar because it consists of the same data that is reported to the Department on other forms. The facility-level data will also be familiar because it is the same information that was submitted on the NJ Department DEQ-114 (the Release and Pollution Prevention Report) in the past. Some changes have been made to this facility-level materials accounting information, however, to reflect accurately what can happen at an industrial facility. The detailed instructions that the facility will receive with its reporting package explain these changes. Facilities are required to fill out the administrative section once and a separate materials accounting section for each hazardous substance.

The rest of the Progress Report deals directly with the Plan and with progress toward meeting the Plan's goals. Since this information must be reported every year, your team should consider setting up a system, perhaps a spreadsheet that allows the reported elements to be tracked automatically. By tracking the important pollution prevention values continuously, your team can report on progress easily for the facility as a whole and for individual processes.

Facilities must report on their achievements facility-wide and for each targeted process. For each hazardous substance, the facilities must provide the reductions (or increases) in hazardous substance use or generation of nonproduct output compared to the base year and the progress toward facility-wide goals from the base year to the current year.

For targeted processes, facilities will report on their progress for each hazardous substance that the process is involved with. They will show their progress toward their five year goals, the progress made since the base year, and the reduction methods used to achieve that progress. At both the facility and the process level, the changes in releases are also reported from year to year.

The Progress Report form also allows companies to fulfill the requirements for adjusting the Plan and Plan Summary when significant changes happen that affect the Plan. The situations where a Plan modification is required by the Rule[1] are listed as a series of yes or no questions. If any of those situations apply, the facility can show which parts of its Plan it will modify. For instance, changing the facility's grouping decision in the middle of a planning cycle would trigger a Plan update. Changes to the Plan Summary are submitted along with the Progress Report, so the Department's records reflect changes in the facility's Plan.

Detailed instructions for the Progress Report will be included in the reporting package that covered facilities will receive before the Progress Reports are due. Feel free to call the Office of Pollution Prevention at 609/777-0518 with any questions about reporting that arise either before or after the reporting packages are sent out.

Pollution Prevention Process-level Data Worksheet (P2-115)

In lieu of the Progress Report described above, a facility has the option of annually submitting a Pollution Prevention Process-level Data Worksheet (P2-115) for each covered chemical at each process. Since this worksheet must be completed for the Plan, submittal will save facilities the time to complete additional forms each year. In addition, the Department has committed in the Rules to perform all necessary calculations. Additional instructions on filling out this form is given in the Instructions for the Release and Pollution Prevention Report available form the Department and on the Department's website (www.state.nj.us/dep/opppc.)

Financial Progress

A final area where your facility will see progress is in the money saved and spent through pollution prevention, although it is *not* reported on a Department form. When assessing the financial feasibility of your pollution prevention options, your team made estimates of the economic impacts of carrying out various options. At this point, you should be able to directly measure how costs have changed for your targeted processes. The cost accounting framework your team set up to complete the requirements of the Plan may be very helpful in assessing economic progress. Once the firm has begun to realize the financial benefits of pollution prevention in real savings, interest in pollution prevention will increase throughout the company. In addition, knowledge of which pollution prevention measures are most cost-effective will improve your analyses in the future.

Confidentiality

The confidentiality provisions that apply to Plan Summaries, as described in Step 10, also apply to Progress Reports. A facility manager may submit a confidentiality claim for a Progress Report when he or she feels that the disclosure of the information is likely to cause the company economic harm. When the Department receives a public request to see a Progress Report for which a confidentiality claim has been filed, it will assess the claim and determine whether it is justified according to the confidentiality provisions of the Rule.

CASE STUDY: Reporting the First Year's Progress

Top Shelf's team was responsible for putting the Plan into practice. The team worked hard during the year after submitting the Plan Summary to the Department. Their implementation schedule kept them busy preparing and installing pollution prevention options. Emily completed work on the spreadsheet she'd designed to track the production, use, and nonproduct output generation at each process, which, after the first year was over, allowed Thomas to fill out the Progress Report forms without very much hassle.

STEP 12

Update Your Plan

The last step in the planning process is to start again. Pollution prevention should be ongoing, providing continuing environmental and economic benefits to the companies that pursue it.

Pollution prevention teams do not retire; Pollution Prevention Plans are not completed. In the same way that a company manager is always on the lookout for ways to improve business, the pollution prevention team should always be hunting for new opportunities. More often than not pollution prevention opportunities *are* ways to improve business.

By establishing a pollution prevention policy the firm cleared the way for doing pollution prevention. Now your team's task is to turn its accomplishments into a stable planning framework. There are several reasons for doing pollution prevention this way:

- Initial successes will provide an incentive to do more.
- When long term projects succeed, resources will become available to start new projects.
- When problems arise for one option, a stable planning structure provides a way to look for alternatives.

Continuing reporting and revision requirements under the Rules are another reason for your team to keep its prevention activities current. For these reasons, part of your team's pollution prevention strategy should be one of continuous improvement. Therefore, the final step of pollution prevention planning is to begin again.

Develop a cycle of pollution prevention action and re-evaluation. Reevaluation may show that changes in technology or finances have made something feasible that did not appear so in previous planning cycles. Through such checks the company can maintain pollution prevention programs over the long term without exhausting the feasible and financially rewarding options. It is important to find concrete ways of spurring continuing progress, perhaps by offering new employee incentives, or by reviewing past successes and presenting them as the record to beat.

Continuing planning is required by the Rules. They require Plan revisions every five years, yearly updates of certain information, and modifications when significant changes occur that affect the Plan. Nevertheless, these requirements should not limit your team from updating and improving its Plan more frequently. If your program seems to call for a shorter interval, then follow your program. The Rules are designed to encourage planning. More frequent revisions are within the spirit of that design.

If your team does decide to update its Plan between five-year revisions, it can explain how the update would affect the Plan Summary in a special section of the yearly Progress Report. That way, progress toward your new goals will be made public through the Progress Report and your facility will get the credit it deserves.

Beginning again is the way to make your firm's program an ongoing success rather than a brief flurry of pollution prevention techniques. As the planning cycles go by and your team gets more comfortable with pollution prevention, new ideas are almost sure to crop up. New Jersey's Office of Pollution Prevention is anxious to help in this process in any way possible, as is the New Jersey Technical Assistance Program. Pollution prevention opens the way to new environmental protection, economic strength, and powerful partnerships in New Jersey.

APPENDIX A

The TRI Toxic Chemical List

The TRI Toxic Chemical List (EPCRA SECTION 313)

CAS Number	RTK Number	Substance Name	De minimis Concentration
71751-41-2	3175	Abamectin [Avermectin B1]	1.0
30560-19-1	3140	Acephate (Acetylphosphoramidothioic acid O,S-dimethyl ester)	1.0
75-07-0	0001	Acetaldehyde	0.1
60-35-5	2890	Acetamide	0.1
75-05-8	0008	Acetonitrile	1.0
98-86-2	2961	Acetophenone	1.0
53-96-3	0010	2-Acetylaminofluorene	0.1
62476-59-9	3455	Acifluorfen, sodium salt [5-(2-Chloro-4-(trifluoromethyl)phenoxy)-2-nitrobenzoic acid, sodium salt]	1.0
107-02-8	0021	Acrolein	1.0
79-06-1	0022	Acrylamide	0.1
79-10-7	0023	Acrylic acid	1.0
107-13-1	0024	Acrylonitrile	0.1
15972-60-8	3143	Alachlor	1.0
116-06-3	0031	Aldicarb	1.0
28057-48-9	3647	d-trans-Allethrin [d-trans-Chrysanthemic acid of d-allethrone]	1.0
107-18-6	0036	Allyl alcohol	1.0
107-11-9	0037	Allylamine	1.0
107-05-1	0039	Allyl chloride	1.0
7429-90-5	0054	Aluminum (fume or dust)	1.0
1344-28-1	2891	Aluminum oxide (fibrous form)	1.0
20859-73-8	0063	Aluminum phosphide	1.0
834-12-8	3150	Ametryn (N-Ethyl-N-(1-methylethyl)-6-(methylthio)-1,3,5,-triazine-2,4-diamine)	1.0
117-79-3	0069	2-Aminoanthraquinone	0.1
60-09-3	0508	4-Aminoazobenzene	0.1
92-67-1	0072	4-Aminobiphenyl	0.1
82-28-0	0076	1-Amino-2-methylanthraquinone	0.1
33089-61-1	3156	Amitraz	1.0
61-82-5	0083	Amitrole	0.1
7664-41-7	0084	Ammonia (includes anhydrous ammonia and aqueous ammonia from water dissociable ammonium salts and other sources; 10 percent of total aqueous ammonia is reportable under this listing)	1.0
101-05-3	3648	Anilazine [4,6-Dichloro-N-(2-chlorophenyl)-1,3,5-triazin-2-amine]	1.0
62-53-3	0135	Aniline	1.0
90-04-0	1421	o-Anisidine	0.1
104-94-9	2893	p-Anisidine	1.0
134-29-2	1422	o-Anisidine hydrochloride	0.1
120-12-7	0139	Anthracene	1.0
7440-36-0	0141	Antimony	1.0
7440-38-2	0152	Arsenic	0.1
1332-21-4	0164	Asbestos (friable)	0.1
1912-24-9	0171	Atrazine (6-Chloro-N-ethyl-N-(1-methylethyl)-1,3,5-triazine-2,4-diamine)	0.1
7440-39-3	0180	Barium	1.0
22781-23-3	0191	Bendiocarb [2,2-Dimethyl-1,3-benzodioxol-4-ol methylcarbamate]	1.0
1861-40-1	3181	Benfluralin (N-Butyl-N-ethyl-2,6-dinitro-4-(trifluoromethyl) benzenamine)	1.0
17804-35-2	0192	Benomyl	1.0
98-87-3	0195	Benzal chloride	1.0
55-21-0	2895	Benzamide	1.0
71-43-2	0197	Benzene	0.1
92-87-5	0204	Benzidine	0.1
98-07-7	0212	Benzoic trichloride (Benzotrichloride)	0.1
98-88-4	0214	Benzoyl chloride	1.0
94-36-0	0215	Benzoyl peroxide	1.0
100-44-7	0217	Benzyl chloride	1.0
7440-41-7	0222	Beryllium	0.1
82657-04-3	3194	Bifenthrin	1.0
92-52-4	0795	Biphenyl	1.0
111-91-1	2971	Bis(2-chloroethoxy) methane	1.0
111-44-4	0232	Bis(2-chloroethyl) ether	1.0
542-88-1	0234	Bis(chloromethyl) ether	0.1
108-60-1	0235	Bis(2-chloro-1-methylethyl)ether	1.0
56-35-9	3479	Bis(tributyltin) oxide	1.0
10294-34-5	0245	Boron trichloride	1.0
7637-07-2	0246	Boron trifluoride	1.0
314-40-9	0251	Bromacil (5-Bromo-6-methyl-3-(1-methylpropyl)-2,4-(1H,3H)-pyrimidinedione)	1.0
53404-19-6	3651	Bromacil, lithium salt (2,4-(1H,3H)-Pyrimidinedione, 5-bromo-6-methyl-3-(1-methylpropyl), lithium salt)	1.0
7726-95-6	0252	Bromine	1.0
35691-65-7	3652	1-Bromo-1-(bromomethyl)-1,3-propanedicarbonitrile	1.0
353-59-3	0384	Bromochlorodifluoromethane (Halon 1211)	1.0
75-25-2	0262	Bromoform (Tribromomethane)	1.0
74-83-9	1231	Bromomethane (Methyl bromide)	1.0
75-63-8	1912	Bromotrifluoromethane (Halon 1301)	1.0
1689-84-5	3211	Bromoxynil (3,5-Dibromo-4-hydroxybenzonitrile)	1.0

1689-99-2	3212	Bromoxynil octanoate (Octanoic acid, 2,6-dibromo-4-cyanophenyl ester)	1.0
357-57-3	0270	Brucine	1.0
106-99-0	0272	1,3-Butadiene	0.1
141-32-2	0278	Butyl acrylate	1.0
71-36-3	1330	n-Butyl alcohol	1.0
78-92-2	1645	sec-Butyl alcohol	1.0
75-65-0	1787	tert-Butyl alcohol	1.0
106-88-7	0287	1,2-Butylene oxide	1.0
123-72-8	0299	Butyraldehyde	1.0
4680-78-8	0442	C.I. Acid Green 3	1.0
6459-94-5	0445	C.I. Acid Red 114	0.1
569-64-2	0448	C.I. Basic Green 4	1.0
989-38-8	0449	C.I. Basic Red 1	1.0
1937-37-7	0453	C.I. Direct Black 38	0.1
2602-46-2	0462	C.I. Direct Blue 6	0.1
28407-37-6	3661	C.I. Direct Blue 218	1.0
16071-86-6	0478	C.I. Direct Brown 95	0.1
2832-40-8	0503	C.I. Disperse Yellow 3	1.0
3761-53-3	0504	C.I. Food Red 5	0.1
81-88-9	0505	C.I. Food Red 15	1.0
3118-97-6	0506	C.I. Solvent Orange 7	1.0
97-56-3	0507	C.I. Solvent Yellow 3	1.0
842-07-9	0509	C.I. Solvent Yellow 14	1.0
492-80-8	2894	C.I. Solvent Yellow 34 (Auramine)	0.1
128-66-5	0512	C.I. Vat Yellow 4	1.0
7440-43-9	0305	Cadmium	0.1
156-62-7	0316	Calcium cyanamide	1.0
133-06-2	0339	Captan [1H-Isoindole-1,3(2H)-dione, 3a,4,7,7a-tetrahydro-2-[(trichloromethyl)thio]-]	1.0
63-25-2	0218	Carbaryl [1-Naphthalenol, methylcarbamate]	1.0
1563-66-2	0341	Carbofuran	1.0
75-15-0	0344	Carbon disulfide	1.0
56-23-5	0347	Carbon tetrachloride	0.1
463-58-1	0349	Carbonyl sulfide	1.0
5234-68-4	3224	Carboxin (5,6-Dihydro-2-methyl-N-phenyl-1,4-oxathiin-3-carboxamide)	1.0
120-80-9	0722	Catechol	1.0
2439-01-2	3654	Chinomethionat (6-Methyl-1,3-dithiolo[4,5-b]quinoxalin-2-one)	1.0
133-90-4	0357	Chloramben [Benzoic acid, 3-amino-2,5-dichloro-]	1.0
115-28-6	3228	Chlorendic acid	0.1
90982-32-4	3229	Chlorimuron ethyl (Ethyl-2-[[[(4-chloro-6-methoxyprimidin-2-yl)-carbonyl]-amino]sulfonyl]benzoate)	1.0
7782-50-5	0367	Chlorine	1.0
10049-04-4	0368	Chlorine dioxide	1.0
79-11-8	0373	Chloroacetic acid	1.0
532-27-4	0048	2-Chloroacetophenone	1.0
4080-31-3	3655	1-(3-Chloroallyl)-3,5,7-triaza-1-azoniaadamantane chloride	1.0
106-47-8	2964	p-Chloroaniline	0.1
108-90-7	0379	Chlorobenzene	1.0
510-15-6	0205	Chlorobenzilate [Benzeneacetic acid,4-chloro-.alpha.-(4-chlorophenyl)-.alpha.-hydroxy-, ethyl ester]	1.0
75-68-3	0385	1-Chloro-1,1-difluoroethane (HCFC-142b)	1.0
75-45-6	0386	Chlorodifluoromethane (HCFC-22)	1.0
75-00-3	0863	Chloroethane (Ethyl chloride)	1.0
67-66-3	0388	Chloroform	0.1
74-87-3	1235	Chloromethane (Methyl chloride)	1.0
107-30-2	0391	Chloromethyl methyl ether	0.1
563-47-3	1223	3-Chloro-2-methyl-1-propene	0.1
104-12-1	3656	p-Chlorophenyl isocyanate	1.0
76-06-2	0405	Chloropicrin	1.0
126-99-8	0407	Chloroprene	1.0
542-76-7	2711	3-Chloropropionitrile	1.0
63938-10-3	0414	Chlorotetrafluoroethane	1.0
354-25-6	3606	1-Chloro-1,1,2,2-tetrafluoroethane (HCFC-124a)	1.0
2837-89-0	3607	2-Chloro-1,1,1,2-tetrafluoroethane (HCFC-124)	1.0
1897-45-6	0415	Chlorothalonil [1,3-Benzenedicarbonitrile, 2,4,5,6-tetrachloro-]	1.0
95-69-2	3657	p-Chloro-o-toluidine	0.1
75-88-7	3658	2-Chloro-1,1,1-trifluoroethane (HCFC-133a)	1.0
75-72-9	0425	Chlorotrifluoromethane (CFC-13)	1.0
460-35-5	3659	3-Chloro-1,1,1-trifluoropropane (HCFC-253fb)	1.0
5598-13-0	3660	Chlorpyrifos methyl (O,O-Dimethyl-O-(3,5,6-trichloro-2-pyridyl)phosphorothioate)	1.0
64902-72-3	3574	Chlorsulfuron (2-Chloro-N-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl) amino]carbonyl]benzenesulfonamide)	1.0
7440-47-3	0432	Chromium	1.0
7440-48-4	0520	Cobalt	0.1
7440-50-8	0528	Copper	1.0
8001-58-9	0517	Creosote	0.1
120-71-8	1467	p-Cresidine	0.1
108-39-4	1161	m-Cresol	1.0
95-48-7	1426	o-Cresol	1.0
106-44-5	1468	p-Cresol	1.0
1319-77-3	0537	Cresol (mixed isomers)	1.0
4170-30-3	2888	Crotonaldehyde	1.0
98-82-8	0542	Cumene	1.0
80-15-9	0543	Cumene hydroperoxide	1.0
135-20-6	0545	Cupferron [Benzeneamine, N-hydroxy-N-nitroso, ammonium salt]	0.1
21725-46-2	0240	Cyanazine	1.0
1134-23-2	3662	Cycloate	1.0
110-82-7	0565	Cyclohexane	1.0

108-93-0	0569	Cyclohexanol	1.0
68359-37-5	3180	Cyfluthrin (3-(2,2-Dichloroethenyl)-2,2-dimethylcyclopropanecarboxylic acid, cyano(4-fluoro-3-phenoxyphenyl)methyl ester)	1.0
68085-85-8	3248	Cyhalothrin (3-(2-Chloro-3,3,3-trifluoro-1-propenyl)-2,2-Dimethylcyclo-propanecarboxylic acid cyano(3-phenoxyphenyl) methyl ester)	1.0
94-75-7	0593	2,4-D [Acetic acid, (2,4-dichloro-phenoxy)-]	0.1
533-74-4	3664	Dazomet (Tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione)	1.0
53404-60-7	3665	Dazomet, sodium salt (Tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione, ion(1-), sodium)	1.0
94-82-6	3271	2,4-DB	1.0
1929-73-3	2949	2,4-D butoxyethyl ester	0.1
94-80-4	2943	2,4-D butyl ester	0.1
2971-38-2	2947	2,4-D chlorocrotyl ester	0.1
1163-19-5	0598	Decabromodiphenyl oxide	1.0
13684-56-5	3666	Desmedipham	1.0
1928-43-4	3667	2,4-D 2-ethylhexyl ester	0.1
53404-37-8	3668	2,4-D 2-ethyl-4-methylpentyl ester	0.1
2303-16-4	0608	Diallate [Carbamothioic acid, bis(1-methylethyl)-S-(2,3-dichloro-2-propenyl)ester]	1.0
615-05-4	0611	2,4-Diaminoanisole	0.1
39156-41-7	2899	2,4-Diaminoanisole sulfate	0.1
101-80-4	0612	4,4'-Diaminodiphenyl ether	0.1
95-80-7	0613	2,4-Diaminotoluene	0.1
25376-45-8	2134	Diaminotoluene (mixed isomers)	0.1
333-41-5	0618	Diazinon	1.0
334-88-3	0620	Diazomethane	1.0
132-64-9	2230	Dibenzofuran	1.0
96-12-8	0595	1,2-Dibromo-3-chloropropane (DBCP)	0.1
106-93-4	0877	1,2-Dibromoethane (Ethylene dibromide)	0.1
124-73-2	3137	Dibromotetrafluoroethane (Halon 2402)	1.0
84-74-2	0773	Dibutyl phthalate	1.0
1918-00-9	0634	Dicamba (3,6-Dichloro-2-methyoxybenzoic acid)	1.0
99-30-9	3671	Dichloran (2,6-Dichloro-4-nitroaniline)	1.0
95-50-1	0642	1,2-Dichlorobenzene	1.0
541-73-1	2301	1,3-Dichlorobenzene	1.0
106-46-7	0643	1,4-Dichlorobenzene	0.1
25321-22-6	2321	Dichlorobenzene (mixed isomers)	0.1
91-94-1	0644	3,3'-Dichlorobenzidine	0.1
612-83-9	3267	3,3'-Dichlorobenzidine dihydrochloride	0.1
64969-34-2	3672	3,3'-Dichlorobenzidine sulfate	0.1
75-27-4	2341	Dichlorobromomethane	1.0
764-41-0	3070	1,4-Dichloro-2-butene	1.0
110-57-6	2829	trans-1,4-Dichloro-2-butene	1.0
1649-08-7	3673	1,2-Dichloro-1,1-difluoroethane (HCFC-132b)	1.0
75-71-8	0649	Dichlorodifluoromethane (CFC-12)	1.0
107-06-2	0652	1,2-Dichloroethane (Ethylene dichloride)	0.1
540-59-0	0653	1,2-Dichloroethylene	1.0
1717-00-6	3270	1,1-Dichloro-1-fluoroethane (HCFC-141b)	1.0
75-43-4	3109	Dichlorofluoromethane (HCFC-21)	1.0
75-09-2	1255	Dichloromethane (Methylene chloride)	0.1
127564-92-5	3681	Dichloropentafluoropropane	1.0
13474-88-9	3679	1,1-Dichloro-1,2,2,3,3-pentafluoropropane (HCFC-225cc)	1.0
111512-56-2	3680	1,1-Dichloro-1,2,3,3,3-pentafluoropropane (HCFC-225eb)	1.0
422-44-6	3674	1,2-Dichloro-1,1,2,3,3-pentafluoropropane (HCFC-225bb)	1.0
431-86-7	3677	1,2-Dichloro-1,1,3,3,3-pentafluoropropane (HCFC-225da)	1.0
507-55-1	3678	1,3-Dichloro-1,1,2,2,3-pentafluoropropane (HCFC-225cb)	1.0
136013-79-1	3683	1,3-Dichloro-1,1,2,3,3-pentafluoropropane (HCFC-225ea)	1.0
128903-21-9	3682	2,2-Dichloro-1,1,1,3,3-pentafluoropropane (HCFC-225aa)	1.0
422-48-0	3675	2,3-Dichloro-1,1,1,2,3-pentafluoropropane (HCFC-225ba)	1.0
422-56-0	3676	3,3-Dichloro-1,1,1,2,2-pentafluoropropane (HCFC-225ca)	1.0
97-23-4	3684	Dichlorophene (2,2'-Methylenebis(4-chlorophenol)	1.0
120-83-2	2344	2,4-Dichlorophenol	1.0
78-87-5	0664	1,2-Dichloropropane	1.0
10061-02-6	3685	trans-1,3-Dichloropropene	0.1
78-88-6	2929	2,3-Dichloropropene	1.0
542-75-6	0666	1,3-Dichloropropylene	0.1
76-14-2	0671	Dichlorotetrafluoroethane (CFC-114)	1.0
34077-87-7	3608	Dichlorotrifluoroethane	1.0
90454-18-5	3609	Dichloro-1,1,2-trifluoroethane	1.0
812-04-4	3611	1,1-Dichloro-1,2,2-trifluoroethane (HCFC-123b)	1.0
354-23-4	3612	1,2-Dichloro-1,1,2-trifluoroethane (HCFC-123a)	1.0
306-83-2	3613	2,2-Dichloro-1,1,1-trifluoroethane (HCFC-123)	1.0
62-73-7	0674	Dichlorvos [Phosphoric acid, 2-dichloroethenyl dimethyl ester]	0.1
51338-27-3	3686	Diclofop methyl (2-[4-(2,4-Dichlorophenoxy) phenoxy]propanoic acid, methyl ester)	1.0
115-32-2	0675	Dicofol [Benzenemethanol, 4-chloro-.alpha.-4-(chlorophenyl)-.alpha.-(trichloromethyl)-]	1.0
77-73-6	0681	Dicyclopentadiene	1.0
1464-53-5	0685	Diepoxybutane	0.1
111-42-2	0686	Diethanolamine	1.0
38727-55-8	3687	Diethatyl ethyl	1.0
117-81-7	0238	Di(2-ethylhexyl) phthalate (DEHP)	0.1
64-67-5	0710	Diethyl sulfate	0.1
35367-38-5	3276	Diflubenzuron	1.0
101-90-6	2054	Diglycidyl resorcinol ether	0.1
94-58-6	0199	Dihydrosafrole	0.1
55290-64-7	3278	Dimethipin (2,3,-Dihydro-5,6-dimethyl-1,4-dithiin 1,1,4,4-tetraoxide)	1.0
60-51-5	0733	Dimethoate	1.0
119-90-4	0734	3,3-Dimethoxybenzidine	0.1

20325-40-0	3692	3,3-Dimethoxybenzidine dihydrochloride (o-Dianisidine dihydrochloride)	0.1
111984-09-9	3693	3,3-Dimethoxybenzidine hydrochloride (o-Dianisidine hydrochloride)	0.1
124-40-3	0737	Dimethylamine	1.0
2300-66-5	3694	Dimethylamine dicamba	1.0
60-11-7	0739	4-Dimethylaminoazobenzene	0.1
121-69-7	0741	N,N-Dimethylaniline	1.0
119-93-7	0742	3,3-Dimethylbenzidine (o-Tolidine)	0.1
612-82-8	3695	3,3-Dimethylbenzidine dihydrochloride (o-Tolidine dihydrochloride)	0.1
41766-75-0	3696	3,3-Dimethylbenzidine dihydrofluoride (o-Tolidine dihydrofluoride)	0.1
79-44-7	0746	Dimethylcarbamyl chloride	0.1
2524-03-0	0770	Dimethyl chlorothiophosphate	1.0
68-12-2	0759	N,N-Dimethylformamide	0.1
57-14-7	0761	1,1-Dimethyl hydrazine	0.1
105-67-9	0764	2,4-Dimethylphenol	1.0
576-26-1	3285	2,6-Dimethylphenol	1.0
131-11-3	0765	Dimethyl phthalate	1.0
77-78-1	0768	Dimethyl sulfate	0.1
99-65-0	3017	m-Dinitrobenzene	1.0
528-29-0	3018	o-Dinitrobenzene	1.0
100-25-4	3019	p-Dinitrobenzene	1.0
88-85-7	2354	Dinitrobutyl phenol (Dinoseb)	1.0
534-52-1	0779	4,6-Dinitro-o-cresol	1.0
51-28-5	2950	2,4-Dinitrophenol	1.0
121-14-2	0783	2,4-Dinitrotoluene	0.1
606-20-2	0784	2,6-Dinitrotoluene	0.1
25321-14-6	2985	Dinitrotoluene (mixed isomers)	1.0
39300-45-3	3699	Dinocap	1.0
123-91-1	0789	1,4-Dioxane	0.1
957-51-7	3290	Diphenamid	1.0
122-39-4	0796	Diphenylamine	1.0
122-66-7	0800	1,2-Diphenylhydrazine (Hydrazobenzene)	0.1
2164-07-0	3700	Dipotassium endothall (7-Oxabicyclo(2.2.1)heptane-2,3-dicarboxylic acid, dipotassium salt)	1.0
136-45-8	3701	Dipropyl isocinchomeronate	1.0
138-93-2	3702	Disodium cyanodithioimidocarbonate	1.0
94-11-1	3941	2,4-D isopropyl ester	0.1
541-53-7	2368	2,4-Dithiobiuret	1.0
330-54-1	0819	Diuron	1.0
2439-10-3	3579	Dodine (Dodecylguanidine monoacetate)	1.0
120-36-5	3076	2,4-DP	0.1
1320-18-9	2944	2,4-D propylene glycol butyl ether ester	0.1
2702-72-9	3297	2,4-D sodium salt	0.1
106-89-8	0828	Epichlorohydrin	0.1
13194-48-4	2395	Ethoprop (Phosphorodithioic acid O-ethyl S,S-dipropyl ester)	1.0
110-80-5	0839	2-Ethoxyethanol	1.0
140-88-5	0843	Ethyl acrylate	0.1
100-41-4	0851	Ethylbenzene	1.0
541-41-3	0865	Ethyl chloroformate	1.0
759-94-4	3300	Ethyl dipropylthiocarbamate (EPTC)	1.0
74-85-1	0873	Ethylene	1.0
107-21-1	0878	Ethylene glycol	1.0
151-56-4	0881	Ethyleneimine (Aziridine)	0.1
75-21-8	0882	Ethylene oxide	0.1
96-45-7	0883	Ethylene thiourea	0.1
75-34-3	0651	Ethylidene dichloride	1.0
52-85-7	2915	Famphur	1.0
60168-88-9	3703	Fenarimol (.alpha.-(2-Chlorophenyl)-.alpha.-4-chlorophenyl)-5-pyrimidinemethanol)	1.0
13356-08-6	3704	Fenbutatin oxide (Hexakis(2-methyl-2-phenylpropyl)distannoxane)	1.0
66441-23-4	3705	Fenoxaprop ethyl (2-(4-((6-Chloro-2-benzoxazolylen)oxy)phenoxy)propanoic acid, ethyl ester)	1.0
72490-01-8	3706	Fenoxycarb (2-(4-Phenoxy-phenoxy)-ethyl]carbamic acid ethyl ester)	1.0
39515-41-8	3253	Fenpropathrin (2,2,3,3-Tetramethylcyclopropane carboxylic acid cyano(3-phenoxyphenyl)methyl ester)	1.0
55-38-9	0916	Fenthion (O,O-Dimethyl O-[3-methyl-4-(methylthio) phenyl] ester, phosphorothioic acid)	1.0
51630-58-1	3134	Fenvalerate (4-Chloro-alpha-(1-methylethyl)benzeneacetic acid cyano(3-phenoxyphenyl)methyl ester)	1.0
14484-64-1	0917	Ferbam (Tris(dimethylcarbamodithioato-S,S')iron)	1.0
69806-50-4	3707	Fluazifop butyl (2-[4-[[5-(Trifluoromethyl)-2-pyridinyl]oxy]-phenoxy] propanoic acid, butyl ester)	1.0
2164-17-2	0935	Fluometuron [Urea, N,N-dimethyl-N'-[3-(trifluoromethyl)phenyl]-]	1.0
7782-41-4	0937	Fluorine	1.0
51-21-8	1966	Fluorouracil (5-Fluorouracil)	1.0
69409-94-5	3310	Fluvalinate (N-[2-Chloro-4-(trifluoromethyl)phenyl]-DL-valine (+)-cyano(3-phenoxyphenyl)methyl ester)	1.0
133-07-3	3554	Folpet	1.0
72178-02-0	3312	Fomesafen (5-(2-Chloro-4-(trifluoromethyl)phenoxy)-N-methylsulfonyl-2-nitrobenzamide)	1.0
50-00-0	0946	Formaldehyde	0.1
64-18-6	0948	Formic acid	1.0
76-13-1	1904	Freon 113 [Ethane, 1,1,2-trichloro-1,2,2,-trifluoro-]	1.0
87-68-3	0979	Hexachloro-1,3-butadiene	1.0
319-84-6	0566	alpha-Hexachlorocyclohexane	1.0
77-47-4	0980	Hexachlorocyclopentadiene	1.0
67-72-1	0981	Hexachloroethane	1.0
1335-87-1	0982	Hexachloronaphthalene	1.0
70-30-4	0983	Hexachlorophene	1.0
680-31-9	0973	Hexamethylphosphoramide	0.1

110-54-3	1340	n-Hexane	1.0
51235-04-2	3339	Hexazinone	1.0
67485-29-4	3149	Hydramethylnon (Tetrahydro-5,5-dimethyl-2(1H)-pyrimidinone[3-[4-(trifluoromethyl)phenyl]-1-[2-[4-(trifluoromethyl)phenyl]ethenyl]-2-propenylidene]hydrazone)	1.0
302-01-2	1006	Hydrazine	0.1
10034-93-2	2360	Hydrazine sulfate	0.1
7647-01-0	1012	Hydrochloric acid (acid aerosols including mists, vapors, gas, fog, and other airborne species of any particle size)	1.0
74-90-8	1013	Hydrogen cyanide	1.0
7664-39-3	1014	Hydrogen fluoride	1.0
123-31-9	1019	Hydroquinone	1.0
35554-44-0	3343	Imazalil (1-[2-(2,4-Dichlorophenyl)-2-(2-propenyloxy)ethyl]-1H-imidazole)	1.0
55406-53-6	3708	3-Iodo-2-propynyl butylcarbamate	1.0
13463-40-6	1037	Iron pentacarbonyl	1.0
78-84-2	1051	Isobutyraldehyde	1.0
25311-71-1	3709	Isofenphos (2-[[Ethoxyl[(1-methylethyl)amino]phosphinothioyl]oxy] benzoic acid 1-methylethyl ester)	1.0
67-63-0	1076	Isopropyl alcohol (manufacturing: strong acid process only)	1.0
80-05-7	2388	4,4'-Isopropylidenediphenol	1.0
120-58-1	0198	Isosafrole	1.0
77501-63-4	3550	Lactofen (5-(2-Chloro-4-(trifluoromethyl)phenoxy)-2-nitro-2-ethoxy-1-methyl-2-oxoethyl ester)	1.0
7439-92-1	1096	Lead	0.1
58-89-9	1117	Lindane [Cyclohexane, 1,2,3,4,5,6-hexachloro-,(1.alpha.,2.alpha., 3.beta.,4.alpha.,5.alpha.,6.beta.)-]	0.1
330-55-2	3352	Linuron	1.0
554-13-2	1124	Lithium carbonate	1.0
121-75-5	1150	Malathion	1.0
108-31-6	1152	Maleic anhydride	1.0
109-77-3	1153	Malononitrile	1.0
12427-38-2	1154	Maneb [Carbamodithioic acid, 1,2-ethanediylbis-, manganese complex]	1.0
7439-96-5	1155	Manganese	1.0
93-65-2	3093	Mecoprop	0.1
149-30-4	3710	2-Mercaptobenzothiazole (MBT)	1.0
150-50-5	3359	Merphos	1.0
126-98-7	1220	Methacrylonitrile	1.0
137-42-8	3711	Metham sodium (Sodium methyldithiocarbamate)	1.0
67-56-1	1222	Methanol	1.0
20354-26-1	3712	Methazole (2-(3,4-Dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione)	1.0
2032-65-7	1165	Methiocarb	1.0
94-74-6	3094	Methoxone ((4-Chloro-2-methylphenoxy) acetic acid) (MCPA)	0.1
3653-48-3	3713	Methoxone sodium salt ((4-Chloro-2-methylphenoxy) acetate sodium salt)	0.1
109-86-4	1211	2-Methoxyethanol	1.0
96-33-3	1219	Methyl acrylate	1.0
1634-04-4	1293	Methyl tert-butyl ether	1.0
79-22-1	1238	Methyl chlorocarbonate	1.0
101-14-4	1250	4,4-Methylenebis(2-chloroaniline) (MBOCA)	0.1
101-61-1	1252	4,4-Methylenebis(N,N-dimethyl)benzenamine	0.1
74-95-3	1254	Methylene bromide	1.0
101-77-9	1256	4,4-Methylenedianiline	0.1
78-93-3	1258	Methyl ethyl ketone	1.0
60-34-4	1265	Methyl hydrazine	1.0
74-88-4	1266	Methyl iodide	1.0
108-10-1	1268	Methyl isobutyl ketone	1.0
624-83-9	1270	Methyl isocyanate	1.0
556-61-6	1272	Methyl isothiocyanate (Isothiocyanatomethane)	1.0
75-86-5	0007	2-Methyllactonitrile	1.0
80-62-6	1277	Methyl methacrylate	1.0
924-42-5	3715	N-Methylolacrylamide	1.0
298-00-0	1283	Methyl parathion	1.0
109-06-8	2955	2-Methylpyridine	1.0
872-50-4	3716	N-Methyl-2-pyrrolidone	1.0
9006-42-2	3717	Metiram	1.0
21087-64-5	1302	Metribuzin	1.0
7786-34-7	3507	Mevinphos	1.0
90-94-8	1305	Michler's ketone	0.1
2212-67-1	3718	Molinate (1H-Azepine-1 carbothioic acid, hexahydro-S-ethyl ester)	1.0
1313-27-5	1312	Molybdenum trioxide	1.0
76-15-3	0398	Monochloropentafluoroethane (CFC-115)	1.0
150-68-5	3719	Monuron	1.0
505-60-2	1319	Mustard gas [Ethane, 1,1'-thiobis[2-chloro-]	0.1
88671-89-0	3462	Myclobutanil (.alpha.-Butyl-.alpha.-(4-chlorophenyl)-1H-1,2,4-triazole-1-propanenitrile)	1.0
142-59-6	3720	Nabam	1.0
300-76-5	0751	Naled	1.0
91-20-3	1322	Naphthalene	1.0
134-32-7	1325	alpha-Naphthylamine	0.1
91-59-8	1324	beta-Naphthylamine	0.1
7440-02-0	1341	Nickel	0.1
1929-82-4	1355	Nitrapyrin (2-Chloro-6-(trichloromethyl)pyridine)	1.0
7697-37-2	1356	Nitric acid	1.0
139-13-9	1358	Nitrilotriacetic acid	0.1
100-01-6	1548	p-Nitroaniline	1.0
99-59-2	1388	5-Nitro-o-anisidine	1.0
98-95-3	1361	Nitrobenzene	0.1
92-93-3	0229	4-Nitrobiphenyl	0.1
1836-75-5	1374	Nitrofen [Benzene, 2,4-dichloro-1-(4-nitrophenoxy)-]	0.1

51-75-2	1377	Nitrogen mustard [2-Chloro-N-(2-chloroethyl)-N-methylethanamine]	0.1
55-63-0	1383	Nitroglycerin	1.0
88-75-5	1391	2-Nitrophenol	1.0
100-02-7	1390	4-Nitrophenol	1.0
79-46-9	1392	2-Nitropropane	0.1
924-16-3	1406	N-Nitrosodi-n-butylamine	0.1
55-18-5	1404	N-Nitrosodiethylamine	0.1
62-75-9	1405	N-Nitrosodimethylamine	0.1
86-30-6	1408	N-Nitrosodiphenylamine	1.0
156-10-5	1551	p-Nitrosodiphenylamine	1.0
621-64-7	1407	N-Nitrosodi-n-propylamine	0.1
759-73-9	1410	N-Nitroso-N-ethylurea	0.1
684-93-5	1411	N-Nitroso-N-methylurea	0.1
4549-40-0	2907	N-Nitrosomethylvinylamine	0.1
59-89-2	1409	N-Nitrosomorpholine	0.1
16543-55-8	2900	N-Nitrosonornicotine	0.1
100-75-4	1412	N-Nitrosopiperidine	0.1
99-55-8	1444	5-Nitro-o-toluidine	1.0
27314-13-2	3405	Norflurazon (4-Chloro-5-(methylamino)-2-[3-(trifluoromethyl)phenyl]-3(2H)-pyridazinone)	1.0
2234-13-1	1427	Octachloronaphthalene	1.0
19044-88-3	3409	Oryzalin (4-(Dipropylamino)-3,5-dinitrobenzenesulfonamide)	1.0
20816-12-0	1441	Osmium tetroxide	1.0
301-12-2	3724	Oxydemeton methyl (S-(2-(Ethylsulfinyl)ethyl) O,O-dimethyl ester phosphorothioic acid)	1.0
19666-30-9	3410	Oxydiazon (3-[2,4-Dichloro-5-(1-methylethoxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2(3H)-one)	1.0
42874-03-3	3411	Oxyfluorfen	1.0
10028-15-6	1451	Ozone	1.0
123-63-7	1455	Paraldehyde	1.0
1910-42-5	1458	Paraquat dichloride	1.0
56-38-2	1459	Parathion [Phosphorothioic acid, O,O-diethyl-O-(4-nitrophenyl) ester]	1.0
1114-71-2	3725	Pebulate (Butylethylcarbamothioic acid S-propyl ester)	1.0
76-01-7	1471	Pentachloroethane	1.0
87-86-5	1473	Pentachlorophenol (PCP)	0.1
57-33-0	3726	Pentobarbital sodium	1.0
79-21-0	1482	Peracetic acid	1.0
594-42-3	1480	Perchloromethyl mercaptan	1.0
52645-53-1	3422	Permethrin (3-(2,2-Dichloroethenyl)-2,2-dimethylcyclopropane carboxylic acid, (3-phenoxyphenyl)methyl ester)	1.0
85-01-8	3004	Phenanthrene	1.0
108-95-2	1487	Phenol	1.0
26002-80-2	3727	Phenothrin (2,2-Dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylic acid (3-phenoxyphenyl)methyl ester)	1.0
95-54-5	1495	1,2-Phenylenediamine	1.0
108-45-2	1316	1,3-Phenylenediamine	1.0
106-50-3	1586	p-Phenylenediamine	1.0
615-28-1	3728	1,2-Phenylenediamine dihydrochloride	1.0
624-18-0	3729	1,4-Phenylenediamine dihydrochloride	1.0
90-43-7	1439	2-Phenylphenol	1.0
57-41-0	1507	Phenytoin	0.1
75-44-5	1510	Phosgene	1.0
7803-51-2	1514	Phosphine	1.0
7664-38-2	1516	Phosphoric acid	1.0
7723-14-0	1520	Phosphorus (yellow or white)	1.0
85-44-9	1535	Phthalic anhydride	1.0
1918-02-1	1536	Picloram	1.0
88-89-1	1946	Picric acid	1.0
51-03-6	3732	Piperonyl butoxide	1.0
29232-93-7	3430	Pirimiphos methyl (O-(2-(Diethylamino)-6-methyl-4-pyrimidinyl)-O,O-dimethyl phosphorothioate)	1.0
7758-01-2	1559	Potassium bromate	0.1
128-03-0	3735	Potassium dimethyldithiocarbamate	1.0
137-41-7	3736	Potassium N-methyldithiocarbamate	1.0
41198-08-7	3737	Profenofos (O-(4-Bromo-2-chlorophenyl)-O-ethyl-S-propylphosphorothioate)	1.0
7287-19-6	3437	Prometryn (N,N'-Bis(1-methylethyl)-6-methylthio-1,3,5-triazine-2,4-diamine)	1.0
23950-58-5	1592	Pronamide	1.0
1918-16-7	3438	Propachlor (2-Chloro-N-(1-methylethyl)-N-phenylacetamide)	1.0
1120-71-4	1446	Propane sultone	0.1
709-98-8	3439	Propanil (N-(3,4-Dichlorophenyl)propanamide)	1.0
2312-35-8	1596	Propargite	1.0
107-19-7	1597	Propargyl alcohol	1.0
31218-83-4	3738	Propetamphos (3-[(Ethylamino)methoxyphosphinothioyl]oxy]-2-butenoic acid, 1-methylethyl ester)	1.0
60207-90-1	3442	Propiconazole (1-[2-(2,4-Dichlorophenyl)-4-propyl-1,3-dioxolan-2-yl]-methyl-1H-1,2,4,-triazole)	1.0
57-57-8	0228	beta-Propiolactone	0.1
123-38-6	1598	Propionaldehyde	1.0
114-26-1	1604	Propoxur [Phenol, 2-(1-methylethoxy)-, methylcarbamate]	1.0
115-07-1	1609	Propylene (Propene)	1.0
75-55-8	1614	Propyleneimine	0.1
75-56-9	1615	Propylene oxide	0.1
110-86-1	1624	Pyridine	1.0
91-22-5	1638	Quinoline	1.0
106-51-4	1460	Quinone	1.0
82-68-8	1630	Quintozene (Pentachloronitrobenzene)	1.0
76578-14-8	3173	Quizalofop-ethyl	1.0

		(2-[4-[(6-Chloro-2-quinoxalinyl)oxy]phenoxy] propanoic acid ethyl ester)	
10453-86-8	3450	Resmethrin ([5-(Phenylmethyl)-3-furanyl]methyl 2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate])	1.0
81-07-2	1641	Saccharin (manufacturing)	0.1
94-59-7	1642	Safrole	0.1
7782-49-2	1648	Selenium	1.0
74051-80-2	3453	Sethoxydim (2-[1-(Ethoxyimino) butyl]-5-[2-(ethylthio)propyl]-3-hydroxyl-2-cyclohexen-1-one)	1.0
7440-22-4	1669	Silver	1.0
122-34-9	3454	Simazine	1.0
26628-22-8	1684	Sodium azide	1.0
1982-69-0	3739	Sodium dicamba (3,6-Dichloro-2-methoxybenzoic acid, sodium salt)	1.0
128-04-1	3740	Sodium dimethyldithiocarbamate	1.0
62-74-8	1700	Sodium fluoroacetate	1.0
7632-00-0	2258	Sodium nitrite	1.0
131-52-2	1712	Sodium pentachlorophenate	1.0
132-27-4	3458	Sodium o-phenylphenoxide	0.1
100-42-5	1748	Styrene	0.1
96-09-3	1749	Styrene oxide	0.1
7664-93-9	1761	Sulfuric acid (acid aerosols including mists, vapors, gas, fog, and other airborne species of any particle size)	1.0
2699-79-8	1769	Sulfuryl fluoride (Vikane)	1.0
35400-43-2	1771	Sulprofos (O-Ethyl O-[4-(methylthio)phenyl]phosphorodithioic acid S-propyl ester)	1.0
34014-18-1	3464	Tebuthiuron (N-[5-(1,1-Dimethylethyl)-1,3,4-thiadiazol-2-yl)-N,N-dimethylurea)	1.0
3383-96-8	1780	Temephos	1.0
5902-51-2	3466	Terbacil (5-Chloro-3-(1,1-dimethylethyl)-6-methyl- 2,4 (1H,3H)-pyrimidinedione)	1.0
630-20-6	2992	1,1,1,2-Tetrachloroethane	1.0
79-34-5	1809	1,1,2,2-Tetrachloroethane	1.0
127-18-4	1810	Tetrachloroethylene (Perchloroethylene)	0.1
354-11-0	3742	1,1,1,2-Tetrachloro-2-fluoroethane (HCFC-121a)	1.0
354-14-3	3743	1,1,2,2-Tetrachloro-1-fluoroethane (HCFC-121)	1.0
961-11-5	1813	Tetrachlorvinphos [Phosphoric acid, 2-chloro-1-(2,3,5-trichlorophenyl) ethenyl dimethyl ester]	1.0
64-75-5	3744	Tetracycline hydrochloride	1.0
7696-12-0	3745	Tetramethrin (2,2-Dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylic acid (1,3,4,5,6,7-hexahydro-1,3-dioxo-2H-isoindol-2-yl)methyl ester)	1.0
7440-28-0	1840	Thallium	1.0
148-79-8	3746	Thiabendazole (2-(4-Thiazolyl)-1H-benzimidazole)	1.0
62-55-5	1844	Thioacetamide	0.1
28249-77-6	3472	Thiobencarb (Carbamic acid, diethylthio-, S-(p-chlorobenzyl))	1.0
139-65-1	1847	4,4-Thiodianiline	0.1
59669-26-0	3747	Thiodicarb	1.0
23564-06-9	3748	Thiophanate ethyl ([1,2-Phenylenebis (iminocarbonothioyl)] biscarbamic acid diethyl ester)	1.0
23564-05-8	3473	Thiophanate-methyl	1.0
79-19-6	2823	Thiosemicarbazide	1.0
62-56-6	1853	Thiourea	0.1
137-26-8	1854	Thiram	1.0
1314-20-1	1856	Thorium dioxide	1.0
7550-45-0	1864	Titanium tetrachloride	1.0
108-88-3	1866	Toluene	1.0
584-84-9	1869	Toluene-2,4-diisocyanate	0.1
91-08-7	1868	Toluene-2,6-diisocyanate	0.1
26471-62-5	3132	Toluene diisocyanate (mixed isomers)	0.1
95-53-4	1442	o-Toluidine	0.1
636-21-5	1443	o-Toluidine hydrochloride	0.1
43121-43-3	3179	Triadimefon (1-(4-Chlorophenoxy)-3,3-dimethyl-1-(1H-1,2,4-triazol-1-yl)-2-butanone)	1.0
2303-17-5	3474	Triallate	1.0
68-76-8	1461	Triaziquone [2,5-Cyclohexadiene-1,4-dione, 2,3,5-tris(1-aziridinyl)-]	1.0
101200-48-0	3749	Tribenuron methyl (2-(4-Methoxy-6-methyl-1,3,5-triazin-2-yl)-methylamino)carbonyl)amino)sulfonyl)-, methyl ester)	1.0
1983-10-4	3750	Tributyltin fluoride	1.0
2155-70-6	3751	Tributyltin methacrylate	1.0
78-48-8	3360	S,S,S-Tributyltrithiophosphate (DEF)	1.0
52-68-6	1882	Trichlorfon [Phosphonic acid, (2,2,2-trichloro-1-hydroxyethyl)-,dimethyl ester]	1.0
76-02-8	1884	Trichloroacetyl chloride	1.0
120-82-1	1887	1,2,4-Trichlorobenzene	1.0
71-55-6	1237	1,1,1-Trichloroethane (Methyl chloroform)	1.0
79-00-5	1889	1,1,2-Trichloroethane	1.0
79-01-6	1890	Trichloroethylene	0.1
75-69-4	1891	Trichlorofluoromethane (CFC-11)	1.0
95-95-4	1895	2,4,5-Trichlorophenol	1.0
88-06-2	1894	2,4,6-Trichlorophenol	0.1
96-18-4	1902	1,2,3-Trichloropropane	0.1
57213-69-1	3752	Triclopyr triethylammonium salt	1.0
121-44-8	1907	Triethylamine	1.0
26644-46-2	3753	Triforine (N,N-[1,4-Piperazinediylbis(2,2,2-trichloroethylidene)] bisformamide)	1.0
95-63-6	2716	1,2,4-Trimethylbenzene	1.0
2655-15-4	3756	2,3,5-Trimethylphenyl methylcarbamate	1.0
639-58-7	2845	Triphenyltin chloride	1.0
76-87-9	1953	Triphenyltin hydroxide	1.0
126-72-7	1957	Tris(2,3-dibromopropyl) phosphate	0.1
72-57-1	0465	Trypan blue	0.1

51-79-6	1986	Urethane (Ethyl carbamate)	0.1
7440-62-2	1990	Vanadium (fume or dust)	1.0
50471-44-8	3494	Vinclozolin (3-(3,5-Dichlorophenyl)-5-ethenyl-5-methyl-2,4-oxazolidinedione)	1.0
108-05-4	1998	Vinyl acetate	0.1
593-60-2	1999	Vinyl bromide	0.1
75-01-4	2001	Vinyl chloride	0.1
75-35-4	2006	Vinylidene chloride	1.0
108-38-3	2902	m-Xylene	1.0
95-47-6	2903	o-Xylene	1.0
106-42-3	2904	p-Xylene	1.0
1330-20-7	2014	Xylene (mixed isomers)	1.0
87-62-7	2016	2,6-Xylidine	0.1
7440-66-6	2021	Zinc (fume or dust)	1.0
12122-67-7	2045	Zineb [Carbamodithioic acid, 1,2-ethanediylbis-, zinc complex]	1.0

CHEMICAL CATEGORIES

The metal compounds listed below, unless otherwise specified, are defined as including any unique chemical substance that contains the named metal (i.e. antimony, arsenic, etc.) as part of that chemical's structure.

Chemical categories are subject to the 1.0 percent de minimis concentration unless the substance involved meets the definition of an OSHA carcinogen. OSHA carcinogens are subject to the 0.1 percent de minimis concentration. The de minimis concentration for each category is provided in parentheses.

Category1 Code	RTK Number	Chemical Category Name (de minimis concentration)
N010	2223	Antimony Compounds (1.0)
N020	2138	Arsenic Compounds (inorganic compounds: 0.1; organic compounds: 1.0)
N040	2146	Barium Compounds (1.0) (excludes Barium sulfate CAS# 7727-43-7)
N050	2163	Beryllium Compounds (0.1)
N078	2199	Cadmium Compounds (0.1)
N084	2976	Chlorophenols (0.1)
N090	2245	Chromium Compounds (chromium VI compounds: 0.1; chromium III compounds: 1.0)
N096	2222	Cobalt Compounds (0.1)
N100	2215	Copper Compounds (1.0) (excludes C.I. Pigment Blue 15, C.I. Pigment Green 7, C.I. Pigment Green 36, and all copper phthalocyanine compounds substituted with only hydrogen and/or bromine and/or chlorine)
N106	2308	Cyanide Compounds (1.0)
N120	3757	Diisocyanates (this category includes only those listed below and the next page):
		1,3-Bis(methylisocyanate)cyclohexane (38661-72-2)
		1,4-Bis(methylisocyanate)cyclohexane (10347-54-3)
		1,4-Cyclohexane diisocyanate (2556-36-7)
		Diethyldiisocyanatobenzene (134190-37-7)
		4,4-Diisocyanatodiphenyl ether (4128-73-8)
		2,4-Diisocyanatodiphenyl sulfide (75790-87-3)
		3,3-Dimethoxybenzidine-4,4-diisocyanate (91-93-0)
		3,3-Dimethyl-4,4-diphenylene diisocyanate (91-97-4)
		3,3-Dimethyldiphenylmethane-4,4-diisocyanate (139-25-3)

(continued)

Category1 Code	RTK Number	Chemical Category Name (de minimis concentration)
N120	3757	Diisocyanates (continued) Hexamethylene-1,6-diisocyanate (822-06-0) Isophorone diisocyanate (4098-71-9) 4-Methyldiphenylmethane-3,4-diisocyanate (75790-84-0) 1,1-Methylene bis(4-isocyanatocyclohexane) (5124-30-1) Methylenebis(phenylisocyanate)2 (101-68-8) 1,5-Naphthalene diisocyanate (3173-72-6) 1,3-Phenylene diisocyanate (123-61-5) 1,4-Phenylene diisocyanate (104-49-4) Polymeric diphenylmethane diisocyanate (9016-87-9) 2,2,4-Trimethylhexamethylene diisocyanate (16938-22-0) 2,4,4-Trimethylhexamethylene diisocyanate (15646-96-5)
N171	3614	Ethylenebisdithiocarbamic acid, salts and esters (1.0)
N230	3138	Glycol Ethers (1.0) (excludes surfactant glycol ethers) consists of those glycol ethers that meet the following definition: R-(OCH2CH2)n-OR where n = 1,2, or 3; R = alkyl C7 or less; or R = phenyl or alkyl substituted phenyl; R' = H or alkyl C7 or less; or OR' consisting of carboxylic acid ester, sulfate, phosphate, nitrate, or sulfonate.
N420	2266	Lead Compounds (inorganic compounds: 0.1; organic compounds: 1.0)
N450	2324	Manganese Compounds (1.0)
N458	2414	Mercury Compounds (1.0)
N495	2366	Nickel Compounds (0.1)
N503	2583	Nicotine and salts (1.0)
N511	3722	Nitrate compounds (1.0) (water dissociable; reportable only when in aqueous solution)
N575	1552	Polybrominated Biphenyls (PBBs) (0.1)
N583	3733	Polychlorinated alkanes (C10 to C13) (polychlorinated alkanes and mixtures of polychlorinated alkanes that have an average chain length of 12 carbons and contain an average chlorine content of 60 percent by weight are subject to the 0.1 percent de minimis concentration; all other members of the polychlorinated alkanes category are subject to the 1.0 percent de minimis concentration) includes those chemicals defined by the following formula: CxH2x-y+2Cly where x = 10 to 13; y = 3 to 12; and where the average chlorine content ranges from 40-70% with the limiting molecular formulas C10H19Cl3 and C13H16Cl12.

Category1 Code	RTK Number	Chemical Category Name (de minimis concentration)
N590	3758	Polycyclic aromatic compounds (PACs) **(NO DE MINIMIS)** (this category includes those chemicals listed below): Benz[a]anthracene (56-55-3) Benzo[b]fluoranthene (205-99-2) Benzo[j]fluoranthene (205-82-3) Benzo[k]fluoranthene (207-08-9) Benzo[rst]pentaphene (189-55-9) Benzo[a]phenanthrene (218-01-9) Benzo[a]pyrene (50-32-8) Dibenz[a,h]acridine (226-36-8) Dibenz[a,j]acridine (224-42-0) Dibenzo[a,h]anthracene (53-70-3) 7H-Dibenzo[c,g]carbazole (194-59-2) Dibenzo[a,e]fluoranthene (5385-75-1) Dibenzo[a,e]pyrene (192-65-4) Dibenzo[a,h]pyrene (189-64-0) Dibenzo[a,l]pyrene (191-30-0) 7,12-Dimethylbenz[a]anthracene (57-97-6) Indeno[1,2,3-cd]pyrene (193-39-5) 5-Methylchrysene (3697-24-3) 1-Nitropyrene (5522-43-0)

N725	2347	Selenium Compounds (1.0)
N740	3008	Silver Compounds (1.0)
N746	3741	Strychnine and salts (1.0)
N760	2809	Thallium Compounds (1.0)
N874	3627	Warfarin and salts (1.0)
N982	3012	Zinc Compounds (1.0)

Persistent Bioaccumulative Toxic Chemicals (PBTs) *covered by the October 29, 1999 Rule*

Chemical Name or Chemical Category	*CAS No.*	*Threshold Quantity-* ***NO DE MINIMUS*** *(in pounds unless noted otherwise)*
Aldrin	309-00-2	100
Benzo(g,h,I)perylene*	191-24-2	10
Chlordane	57-74-9	10
Dioxin and dioxin-like compounds category*[1]	NA	0.1 gram
Heptachlor	76-44-8	10
Hexachlorobenzene	118-74-1	10
Isodrin	465-73-6	10
Mercury	7439-97-6	10
Mercury compounds	NA	10
Methoxychlor	72-43-5	100
Octachlorostyrene*	29082-74-4	10
Pendimethalin	40487-42-1	100
Pentachlorobenzene*	608-93-5	10
Polycyclic aromatic compounds category*[2]	NA	100
Polychorinated biphenyls (PCBs)	1336-36-3	10
Tetrabromobisphenol A*	79-94-7	100
Toxaphene	8001-35-2	10
Trifluralin	1582-09-8	100

1. manufacturing; and the processing or otherwise use of dioxin and dioxin-like compounds if the dioxin and dioxin-like compounds are present as contaminants in a chemical and if they were created during the manufacturing of that chemical
2. two chemicals,benzo(j,k)fluorene (206-44-0) and 3-methylcholanthrene (56-49-5), were added to this category

APPENDIX B-1

Pollution Prevention Plan Summary

- Pollution Prevention Plan Summary – Blank Form DEP-113
- Pollution Prevention Plan Summary – Completed Sample Form DEP-113

NOTE: THIS IS AN EXAMPLE OF A COMPLETED FORM FOR THE CASE STUDY IN THIS GUIDANCE. FOR SIMPLIFICATION, ONLY 2 OF THE 10 TARGETED PROCESSES ARE INCLUDED IN SECTION C.

Return to: NJDEP, Pollution Prevention and Permit Coordination, P.O. Box 423, Trenton, NJ 08625-0423

POLLUTION PREVENTION PLAN SUMMARY

(Based on Pollution Prevention Plan On Site)

PLEASE TYPE OR PRINT CLEARLY THE ENTIRE FORM .

MAILING ADDRESS
Indicate any changes to above information.

FACILITY LOCATION
Indicate any changes to above information

FACID: __ __ __ __ __ __ __ __ __ __ __

FEIN: __ __ __ __ __ __ __ __ __ __ __ __ __

Base Year ______________

☐ New
☐ Update

Section A: Facility-Level Administrative Information

(This section needs to be filled out only ONCE)

1. Company's Phone Number and Fax Number:

(______)____________________ Phone Number

(________)____________________ Fax Number

2. Highest Ranking Corporate Official at Facility: (Print)

____________________ Last Name ______________ First Name b. M.I. ____________________ Position/Title

3. If your facility has an approved NJRTK Research & Development Laboratory exemption pursuant to N.J.A.C. 7:1G, enter the approval number here. ___ ___ ___ ___ ___

4. Facility Planning information:

a. How many processes, including grouped processes, are there at this facility? . . . . a. [ ]

b. How many processes or grouped processes are targeted?. . . . . b. [ ]

c. What is the facility's basis for targeting? (U)se/(N)PO/(R)eleases . . . . c. [ ]
Enter U, N or R

5. Does your facility's Pollution Prevention Plan Summary contain information which you are claiming confidential? . . . .(Y)es or (N)o . . . . a. [ ]

If "Yes", mark which type of copy this is: (C)onfidential or (P)reliminary Public Copy . . . . . . b. [ ]

6. Union representative at Facility, (if applicable), (Print)

a. ____________________ Last Name ________________ First Name ______________ M.I.

b. (__________)____________________ Phone Number

c. ____ Name of Union/ Local #

7. Certification by owner/operator of this facility that a plan has been prepared and is on site:

I certify under penalty of law that a Pollution Prevention Plan has been prepared for this industrial facility and that the Plan is available at the facility for inspection by the Department. I further certify that the information submitted in the Pollution Prevention Plan Summary is true, accurate, and complete to the best of my knowledge.

____________________ Signature ____________________ Position/Title (__________)______________ Phone Number

Print or Type Name: ______________________________ Date: (MM/DD/YYYY) ____________________

NOTE: N.J.A.C. 7:1K-5.1(b)3iii requires the submission of a list of permits issued by the Department as part of a Pollution Prevention Plan Summary. Because the Department currently has such permit information on file, pursuant to specific permitting programs, it is not requiring a separate submission of this list in an effort to streamline reporting. However, the Department reserves the right to require submission of this permit list by any facility.

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Pollution Prevention Plan Summary

(Based on Pollution Prevention Plan On Site)

FACID: __ __ __ __ __ __ __ __ __ __ __

FEIN: __ __ __ __ __ __ __ __ __ __ __ __ __

Facility Name: ____

Section B: Facility-Level Information (Photocopy and use separate page for additional hazardous substance.)

Five year reduction goals for USE and NPO: *Assume constant production when calculation goals.*
Fill in both pounds and percent. Use the worksheets in the instructions for assistance. Reductions can be zero, but cannot be N/A or Blank. Also, USE reduction (lbs.) must be >or = NPO reduction (lbs.), (i.e. 3.a ≥ 3.b).

		3. 5 Year Reduction Goals			
1. CAS # or Category #	2. Hazardous Substance	3.a USE[a] lb.	3.b. NPO[a] lb	3.c %USE[b]	3.d. %NPO[b]
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %
__ __ __ __ __ __-__ __-__				_ _ _._ %	_ _ _._ %

☐ Check here if additional sheets are attached

a. USE reduction goals are the difference between the fifth year planning year and base year total USE, assuming constant production. Total USE can be determined from quantities reported on the Release & Pollution Prevention Report (DEQ-114). Total USE represents the sum of Starting inventory, Produced On-Site, Brought On-Site, and Recycled Out-of-Process On Site and used On Site minus ending inventory. Nonproduct Output (NPO) reduction goals are the difference between the fifth planning year and base year total NPO, assuming constant production. Total NPO represents all material leaving production processes that is not product.
b. To calculate the USE percentage reduction goal, divide 5 year USE reduction goals by the TOTAL USE of the BASE YEAR and multiply the quotient by 100. To calculate the NPO percentage reduction goal, divide 5 year NPO reduction goals by TOTAL NPO of the BASE YEAR and multiply quotient by 100. (See accompanying instructions.)

Pollution Prevention Plan Summary

(Based on Pollution Prevention Plan On Site)

FACID: __ __ __ __ __ __ __ __ __ __ __

FEIN: __ __ __ __ __ __ __ __ __ __ __ __ __

Facility Name: ____

The number of Section C's should correspond to Question 4a, Section A.

Section C: Process Description (Photocopy and use separate page for each process or grouped process at your facility.)

1. Process ID: Process code chosen by facility. Up to twelve characters or digits may be used. ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
(Must use same Process ID in Plan Summary and ALL future Release and Pollution Prevention Reports.)

2. Product SIC Code: Use 4 digit codes - list provided in Appendix 2 of instructions. ___ ___ ___ ___

3. Process Description: Fill (a) and (b) with one appropriate code from below.

a. Process Category: ☐

1 = Chemical Manufacturing (Product or process is a chemical)
2 = Article Manufacturing (Chemicals are used in process, but product is an article)
3 = Storage and Handling (if separate from process)
4 = Treatment Operations

b. Mode of Operation ☐

(B)atch, (C)ontinuous, or (N)ot Applicable
Enter B, C, or N

c. Specific Descriptions

Most processes have one discrete step (for example, a "coating" process). Some may be defined to have more than one (e.g., "cleaning and then "coating"). For a one-step process, use one descriptor (See Appendix 3 of instructions). If there is a second step, use an additional descriptor for the second step. If your process category in 3a above is 4 (Treatment Operations), you may use the Waste Treatment Codes (See Appendix 4 of instructions.) Continue in this manner until all steps are described.

__ __ __ , __ __ __ , __ __ __ , __ __ __ , __ __ __ , __ __ __ , __ __ __ , __ __ __ , __ __ __ , __ __ __

If "Other" or "Similar" is chosen, describe below.

____

d. Identify which hazardous substances are used, generated, or released in the process or grouped process.
Check box at right if additional hazardous substances are included and attach additional pages. ☐

CAS Number or Category Number	Hazardous Substance
(1) ___ ___ ___ ___ ___ ___ -- ___ ___ -- ___	____________________
(2) ___ ___ ___ ___ ___ ___ -- ___ ___ -- ___	____________________
(3) ___ ___ ___ ___ ___ ___ -- ___ ___ -- ___	____________________
(4) ___ ___ ___ ___ ___ ___ -- ___ ___ -- ___	____________________
(5) ___ ___ ___ ___ ___ ___ -- ___ ___ -- ___	____________________
(6) ___ ___ ___ ___ ___ ___ -- ___ ___ -- ___	____________________

4. Is this a targeted process? (Y)es or (N)o ☐

5. Is this a grouped process? (Y)es or (N)o ☐

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Pollution Prevention Plan Summary

(Based on Pollution Prevention Plan On Site

Process ID: ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

(Must use same Process ID in Plan Summary and ALL future Release and Pollution Prevention Reports.)

☐ Check here if additional hazardous substances are included and attach additional pages.

Facility

FACID: __ __ __ __ __ __ __ __ __ __ __

FEIN: __ __

Section D: Process-Level Information for Targeted Processes Only

(Photocopy and use separate page for each targeted process or targeted grouped process. The number of Section D's should correspond to Que

1. Five Year Reduction Goals for Hazardous Substances Used in Process or Grouped Process:

CAS Number / Hazardous Substance	USE Range*	Technique (Use codes from Appendix 2 of instructions. If "Other," describe on additional sheets.)	Five Year Reduction Goal Per Unit of Product (Percent) USE	NPO
__ __ __ __ __ __-__ __-__		__|__|__ __|__|__ __|__|__ __|__|__ __|__|__	__ __ __.__%	__ __ __.__%
__ __ __ __ __ __-__ __-__		__|__|__ __|__|__ __|__|__ __|__|__ __|__|__	__ __ __.__%	__ __ __.__%
__ __ __ __ __ __-__ __-__		__|__|__ __|__|__ __|__|__ __|__|__ __|__|__	__ __ __.__%	__ __ __.__%
__ __ __ __ __ __-__ __-__		__|__|__ __|__|__ __|__|__ __|__|__ __|__|__	__ __ __.__%	__ __ __.__%
__ __ __ __ __ __-__ __-__		__|__|__ __|__|__ __|__|__ __|__|__ __|__|__	__ __ __.__%	__ __ __.__%
__ __ __ __ __ __-__ __-__		__|__|__ __|__|__ __|__|__ __|__|__ __|__|__	__ __ __.__%	__ __ __.__%
__ __ __ __ __ __-__ __-__		__|__|__ __|__|__ __|__|__ __|__|__ __|__|__	__ __ __.__%	__ __ __.__%

* Use Range: A = 0 to 4,999 lb.; B = 5,000 - 9,999 lb.; C = 10,000 - 24,999 lb.; D = 25,000 - 49,999 lb.; E = 50,000 lb. +

Optional: Do not fill out unless applicable under N.J.A.C. 7:1K-4.6

2. Raw Material Substitution Certification: (See instructions for requirements. **NOTE**: all above information is still required)

a. Identify hazardous substance for which claim is being made:

____

b. Explain why substitution is not feasible:

____

____

c. Certification: **I certify that Parts I and II of the Pollution Prevention Plan have been completed for the specific combination of hazardous substances and production processes for which this Raw Material Substitution Certification is being claimed and that through completion of the Pollution Prevention Plan, this industrial facility has determined that it is not technically feasible to reduce the input use of the hazardous substance below current levels by replacing the substance with a different raw material in the specific production process.**

______________________ Signature

______________________ Print or Type Name

Return to: NJDEP, Pollution Prevention and Permit Coordination, P.O. Box 423, Trenton, NJ 08625-0423

POLLUTION PREVENTION PLAN SUMMARY

(Based on Pollution Prevention Plan On Site)

PLEASE TYPE OR PRINT CLEARLY THE ENTIRE FORM.

MAILING ADDRESS	FACILITY LOCATION
Top Shelf Wallcoverings 100 Road Drive Anywhere, NJ 12345	Same as Mailing Address
Indicate any changes to above information	Indicate any changes to above information

NJEIN 1 2 3 4 5 6 0 0 0 0 0

FEIN: 2 3 4 5 6 7 8 0 0 0 0 0 0

Base Year: 1998

☐ New
☒ Update

Section A: Facility-Level Administrative Information (This section needs to be filled out only ONCE)

1. Company's Phone Number and Fax Number:

(609) 999-9999 (Phone Number)   (609) 999-1111 (Fax Number)

2. Highest Ranking Corporate Official at Facility: (Print)

a. Stevens (Last Name) John (First Name) I (M.I.)   b. President (Position/Title)

3. If your facility has an approved NJRTK Research & Development Laboratory exemption pursuant to N.J.A.C. 7:1G, enter the approval number here. ____

4. Facility Planning information:

a. How many processes, including grouped processes, are there at this facility? .... a. 11

b. How many processes or grouped processes are targeted? .... b. 10

c. What is the facility's basis for targeting? (U)se/(N)PO/(R)eleases .... Enter U, N or R c. N

5. Does your facility's Pollution Prevention Plan Summary contain information which you are claiming confidential? .... (Y)es or (N)o .... a. N

If "Yes", mark which type of copy this is: (C)onfidential or (P)reliminary Public Copy ...... b. ____

6. Union representative at Facility, (if applicable), (Print)

a. Smith (Last Name) Mary (First Name) R (M.I.)   b. (609) 999-8822 (Phone Number)

c. AFL-CIO/#007 (Name of Union/Local #)

7. Certification by owner/operator of this facility that a plan has been prepared and is on site:

I certify under penalty of law that a Pollution Prevention Plan has been prepared for this industrial facility and that the Plan is available at the facility for inspection by the Department. I further certify that the information submitted in the Pollution Prevention Plan Summary is true, accurate, and complete to the best of my knowledge.

John Stevens (Signature)   President (Position/Title)   (609) 999-0000 (Phone Number)

Print or Type Name: John Stevens   Date: (MM/DD/YYYY) 6/30/1999

NOTE: N.J.A.C. 7:1K-3.1(b)3iii requires the submission of a list of permits issued by the Department as part of a Pollution Prevention Plan Summary. Because the Department currently has such permit information on file, pursuant to specific permitting programs, it is not requiring a separate submission of this list in an effort to streamline reporting. However, the Department reserves the right to require submission of this permit list by any facility.

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Pollution Prevention Plan Summary

(Based on Pollution Prevention Plan On Site)

NJ-EIN: 123456 00000
FEIN: 2345678 000 000

Facility Name: Top Shelf Wallcoverings

Section B: Facility-Level Information (Photocopy and use separate page for additional hazardous substance.)

Five year reduction goals for USE and NPO: *Assume constant production when calculation goals.*
Fill in both pounds and percent. Use the worksheets in the instructions for assistance. Reductions can be zero, but cannot be N/A or Blank. Also, USE reduction (lbs.) must be ≥ or = NPO reduction (lbs.). (i.e. 3.a ≥ 3.b)

		3. 5 Year Reduction Goals			
1. CAS # or Category #	2. Hazardous Substance	3.a USE[a] lb	3.b NPO[a] lb	3.c %USE[b]	3.d %NPO[b]
108-10-1	Methyl Isobutyl Ketone	0.0037	0.0037	89%	92%
79-46-9	2-Nitropropane	0.0024	0.0024	10.0%	10.0%
78-93-3	Methyl Ethyl Ketone	0.017	0.017	15.0%	15.0%
108-88-3	Toluene	0.0017	0.0017	9.8%	9.8%
67-64-1	Acetone	0.0005	0.0005	33.0%	33.0%
				%	%
				%	%
				%	%
				%	%
				%	%
				%	%
				%	%
				%	%
				%	%
				%	%

☐ Check here if additional sheets are attached

a. USE reduction goals are the difference between the fifth year planning year and base year total USE, assuming constant production. Total USE can be determined from quantities reported on the Release & Pollution Prevention Report (DEQ-114). Total USE represents the sum of Starting inventory, Produced On-Site, Brought On-Site, and Recycled Out-of-Process On Site and used On Site minus ending inventory. Nonproduct Output (NPO) reduction goals are the difference between the fifth planning year and base year total NPO, assuming constant production. Total NPO represents all material leaving production processes that is not product.

b. To calculate the USE percentage reduction goal, divide 5 year USE reduction goals by the TOTAL USE of the BASE YEAR and multiply the quotient by 100. To calculate the NPO percentage reduction goal, divide 5 year NPO reduction goals by TOTAL NPO of the BASE YEAR and multiply quotient by 100. (See accompanying instructions.)

Pollution Prevention Plan Summary

(Based on Pollution Prevention Plan On Site)

NJ-EIN: 123456 00000

FEIN: 2345678 000000

Facility Name: Top Shelf Wallcoverings

The number of Section C's should correspond to Question 4a, Section A.

Section C: Process Description (Photocopy and use separate page for each process or grouped process at your facility.)

1. Process ID: Process code chosen by facility. Up to twelve characters or digits may be used. M I E I
(Must use same Process ID in Plan Summary and ALL future Release and Pollution Prevention Reports.)

2. Product SIC Code: Use 4 digit codes - list provided in Appendix 2 of instructions. 3 6 7 9

3. Process Description: Fill (a) and (b) with one appropriate code from below

a. Process Category: [2]

1 – Chemical Manufacturing (Product or process is a chemical)
2 – Article Manufacturing (Chemicals are used in process, but product is an article)
3 – Storage and Handling (if separate from process)
4 – Treatment Operations

b. Mode of Operation [B] (B)atch, (C)ontinuous, or (N)ot Applicable
Enter B, C, or N

c. Specific Descriptions

Most processes have one discrete step (for example, a "coating" process). Some may be defined to have more than one (e.g., "cleaning and then "coating"). For a one-step process, use one descriptor (See Appendix 3 of instructions). If there is a second step, use an additional descriptor for the second step. If your process category in 3a above is 4 (Treatment Operations), you may use the Waste Treatment Codes (See Appendix 4 of instructions.) Continue in this manner until all steps are described.

CP3 . ACZ . AA4 . HCL . ___ . ___ . ___ . ___ . ___ . ___

If "Other" or "Similar" is chosen, describe below.

Stored as rolls of wallpaper

d. Identify which hazardous substances are used, generated, or released in the process or grouped process.
Check box at right if additional hazardous substances are included and attach additional pages. [ ]

	CAS Number or Category Number	Hazardous Substance
(1)	78-93-3	Methyl Ethyl Ketone
(2)	108-10-1	Methyl Isobutyl Ketone
(3)	67-64-1	Acetone
(4)		
(5)		
(6)		

4. Is this a targeted process? (Y)es or (N)o [Y]

5. Is this a grouped process? (Y)es or (N)o [Y]

Pollution Prevention Plan Summary

(Based on Pollution Prevention Plan On Site)

NJ-EIN: 123456000000
FEIN: 234567800000000

Facility Name: Top Shelf Wallcoverings

The number of Section C's should correspond to Question 4a, Section A.

Section C: Process Description (Photocopy and use separate page for each process or grouped process at your facility.)

1. Process ID: Process code chosen by facility. Up to twelve characters or digits may be used MLE2
(Must use same Process ID in Plan Summary and ALL future Release and Pollution Prevention Reports.)

2. Product SIC Code: Use 4 digit codes - list provided in Appendix 2 of instructions. 2679

3. Process Description. Fill (a) and (b) with one appropriate code from below

a. **Process Category:** [2]
1 – Chemical Manufacturing (Product or process is a chemical)
2 – Article Manufacturing (Chemicals are used in process, but product is an article)
3 – Storage and Handling (if separate from process)
4 – Treatment Operations

b. **Mode of Operation** [B] (B)atch, (C)ontinuous, or (N)ot Applicable
Enter B, C, or N

c. **Specific Descriptions**
Most processes have one discrete step (for example, a "coating" process). Some may be defined to have more than one (e.g., "cleaning and then "coating"). For a one-step process, use one descriptor (See Appendix 3 of instructions). If there is a second step, use an additional descriptor for the second step. If your process category in 3a above is 4 (Treatment Operations), you may use the Waste Treatment Codes (See Appendix 4 of instructions.) Continue in this manner until all steps are described.

CP3, ACZ, AA4, HC1, ____, ____, ____, ____, ____, ____

If "Other" or "Similar" is chosen, describe below.

Stored as rolls of wallpaper

d. Identify which hazardous substances are used, generated, or released in the process or grouped process.
Check box at right if additional hazardous substances are included and attach additional pages. [ ]

CAS Number or Category Number	Hazardous Substance
(1) 78-93-3	Methyl Ethyl Ketone
(2) 108-10-1	Methyl Isobutyl Ketone
(3) 67-64-1	Acetone
(4)	
(5)	
(6)	

4. Is this a targeted process? (Y)es or (N)o [Y]

5. Is this a grouped process? (Y)es or (N)o [Y]

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Pollution Prevention Plan Summary

(Based on Pollution Prevention Plan On Site)

Process ID: M 1 E 1

(Must use same Process ID in Plan Summary and ALL future Release and Pollution Prevention Reports.)

☐ Check here if additional hazardous substances are included and attach additional pages

Top Shelf Wallcoverings
Facility Name

NJEIN: 123456 00000
FEIN: 2345678 000000

Section D: Process-Level Information for Targeted Processes Only

(Photocopy and use separate page for each targeted process or targeted grouped process. The number of Section D's should correspond to Question 4b, Section A.)

1. Five Year Reduction Goals for Hazardous Substances Used in Process or Grouped Process:

CAS Number / Hazardous Substance	USE Range*	Technique (Use codes from Appendix 2 of instructions. If "Other," describe on additional sheets.)	Five Year Reduction Goal Per Unit of Product (Percent) USE	NPO	Estimated Date of Introduction (Month/Year)	Estimated Date of Completion (Month/Year)
78-93-3 Methyl Ethyl Ketone	E	W119 W121 W512 W518 W718	13.5%	13.5%	07/1999	09/2000
108-10-1 Methyl Isobutyl Ketone	B	W119 W152 W518 W718	9.9%	9.9%	08/1999	10/2000
67-64-1 Acetone	B	W512 W1718 W159	35.0%	35.0%	10/2000	10/2001
			%	%	/	/
			%	%	/	/
			%	%	/	/
			%	%	/	/

* Use Range: A = 0 to 4,999 lb.; B = 5,000 - 9,999 lb.; C = 10,000 - 24,999 lb.; D = 25,000 - 49,999 lb.; E = 50,000 lb. +

Optional: Do not fill out unless applicable under N.J.A.C. 7:1K-4.6

2. Raw Material Substitution Certification: (See instructions for requirements. **NOTE:** all above information is still required)

a. Identify hazardous substance for which claim is being made: ______

b. Explain why substitution is not feasible: ______

c. Certification: I certify that Parts I and II of the Pollution Prevention Plan have been completed for the specific combination of hazardous substances and production processes for which this Raw Material Substitution Certification is being claimed and that through completion of the Pollution Prevention Plan, this industrial facility has determined that it is not technically feasible to reduce the input use of the hazardous substance below current levels by replacing the substance with a different raw material in the specific production process.

Signature ______ Print or Type Name ______ Position/Title ______

DEP-113
11/98

Pollution Prevention Plan Summary

(Based on Pollution Prevention Plan On Site

Process ID: M I E 2

(Must use same Process ID in Plan Summary and ALL future Release and Pollution Prevention Reports.)

☐ Check here if additional hazardous substances are included and attach additional pages

Top Shelf Wallcoverings
Facility Name

NJEIN: 1 2 3 4 5 6 0 0 0 0 0
FEIN: 2 3 4 5 6 7 8 0 0 0 0 0 0

Section D: Process-Level Information for Targeted Processes Only

(Photocopy and use separate page for each targeted process or targeted grouped process. The number of Section D's should correspond to Question 4b, Section A.)

1. Five Year Reduction Goals for Hazardous Substances Used in Process or Grouped Process:

CAS Number / Hazardous Substance	USE Range*	Technique (Use codes from Appendix 2 of instructions. If "Other," describe on additional sheets.)	Five Year Reduction Goal Per Unit of Product (Percent) USE	NPO	Estimated Date of Introduction (Month/Year)	Estimated Date of Completion (Month/Year)
78-93-3 Methyl Ethyl Ketone	B	W119 W17 / W718 W114	5.8%	5.8%	07/1999	09/2000
108-10-1 Methyl Isobutyl Ketone	A	W119 W114	4.9%	4.9%	07/1999	09/1999
67-64-1 Acetone	A	W159 W114	35.0%	35.0%	11/2000	06/2001
			%	%	/	/
			%	%	/	/
			%	%	/	/
			%	%	/	/

* Use Range: A = 0 to 4,999 lb.; B = 5,000 - 9,999 lb.; C = 10,000 - 24,999 lb.; D = 25,000 - 49,999 lb.; E = 50,000 lb. +

Optional: Do not fill out unless applicable under N.J.A.C. 7:1K-4.6

2. Raw Material Substitution Certification: (See instructions for requirements. NOTE: all above information is still required)

a. Identify hazardous substance for which claim is being made: __________

b. Explain why substitution is not feasible: __________

c. Certification: I certify that Parts I and II of the Pollution Prevention Plan have been completed for the specific combination of hazardous substances and production processes for which this Raw Material Substitution Certification is being claimed and that through completion of the Pollution Prevention Plan, this industrial facility has determined that it is not technically feasible to reduce the input use of the hazardous substance below current levels by replacing the substance with a different raw material in the specific production process.

Signature ______ Print or Type Name ______ Position/Title ______

APPENDIX B-2

Pollution Prevention Plan Progress Report (Two Alternative Reporting Methods)

- **Sections C & D of the Release and Pollution Prevention Report (DEQ-114)**
- **Pollution Prevention Process-level Data Worksheet (P2-115)**

DEQ-114 NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECT
3/00 BUREAU OF CHEMICAL RELEASE INFORMATION & PREVENTION
P.O. BOX 405, TRENTON, NJ 08625-0405

Return *signed* original to this address

RELEASE & POLLUTION PREVENTION REPORT FOR 1999

Please type this form

MAILING ADDRESS INFORMATION — Make changes to mailing address above.

FACILITY LOCATION INFORMATION — Make changes to facility location above.

IMPORTANT:

- *Read instructions before completing this report. Please type (or print) all responses and transmit the completed report to the Department and a copy to the County Lead Agency of the county in which the facility is located by July 1, 2000.*
- *Complete one Section B form for each reportable substance (listed in Appendices B and C) that were manufactured, processed, or otherwise used in excess of 10,000 pounds in 1999. See instructions for guidance in completing Sections C and D.*

SECTION A. GENERAL FACILITY INFORMATION (This section needs to be complete only ONCE!)

1.1 Person to contact regarding this report
Name (printed)________________________ 1.2 Title________________________

1.3 Phone number (include area code) (_______)________________ 1.4 Fax # (_______)________________

1.5 Contact's address (if different than facility) ________________________
____

2. Briefly describe the nature of business conducted at this facility ________________________
____

3. Centroid coordinates of facility location in New Jersey State Plane Feet (NAD 83):

3.1 X___ ___ ___ ___ ___ _____ 3.2 Y_____ ___ ___ ___ ___ ___

4. Federal Employer ID Number: ________________________

5. TRI Facility ID Number: ________________________

6. EPA (RCRA) Hazardous Waste ID Number: ________________________

7. NJ Air Pollution Control Facility ID Number: ________________________

8. NJPDES ID Number (surface water): ________________________

9. NJPDES ID Number (ground water): ________________________

10. If this facility has an approved NJ RTK Research & Development Laboratory exemption pursuant to N.J.A.C. 7:1G, enter the exemption approval number here: ________________________

11. Is this facility subject to filing any EPA Toxic Release Inventory Forms (Form R) for calendar year 1999? ☐ Yes ☐ No

11.1 Number of Forms R subject to reporting for 1999: ______ 11.2 Number of Forms A subject to reporting for 1999: ______

12. Is this facility subject to filing the Waste Generation and Management Form (Form GM) as part of the 1999 Hazardous Waste Generator Biennial Report? ☐ Yes ☐ No

FAC_ID ___________________________
(first 11 characters on mailing label)

13. WASTEWATER DISCHARGES

13.1 If there is a discharge of a reported substance to a publicly owned treatment works (POTW), complete the following:
  a. Name of utility (POTW) ____________________
  b. Address (physical location) ____________________
  c. Estimated average volume of wastewater discharged to POTW daily (gallons per day) ____________________
  d. Briefly describe any pretreatment methods employed ____________________

13.2 If there is a discharge of a reported substance to a surface water, a navigable waterway, or to a tributary system, complete the following:
  a. Name of receiving stream____________________
  b. Estimated average volume of wastewater discharged to receiving stream (gallons per day) ____________________
  c. Briefly describe any pretreatment methods employed ____________________

13.3 If there is a discharge of a reported substance to groundwater, complete the following:
  a. Estimated average volume of wastewater discharged to groundwater (gallons per day) ____________________
  b. Briefly describe any pretreatment methods employed ____________________

14. TRADE SECRET CLAIMS

14.1 Does this report contain any trade secret (confidential business information) claims for Section B data? ☐ Yes ☐ No
14.2 Does this report contain any trade secret (confidential business information) claims for Section C or D data? ☐ Yes ☐ No

(You are required to provide full documentation on any trade secret (confidentiality) claim. Refer to page 7 of the instructions booklet, *Trade Secret Claim.*)

15. Waste Hauler Information - Provide the full names and locations (including street, city, state, and zip code) and the USEPA ID Number, or NJ Solid Waste Transporter Registration Number if applicable, of the hauler services that transported production-related wastes containing reported substances to off-site locations in 1999.

EPA ID# SOLID WASTE ID#	Name of Hauler	Address	City	State	Zip Code

16. CERTIFICATION OF EMPLOYER OR DULY AUTHORIZED REPRESENTATIVE - I certify under penalty of law that I have personally examined and am familiar with the information submitted in Sections A and B of this report and all attachments, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete.

Signature____________________ Date____________ Phone No. (______)____________

Name (print)____________________ Title____________________

NOTE: You are required pursuant to the authority of N.J.S.A. 34:5A-7(b) to forward a copy of this report to your RTK County Lead Agency. (See Instructions for appropriate addresses.)

RELEASE & POLLUTION PREVENTION REPORT FOR 1999

SECTION B. FACILITY-LEVEL SUBSTANCE-SPECIFIC INFORMATION

Submit one complete Section B for each reportable substance (listed in Appendices B and C of the instructions) that was manufactured, Processed, or otherwise used in excess of 10,000 pounds in 1999.

	1.1 CAS No. (Category No.)
	1.2 RTK Substance No.
1.3 Substance Name (Category Name)	

2. ACTIVITIES AND USES OF THE SUBSTANCE AT THE FACILITY (Check all that apply.)			
2.1	Manufacture the Substance:	a. G Produce b. G Import	If produce or import: c. G For on-site use/ processing d. G For sale/distribution e. G As a byproduct f. G As an impurity
2.2	Process the Substance:	a. G As a reactant b. G As a formulation component c. G As an article component d. G Repackaging	
2.3	Otherwise use the Substance:	a. G As a chemical processing aid b. G As a manufacturing aid c. G Ancillary or other use	
3.1	Principal Method of Storage:		
3.2	Frequency of Transfer from Storage: ____________ times per ____________		
3.3	Methods of Transfer:		

INVENTORY AND THROUGHPUT INFORMATION

	INVENTORY	N/A	Quantity (pounds)	Basis of Estimate (circle one)
4.	Maximum Daily Inventory of the Substance			M C E O
	INPUTS		Quantity	Basis of Estimate
5.	Starting Inventory of the Substance			M C E O
5.1	Quantity of Starting Inventory that is Nonproduct Output (NPO)			M C E O
6.	Quantity Produced on Site			M C E O
7.	Quantity Brought on Site			M C E O
7.1	Quantity of #7 (above) that is Brought on Site as Recycled Substance			M C E O
	OUTPUTS		Quantity (pounds)	Basis of Estimate (circle one)
8.	Quantity Consumed on Site (chemically reacted in process)			M C E O
9.	Quantity Shipped off Site as (or in) Product			M C E O
10.	Ending Inventory			M C E O
10.1	Quantity of Ending Inventory that is NonProduct Output (NPO)			M C E O
11.	Total Nonproduct Output			M T
	ON-SITE MANAGEMENT OF NONPRODUCT OUTPUT		Quantity (pounds)	Basis of Estimate (circle one)
12.	Quantity Recycled Out-of-Process on Site and Used on Site			M C E O
13.	Quantity Destroyed through On-Site Treatment			M C E O
14.	Quantity Destroyed through On-Site Energy Recovery			M C E O

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FAC_ID: ______________________________ Page ____ of ____

Substance or Category Name: ____

RELEASE INFORMATION (Substance Specific)		N/A	Quantity (pounds)	Basis of Estimate (circle one)
15.	Total Stack or Point Source Air Emissions			M C E O
16.	Total Fugitive of Non-Point Source Air Emissions			M C E O
17.	Total Discharge to Publicly Owned Treatment Works (POTW)			M C E O
18.	Total Discharge to Surface Waters			M C E O
19.	Total Discharge to Groundwater			M C E O

20. On-Site Land Disposal: ☐ N/A

Storage Method	Total Quantity of NPO Disposed that contained the Substance (pounds)	Quantity of Reported Substance within Disposed NPO (pounds)	Basis of Estimate (circle one)	Management Method
1. SM ______	________________	________________	M C E O	D _________
2. SM ______	________________	________________	M C E O	D _________
3. SM ______	________________	________________	M C E O	D _________

21. Transfers to Other Off-Site Locations: ☐ N/A

Receiving Facility Information ID#, Name & Address (street, city, state, zip)	Storage Method	Total Quantity of NPO Transferred that contained the Substance (pound)	Quantity of Substance within Transferred NPO (pounds)	Basis of Estimate (circle one)	Management Method
1. ID#________________	1. SM ____	________________	________________	M C E O	D ________
________________	2. SM ____	________________	________________	M C E O	D ________
________________	3. SM ____	________________	________________	M C E O	D ________
2. ID#________________	1. SM ____	________________	________________	M C E O	D ________
________________	2. SM ____	________________	________________	M C E O	D ________
________________	3. SM ____	________________	________________	M C E O	D ________
3. ID#________________	1. SM ____	________________	________________	M C E O	D ________
________________	2. SM ____	________________	________________	M C E O	D ________
________________	3. SM ____	________________	________________	M C E O	D ________
4. ID#________________	1. SM ____	________________	________________	M C E O	D ________
________________	2. SM ____	________________	________________	M C E O	D ________
________________	3. SM ____	________________	________________	M C E O	D ________
5. ID#________________	1. SM ____	________________	________________	M C E O	D ________
________________	2. SM ____	________________	________________	M C E O	D ________
________________	3. SM ____	________________	________________	M C E O	D ________
6. ID#________________	1. SM ____	________________	________________	M C E O	D ________
________________	2. SM ____	________________	________________	M C E O	D ________
________________	3. SM ____	________________	________________	M C E O	D ________

22.	Quantity released to the environment as a result of remedial actions, catastrophic events, or one-time events not associated with production processes (pounds/year)	

☐ Check if additional pages containing information for questions 20 or 21 are attached.

Substance or Category Name: ____

			Quantity	Units	Product Description
23.	1999 Quantity and Units of Production* Associated with the Reported Substance	1.			
		2.			
24.	1998 Quantity and Units of Production* Associated with the Reported Substance	1.			
		2.			

*PRODUCTION: Whenever possible, "UNITS" should be mass or surface area units only, such as pounds of material manufactured or square footage of product involved.

☐ Check if additional pages containing information for questions 23 or 24 are attached.

25. Has any reduction or elimination of either the use of the reported substance or the generation of the reported substance as nonproduct output (NPO) occurred during 1999 due to discontinuance of operations?

☐ Yes ☐ No If "Yes," fill in below:

	Quantity of Substance Reduced (pounds) (1998 to 1999)	Basis of Estimate
Quantity of substance reduced (1998 to 1999) due to the discontinuance of operations, Including operations transferred to or undertaken by another facility		M C E O

POLLUTION PREVENTION ACTIVITIES

For the purposes of this question and Sections C and D of this Report, pollution prevention means: the reduction or elimination of either the use of the reported substance or the generation of the reported substance as nonproduct output, prior to treatment, storage, out-of-process recycling, or disposal. Pollution prevention is not any type of treatment, out-of-process recycling, incineration, or the transfer of releases to different media.

26. Has any material-related change (change in the amount of the reported substance used due to substitution of a non-listed substance) been employed to reduce the quantity of this reported substance during 1999 relative to 1998 levels?

☐ Yes ☐ No If "Yes," fill in the table below:

POLLUTION PREVENTION METHODOLOGY	Quantity of Substance Reduced (pounds) (1998 to 1999)	Basis of Estimate
Material-Related Change (change in the amount of the substance used due to substitution of other non-listed substance)		M C E O

CAS Number, Substance Name and Quantity of Substitute Substance

CAS NUMBER	SUBSTANCE NAME	QUANTITY (pounds)
a) ____________	____________	____________
b) ____________	____________	____________
c) ____________	____________	____________

RELEASE & POLLUTION PREVENTION REPORT FOR 1999

SECTION C. FACILITY-LEVEL SUBSTANCE-SPECIFIC POLLUTION PREVENTION PROGRESS

Submit one complete Section C for each reportable substance (listed in Appendices B and C of the instructions) manufactured, processed or otherwise used in excess of 10,000 pounds in 1999.

FACILITY LOCATION INFORMATION	1.1 CAS No. (Category No.)
	1.2 Substance Name (Category Name)

2. Production Ratio or Activity Index
   (based on the USE per number of units of product) ____ ____.____ ____

3. Percent Change
   (based on the USE or NPO per number of units of product)

Use	NPO
___ ___ ___ . ___ %	___ ___ ___ . ___ %

4. Note the identification numbers of any production processes that your facility discontinued or sent off site in 1999. These numbers should match those identified in your Pollution Prevention Plan and Section C of your Pollution Prevention Plan Summary. If any of the listed processes involved more than one reportable substance, identify the process ID only once on a single Section C. If no production processes were discontinued or sent off site in 1999, leave this blank.

_______________ _______________ _______________

_______________ _______________ _______________

5. CERTIFICATION OF OWNER OR OPERATOR (Signature required on one Section C submission only):
   I certify under penalty of law that the information submitted in Sections C and D of this report is true, accurate and complete to the best of my knowledge.

Signature _______________ Date _______________ Phone No. (______)_______________

Name (print) _______________ Title _______________

RELEASE AND POLLUTION PREVENTION REPORT FOR 1999

SECTION D. PROCESS-LEVEL POLLUTION PREVENTION INFORMATION FOR TARGETED PROCESSES

Submit one complete Section D for each targeted process or targeted grouped process at your facility.

1.2 ☐ Check here if your facility made a production process change in 1999 that triggered a modification of the Pollution Prevention Plan or Plan Summary.

1.3 ☐ Check here if your facility's pollution prevention progress was less than anticipated for any chemical within this targeted process and attach a brief statement explaining why.

1.4 ☐ Check here if this targeted production process uses more than six substances. If so, attach additional sheets.

1.1 Process ID (Must be same ID listed in the Pollution Prevention Summary):

___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

2.1 Substance Name (Category Name)	Percent Change Per unit of product		4.1 Pollution Prevention Techniques Used In 1999 (use 3-digit codes in Appendix F of the instructions)	4.2 Pollution Prevention Techniques Planned for 2000 (use 3-digit codes in Appendix F of the instructions)
2.2 CAS Number (Category No.)	3.1 Use	3.2 NPO		
__ __ __ __ __- __ __ - __	%	%		
__ __ __ __ __- __ __ - __	%	%		
__ __ __ __ __- __ __ - __	%	%		
__ __ __ __ __- __ __ - __	%	%		
__ __ __ __ __- __ __ - __	%	%		
__ __ __ __ __- __ __ - __	%	%		

NOTE: THIS WORKSHEET IS REQUIRED AS PART OF THE POLLUTION PREVENTION PLAN, AND IS OPTIONAL AS A SUBMITTAL IN LIEU OF SECTIONS C AND D OF THE RELEASE AND POLLUTION PREVENTION REPORT. ALL OPTIONAL SUBMITTALS ARE NOT CONFIDENTIAL.

POLLUTION PREVENTION PROCESS LEVEL DATA WORKSHEET (P2-115)
Base Year ________

PROCESS LEVEL INFORMATION: (Use one sheet for each hazardous substance at each process.)

PROCESS I.D. (from Plan Summary) ________________________________

UNITS OF PRODUCTION (e.g. type of widget, lbs. of chemical, ft^2 of product) ___________

Is process targeted? (Y/N)_____Is this a grouped process? (Y/N)_____

HAZARDOUS SUBSTANCE:	CAS No.					
	Base Year	Year 1	Year 2	Year 3	Year 4	Year 5
Production quantity						
USE (pounds)						
Consumed						
Shipped off-site as (or in) product						
NPO (pounds)						
Recycled out of process						
Destroyed:on site treatment						
Destroyed:on site energy recovery						
Stack air emissions						
Fugitive air emissions						
Discharge to POTWs						
Discharge to groundwaters						
Discharge to surface waters						
On site land disposal						
Transferred off site						
P2 techniques used or planned in given year (code in 1999 RPPR Instructions, Appendix F)						
Was this process discontinued or sent off site in given year? (Y/N)						
Did facility make process change(s) that triggered Plan modification? (Y/N)						
Was facility's P2 progress (targeted process only) less than anticipated? (Y/N) (Attach explanation.)						

CERTIFICATION OF OWNER OR OPERATOR (Required only on one P2-115) - I certify under penalty of law that the information submitted on this worksheet is true, accurate and complete to the best of my knowledge.

Signature____________________________ Date______________PhoneNo.(______)_____________
Name (print)___________________________ Title____

←

APPENDIX C
Sources of More Information

If you encounter difficulties at any phase of the pollution prevention process, there are numerous sources of assistance available. A partial list of such sources has been compiled for this manual and is presented below. The list is broken down into the following categories:

- Publications, dealing with all aspects of pollution prevention
- Technical information centers and clearinghouses
- Trade associations

These sources are helpful for obtaining information about pollution prevention opportunities in specific processes and industries, as well as for general pollution prevention planning.

PUBLICATIONS

Additional DEP Guidance -

(available from the Office of Pollution Prevention at (609) 777-0518)

1) Wallpaper Case Study — Covered in guidance document; gives facilities, who otherwise use a hazardous substance, a look at how to prepare a plan; Applicable to painting with solvents, degreasing operations, some catalysts, most cleaning operations, etc.

2) Paint Case Study — Gives formulators and/or facilities who incorporate hazardous substances into their product a look at how to prepare a plan; applicable to paint manufactures, flavors & fragrance formulators, refining operations, repackaging operations, metal working facilities (where a portion of the metal may be a hazardous substance), etc.

3) Chlorine Manufacturer — Gives chemical manufactures and/or facilities who react hazardous substances a look at how to prepare a plan; applicable to any and all facilities generating a hazardous substance, also useful to any facility consuming a hazardous substance (e.g., metal etching, polymerizations, all chemical reactions, etc).

Other manuals and Guides

Facility Manager's Guide to Pollution Prevention and Waste Minimization. Bureau of National Affairs, P.O. Box 7814, Edison, NJ 08818-7814. Phone (800) 960-1220.

Hazardous Waste Minimization Manual for Small Quantity Generators. Pittsburgh, NY: Center for Hazardous Materials Research, University of Pittsburgh Applied Research Center, 1987.

Minnesota Guide to Pollution Prevention Planning. Minnesota Office of Waste Management, 1991.

New York State Waste Reduction Guidance Manual. Fairfax, VA: ICF Technology Inc. for New York State Department of Environmental Conservation, 1989.

Versar, Inc., and Jacobs Engineering Group. Waste Minimization: Issues and Options. Springfield, VA: EPA, 1986.

Case Studies

Davis, Gary A. Measures to Promote the Reduction and Recycling of Hazardous Wastes in Tennessee. Knoxville, TN: University of Tennessee, Energy, Environment and Resources Center, 1984.

Huisingh, Donald et al. Profits of Pollution Prevention: A Compendium of North Carolina Case Studies. Raleigh, ND: North Carolina Department of Natural Resources and Community Development, Pollution Prevention Pays Program, 1985.

New Jersey Hazardous Waste Source Reduction and Recycling Roundtable. New Jersey Waste Facilities Siting Commission with the New Jersey League of Women Voters and Shell Oil Company, July 25, 1984.

Sarokin, David, Warren Muir, Catherine Miller, and Sebastian Sperber. Cutting Chemical Wastes: What 29 Organic Chemical Plants are Doing to Reduce Hazardous Wastes. New York, NY: INFORM, Inc., 1985.

Developing and Implementing a Waste Reduction Program. Raleigh, NC: North Carolina Pollution Prevention Pays Program.

Field, Rosanne A. Management Strategies and Technologies for the Minimization of Chemical Wastes from Laboratories. Durham, NC: Duke University Medical Center, Division of Environmental Safety, the Pollution Pays Program, 1986.

Hunt, Gary E. Overview of Waste Reduction Techniques and Technologies. Raleigh, NC: North Carolina Department of Natural Resources and Community Development, 1989.

Schecter, Roger N. Summary of Waste Reduction Programs. Raleigh, NC: Waste Reduction Resource Center for the Southeast, 1989.

Economic Considerations

Alternative Approaches to the Financial Evaluation of Industrial Pollution Prevention Investments. Trenton, NJ: Prepared for N.J. Department of Environmental Protection by Allen White, Deborah Savage and Monica Becker, 1991.

An Introduction to Environmental Accounting As a Business Management Tool: Key Concepts and Terms., U.S. Environmental Protecition Agency, Washinton, D.C.: June 1995

Campbell, Monica E. and William M. Glenn. Profit from Pollution Prevention: A Guide to Industrial Waste Reduction and Recycling. Toronto: The Pollution Probe Foundation, 1982.

General Electric Co. Financial Analysis of Waste Management Alternatives. ICF Technology, 1986.

Green Ledgers: Case Studies in Corporate Environmental Accounting. Washington, D.C.: World Resources Institute, May 1995.

Polaroid: Managing Environmental Responsibilities and their Costs. Boston, Ma.: Harvard Business School, 1993.

Profiting from Waste Reduction in Your Small Business. Anchorage, AK: Alaska Health Project, 1988 .

Waste Minimization: Environmental Quality with Economic Benefits. Washington, DC: EPA Waste and Emergency Response, 1987.

Technical Options

Kohl, Jerome, Philip Moses, and Brooke Triplett. Managing and Recycling Solvents: North Carolina Practices, Facilities, and Regulations. Raleigh, NC: North Carolina State University, 1984.

Nunn, Thomas, et al. Waste Minimization in the Printed Circuit Board Industry. Washington, DC: EPA, 1988.

Overcash, Michael R. Techniques for Industrial Pollution Prevention: A Compendium for Hazardous and NonHazardous Waste Minimization. Chelsea, MI: Lewis Publishers, Inc., 1986.

Smith, Brent. A Workbook for Pollution Prevention by Source Reduction in Textile Wet Processing. Raleigh, NC: Department of Textile Chemistry, North Carolina State University, 1988.

Swalheim, D. A. Recovery and Reuse of Chemicals in Plating Rinses. American Electroplaters' Society, Inc., 1985.

Tavlarides, Lawrence L. Process Modifications for Industrial Pollution Source Reduction: Industrial Waste Management Series. James W. Patterson, Executive Editor. Chelsea, MI: Lewis Publishers, Inc., 1985.

Waste Minimization in the Petroleum Industry. American Petroleum Institute, Health and Environmental Affairs Department, 1991.

TECHNICAL INFORMATION CENTERS AND CLEARINGHOUSES

Air & Waste Management Association
PO Box 2861
Pittsburgh, PA 15230
(412) 232-344   Fax (412) 232-2350

Control Technology Center Hotline
US Environmental Protection Agency
AERL/E\GECD/OCB
Mail Drop 61
Research Triangle Park, NC 27711
(919) 541-0800 Fax (919) 541-0072

Hazardous Waste Advisement Program
New Jersey Department of Environmental Protection
Bureau of Regulation and Classification
401 East State Street
Trenton, NJ 08625
(609) 292-8341

Hazardous Waste Research and Information Center
One East Hazelwood Drive
Champaign, IL 61820
(217) 333-8940

INFORM, Inc.
381 Park Avenue, South
New York, NY 10016-8806
(212) 689-4040 Fax (212) 447-0689

Information Resource Center
New Jersey Department of Environmental Protection
432 East State Street
Trenton, NJ 08625
(609) 984-2249 Fax (609) 292-3298

Pollution Prevention Information Clearinghouse
- U.S. Environmental Protection Agency
401 M. Street, East Tower #415
Washington, D.C. 20460
(202) 260-1023

Pollution Prevention Research Center
North Carolina State University
PO Box 7905
Raleigh, NC 27695
(919) 515-2325

Risk Reduction Engineering Laboratory
US Environmental Protection Agency
Cincinnati, OH 45268
(513) 569-7748

Risk Reduction Unit
New Jersey Department of Environmental Protection
Office of Science and Research
401 East State Street
Trenton, NJ 08625

TRADE ASSOCIATIONS

Adhesive Manufacturers Association
111 East Wacker Drive
Chicago, IL 60601
(312) 644-6610

Alliance of Metalworking Industries
1100 17th Street, NW
Washington, DC 20036
(202) 223-2431

American Ceramic Society
757 Brooksedge Plaza Drive
Westerville, OH 43081
(614) 890-4700

American Gas Association
1515 Wilson Boulevard
Arlington, VA 22202
(703) 841-8416 (703) 841-8406

American Petroleum Institute
275 Seventh Avenue
New York, NY 10001
(212) 366-4040 (212) 366-4298

American Society of Heating, Refrigerating and Air Conditioning
1791 Tullie Circle, NE
Atlanta, GA 30329
(404) 636-8400 (202) 321-5478

American Textile Manufacturers Institute
1801 K Street, NW, Suite 900

Washington, DC 20006
(202) 862-0580 Fax (202) 862-0570

Association for Finishing Processes
One SME Drive
PO Box 930
Dearborn, MI 48121
(313) 271-1500

Chemical Manufacturers Association
2501 Thomas Jefferson Street, NW
Washington, DC 20037
(202) 887-1388

Independent Lubricant Manufacturers Association
1055 Thomas Jefferson Street, NJ, Suite 302
Washington, DC 20007
(202) 337-3470

International Association of Milk, Food and Environmental Sanitaria
502 East Lincoln Way
Ames, IA 50010
(515) 232-6699

National Electrical Manufacturers Association
2101 L Street, NW
Washington, DC 20037
(202) 457-8400

Sealant and Waterproofers Institute
3101 Broadway, Suite 585
Kansas City, MO 64111
(816) 561-8230

Soap and Detergent Association
475 Park Avenue, South
New York, NY 10016
(212) 725-1262 Fax (212) 213-0685

Society of the Plastics Industry, Inc.
1275 K Street, NW, Suite 400
Washington, DC 20005
Society of Wood Science and Technology
One Gifford Pinchot Drive
Madison, WI 53705
(608) 231-9347

Other trade associations can be found in:

New York State Waste Reduction Guidance Manual. Fairfax, VA: ICF Technology Inc. for New York State Department of Environmental Conservation, 1989.

APPENDIX D

Related Topics: Total Quality, Energy Conservation, Product Stewardship

Pollution prevention is closely related to other popular and important concepts such as energy conservation, total environmental quality management, and product stewardship. Any of these programs can be carried out by the same team you have organized to carry out the requirements of the Pollution Prevention Act. If your company already has one or more of these programs, it may provide a good basis for your pollution prevention program since they are all compatible concepts.

Energy Conservation

A significant amount of energy is used each year in the production of goods and services, including the production and use of hazardous substances and the transport and disposal of hazardous wastes created by industrial processes. The idea that reducing the demand for energy reduces pollution (particularly air pollution) is being actively promoted within industry and through voluntary government programs such as the EPA's Green Lights program. Utility companies may also have programs that offer financial incentives to industries who conserve energy.

Within industrial processes, any pollution prevention technique that increases production efficiency and makes some hazardous substances less necessary will conserve the energy used to manage those hazardous substances. Within facilities, pollution prevention and energy conservation are compatible concepts, although there will be times when there are trade-offs. For instance, if a temperature increase results in a process using hazardous substances more efficiently, increased energy use may be the price of decreasing NPO. However, there are also pollution prevention techniques that improve efficiency in all categories, including energy efficiency. The process of looking for energy conservation opportunities can parallel that of looking for pollution prevention options.

Energy conservation methods will be found by identifying and prioritizing the parts of a process that are energy intensive, then targeting those parts for improvement. The benefits of energy conservation are similar to pollution prevention as well. Energy conservation measures are often cost-effective due to reduced facility overhead costs and utility charges. Energy conservation measures also lend themselves to a Total Cost Assessment analysis because the costs of energy usage can be easily obtained.

Total Quality Management

Total quality management is a philosophy that has been adopted by many companies as a way to gain a competitive edge in the marketplace. Traditionally, this concept has been applied to other aspects of a business, but it also has relevance for pollution prevention. The main idea behind total quality management is to "do it right the first time" by producing high quality products based on customer expectations. Customers know what they want in a product and they know that if one company does not fit their requirements then there is another one that will. The object of total quality management is to modify your product as the expectations of the customer change in order to stay ahead of the competition while still providing for the customer’s needs. This approach emphasizes continuous improvement which is also a concept that is at the heart of pollution prevention.

This on-going process is governed by the Plan-Do-Check-Act cycle (P-D-C-A cycle). The P-D-C-A cycle is the basis of the method used in total quality management. First, you must plan. You need to make an accurate assessment of how your product is received by the customer. Only then can you best decide what is needed for greater customer satisfaction. What does the customer like the most or the least? What concerns does the customer have? Customers have a different perspective on your product than you do, simply because they are involved only in the product’s use, not in its manufacture.

After you have developed a plan, the next logical step is to carry it out (the ‘Do’ part of the cycle). Put the ideas that adhere to the needs of your customers into action. When the “improved” product is being used by the customers or being tested at your facility, observe the effects your changes had (the ‘Check’ part of the cycle). Were the results positive? Did they raise more concerns? Analyze the answers to these and related questions in order to determine what needs to be done next (the ‘Act’ part of the cycle). The cycle is at the beginning again. You now use what you have learned as well as more customer reaction to develop another plan to increase customer satisfaction. In this manner, the process of total quality management is a continuous cycle.

While total quality management focuses on the customer, the customer can be defined in other ways than as the person buying your product. By considering the customer to be the workers or consumers exposed to the product, total quality management can be applied to pollution prevention. This can lead to more efficient processes or, at the very least, processes which your employees feel more comfortable with. This cycle can also be used to address the environmental concerns raised by the workers or by environmental regulations. The morale of the workplace could be substantially increased by this type of program because allowing employees a role in improving efficiency shows that the top management cares about the opinions and concerns of its employees.

Product Stewardship

Product stewardship is based on the premise that a manufacturer has responsibility for a product’s use even after it leaves the manufacturer’s facility. It addresses the effects of the substance on anyone who comes into contact with it. This includes the supplier, the distributor, the user, as well as the manufacturer. Its main goal is to educate people about safety, health, and environmental issues. The Chemical Manufacturers Association has formalized product stewardship, incorporating it into its Responsible Care program.

Product stewardship requires that you take an active part in what happens to your product after it has left your direct control. This process begins with information available at the facility. You should educate yourself and your company about the possible safety, health, and environmental hazards your raw materials and products may cause.

Once your company is confident in its knowledge, information should be passed on to others who are exposed to the product and would, therefore, benefit from the information. Customers need to know what kind of environmental effect something causes or if it can have an unexpected long-term effect not mentioned elsewhere. Explaining how to use your product properly as well as how not to will allow the customers to adjust their practices accordingly.

The final customer or end-user is not the only one who can benefit from improved knowledge of safety, health, and environmental issues. Suppliers, distributors, and industrial users will benefit as well. They need to know, not only about your product, but also what they can do to address the concerns themselves. They are in a unique position to affect how products are treated, especially since they usually handle them in large quantities. In addition, at some point or another, they become customers as well, with all of their cares and concerns.

The ultimate goal of product stewardship is to create an atmosphere of information exchange for the benefit of all. Once this information exchange begins, a plan is developed and then implemented to address any problems that arise, from initial shipment to final disposal.

APPENDIX E

Pollution Prevention Planning Administrative Review Form

POLLUTION PREVENTION PLANNING ADMINISTRATIVE I

FACILITY ______
NJEIN ______
LOCATION ______
REVIEWER/DATE ______
FACILITY REPS PRESENT ______

Pursuant to N.J.A.C. 7:1K-4.3, Part I of a Pollution Prevention Plan shall include:

YES	NO	N/A		COMMENTS
			Part IA: Two certifications are required. (7:1K-4.3(b)1)	
___	___	___	• The first one must be signed by the highest ranking corporate official with direct operating responsibility and must read: "I certify under penalty of law that I have read the Pollution Prevention Plan and that the Pollution Prevention Plan is true, accurate and complete to the best of my knowledge." (e.g., president, vice-president, plant manager.)	
___	___	___	• The second must be signed by the highest ranking corporate official at the facility and must read: "I certify under penalty of law that I am familiar with the Pollution Prevention Plan and that it is the corporate policy of this industrial facility to achieve the goals of the Pollution Prevention Plan." (e.g., plant manager)	
			The following names and telephone numbers must be included:	
___	___	___	• The owner/operator of the facility.	
___	___	___	• The highest ranking corporate official at the facility.	
___	___	___	• The union representative (if applicable).	
			Facility-level information (7:1K-4.3(b)2) (Inclusion of the Release and Pollution Prevention Report (RPPR)) is acceptable except for use quantities. Must be in plan or referenced by plan) (NOTE: Annual inputs should equal outputs within 5% or less.)	
___	___	___	• Chemical name and CAS number for each hazardous substance.	
			Inventory data for annual inputs (in pounds):	
___	___	___	• Stored at facility on first day of reporting year.	
___	___	___	• Brought into facility as non-recycled material.	
___	___	___	• Manufactured as product, co-product or NPO at the facility.	
___	___	___	• Recycled out of process and used as an input.	

YES	NO	N/A		COMMENTS
			Inventory data for annual output (in pounds):	
___	___	___	• Stored at facility on last day of reporting year.	
___	___	___	• Consumed at the facility.	
___	___	___	• Shipped off-site as product/co-product.	
___	___	___	• Generated as NPO.	
___	___	___	• Recycled out of process both on-site and off-site.	
___	___	___	Annual release data:	

- Released to air through stack emissions.
- Released to air through fugitive emissions.
- Discharged to the waters of the State.
- Generated as other waste streams.

Annual chemical use calculation:

- **USE = Inputs - Ending Inventory. (NOTE: USE must be calculated. It is not present on the RPPR.)**

<u>Process-level information</u> (7:1K-4.3(b)3, 7:1K-4.9)

- **Inclusion of P2-115 (Covers next 11 bullets except grouping decision.)**
- **Process ID.**
- **Grouped process (Y/N).**
- **Identification of product/co-product/intermediate product.**
- **Total quantity of production**
- **Description of grouping decision (if applicable) including description of unit for measuring production.**

<u>Process-level inventory data</u> (7:1K-4.3(b)4)

The following information should be collected annually for each hazardous substance, in pounds.

Inventory data for each production process:

- **Contained in products/co-products/intermediate products.**
- **Consumed at the facility.**
- **Used.**
- **Generated as NPO.**
- **Released.**
- **Recycled out of process both on-site and off-site.**

<u>YES</u> <u>NO</u> <u>N/A</u> <u>COMMENTS</u>

<u>Hazardous waste data</u> (7:1K-4.3(b)5)

Facility-level data (Inclusion of RCRA Hazardous Waste Biannual Report may be sufficient.) Measured in pounds:

- **Amount generated. (GM)**
- **Amount treated out-of-process. (GM)**
- **Amount stored out-of-process. (GM)**
- **Amount disposed out-of-process. (GM)**
- **Address of treatment, storage, or disposal facilities (TSDs). (OI)**
- **Description of type of treatment at each TSD. (GM)**
- **Amounts recycled on/off site. (GM)**

Process-level data

- **Pounds of each hazardous waste generated at each production process.**

<u>Cost data</u> (7:1K-4.3(b)6)

An estimate for each source or production process, of the costs of using hazardous substances, generating hazardous substances as NPO, and releasing hazardous substances, including, at a minimum:

- Storage and handling (including safety and health compliance).
- Monitoring, tracking, and reporting.
- Treatment.
- Transportation and disposal.
- Manifesting and labeling.
- Permit fees.
- Liability insurance (if applicable).

Pursuant to N.J.A.C. 7:1K-4.4, a Pollution Prevention Plan shall include:

Targeting (Please check only one of the following four options.)
- **Facility targeted 100% of all processes.**
- **Facility targeted processes that contributed 90% based on USE of hazardous substances.**
- **Facility targeted process that contributed 90% based on NPO generated.**
- **Facility targeted process that contributed 90% based on RELEASE of hazardous substances.**

YES NO N/A COMMENTS

Pursuant to N.J.A.C. 7:1K-4.5, Part II of a Pollution Prevention Plan shall include:

Estimate Source Level NPO (7:1K-4.5(a)2)
- **Estimate in pounds the annual quantities of each hazardous substance generated as NPO at each source within each targeted production process**

Identifying Pollution Prevention Options (7:1K-4.5(a)4)
- **Identify pollution prevention options that reduce the use and generation of hazardous substance.**

Feasibility analysis of options including: (7:1K-4.5(a)5, 12 and 13)
- **Technical analysis: is the option technically feasible?**
- **Financial analysis: is the option financially feasible?**
  - **Monitoring costs.**
  - **Treatment costs.**
  - **Transportation and disposal costs.**
  - **Manifest and labeling costs.**
  - **Permit fees.**
  - **Liability insurance costs, if applicable.**
  - **Cost savings due to more efficient use of raw materials.**
- **Impact on Releases- Impact of P2 option on releases to air, water, waste.**
- **Rationale for not implementing P2 options.**

5 Year Goals for NPO and USE Reductions (7:1K-4.5(a)7-11)

(Should be the same as those reported on the Plan Summary (DEP-113).)

- **Change in use in pounds**
- **Change in NPO in pounds**
- **Change in use reported as a percent**
- **Change in NPO reported as a percent**
- **Percent change in use per unit product for targeted processes**
- **Percent change in NPO per unit of product for targeted processes**
- **Start and completion dates for implementing P2 options. (NOTE: Planned reductions need to match P2 options implemented.)**

YES **NO** **N/A** **COMMENTS**

Part IB: (Plan Progress Report (RPPR Sections C, D) calculations)
(This part may be skipped until July of the year following submission of the initial Plan Summary. Calculations are not required if P2-115 was submitted to the Department)

Facility level information on pollution prevention reductions
(7:1K-4.3(c)1)
(NOTE: Negative numbers indicate the facility became less efficient)

- **Calculations of change in USE to base year.**
- **Calculations of change in NPO to base year.**
- **Calculations of change in releases, by medium, after recycling and treatment, to base year.**
- **Percent progress towards each of the facility's five-year goals.**

Targeted Production Processes (7:1K-4.3(c)2)

- **Unique ID number for each targeted process.**
- **Indication if grouped or not.**
- **Base year USE, NPO, and units of production for each targeted process.**
- **Current year USE, NPO, and units of production for each targeted process.**
- **Calculations of change in releases, by medium, after recycling and treatment, to base year.**
- **Numerical statement of progress towards each of the facility's five-year goals.**
- **Pollution prevention techniques listed for each reduction.**

Notes:

APPENDIX F

Conducting a Total Cost Assessment

OVERVIEW

This Appendix provides guidance to calculating the profitability of pollution prevention projects identified. In the course of preparing a Pollution Prevention Plan targeted at specific production processes and sources, numerous opportunities for source reduction are likely to arise. Profitability analysis helps to answer two key questions:

(1) How profitable is a specific project as compared to an amount which the company needs to realize to make the project worthwhile (a hurdle rate).

(2) How profitable is a specific project when compared to other pollution prevention options?

To comply with the Pollution Prevention Act, companies are required to consider costs at two distinct points during preparation of their Pollution Prevention Plans. In Part I pursuant to *N.J.A.C 7..IK-4.3(b)6,* companies are asked to perform “a comprehensive financial analysis for each source or production process, of the costs of using hazardous substances, generating hazardous substances as nonproduct output, and releasing hazardous substances...”. Furthermore, in Part 11 they are asked to conduct "a comprehensive financial analysis of the costs or savings realized by-investments in pollution prevention options compared to the costs of using hazardous substances, generating hazardous substances as nonproduct output, and releasing hazardous substances ...... Although the Part 11 cost analysis is referred to in the Act As a “full-cost accounting”, the Department has decided to use the phrase “comprehensive financial analysis...” for both Part I and Part 11 because it is a more descriptive phrase and is less easily confused with other concepts. The intent of these sections in the rule is to require that project financial evaluations take into account the full range of costs and savings, both direct and indirect, tangible and less tangible. This will require a systematic analysis of both conventional capital and operating costs items *and* those often omitted from conventional project financial evaluation. This process is an extension of the “comprehensive financial analysis” section introduced in Step 6 and the "financial feasibility" section in Step 8. The term Total Cost Assessment (or TCA) is used to describe the comprehensive financial analysis of the costs and savings of a pollution prevention project.

Firms routinely make capital budgeting decisions. Sometimes this occurs in a formal process as in the case of large firms with many competing divisions and potential investments. Other times, as in the case of small companies, the process is informal and uncomplicated, occurring whenever a promising or urgent capital improvement presents itself. In large firms, proposals for capital expenditures are generally conceived at the operational level, packaged in the form of an appropriations request, and channeled through various technical and economic reviews prior to final approval or rejection. The larger the project, the more in-depth the scrutiny and the greater the number of hurdles in the project justification process. This formalized process stands in contrast to smaller firms which analyze, often on an ad hoc basis and with the assistance of vendors, the profitability of a particular investment using only rudimentary indicators such as simple payback. Whether large or small, the manner in which project financial analysis is conducted is critical to the fate of projects in the highly competitive capital budgeting arena.

Currently, there exists no standardized methodology for project investment an analysis. In contrast to financial accounting standards created by the Federal Accounting Standards Board (FASB) and financial reporting requirements mandated by the Securities and Exchange Commission (SEC) for publicly-traded companies, project investment analysis historically is viewed as a matter internal to the firm. While certain SEC procedures indirectly affect such investment analysis (e.g., required disclosure of anticipated contingency costs such as environmental liability which are 'material" to the firm's capital expenditures, earnings, and competitive position), companies conduct investment analysis using costs, cost allocation methods, time horizons, and profit- ability indicators tailored to their specific needs.

As conventionally practiced, capital budgeting processes often fail to capture the full range of benefits in pollution prevention projects because of two distinct but related biases in conventional managerial accounting. The first bias stems from the tendency of firms to place prevention projects in the category of "profit-sustaining", or "must-do" compliance investments. This stands in contrast to 'profit-adding" (including costs reduction) projects and market-expansion projects, the first priority of management in terms of corporate growth and market development. By lumping prevention projects into the "must-do" category, the tendency is to draw narrow boundaries around costs, savings, and revenues, dispense with in-depth analysis, and thereby omit or underestimate the potential benefits of undertaking the investment.

The second bias in conventional budgeting processes stems from the nature of prevention investments themselves. Because prevention by definition implies "upstream" changes in materials inputs and choice of process technologies, such investments tend to trigger multiple, often indirect or second order affects mid-stream and down-stream in the production process. These may take the form of reduced compliance, insurance, and waste management costs, reduced worker absenteeism, as well as avoidance of contingency costs linked to acute events caused by a sudden release of hazardous materials. Further- more, prevention measures increasingly are tied to less tangible, and difficult to quantify, benefits such as corporate and product image, and to gaining a foothold in the emerging markets for "green products". Insofar as a prevention investment produces such benefits, they tend to occur over time periods longer than the 2-5 years frequently used in conventional project financial analysis. They also require the firm to inventory and allocate costs, both traditional and less quantifiable, more precisely than in conventional capital budgeting practices.

The procedures outlined below are intended to provide industry managers with the tools to reduce these biases such that prevention investments are placed on equal footing with other capital investment options. The guide is not intended to be rigidly prescriptive; firms should continue to design investment analysis practices to fit their internal operating procedures and resources. Nonetheless, adopting even a portion of the guidelines described in this guide will tend to move capital budgeting in the direction of more rational treatment of prevention investments. Better yet, adopting the full package of TCA elements promises advantages greater than the sum of its parts, even if some elements -- such as treatment of liability and corporate image benefits -- are handled in qualitative fashion. This may occur, for example, when savings in operating costs often omitted from a conventional analysis (e.g., raw materials, waste handling, waste disposal, regulatory compliance) escalate rapidly beginning five or more years after the initial investment. By itself, an expanded cost inventory -- a key element of TCA -- will capture such savings during the initial five year period, thereby enhancing the profitability of the investment. In the same vein, extending the time horizon without expanding the inventory also will have a positive effect on profitability. However, by capturing large savings in the out-years, the interactive effect of incorporating **both** an expanded cost inventory **and** an extended time horizon is likely to push profitability indicators up higher than would each element applied separately and then summed. Finally, to take full advantage of TCA will require involvement of staff from throughout the company, including but not limited to, research & development, design, production, environmental, materials management, and financial personnel.

The Department's rules do not make *TCA* ***a mandatory practice, but they*** *do* ***require that*** *two of* ***the*** *four* ***elements*** *of TCA (which* ***are discussed in derail below) be performed: cost inventory*** *of* ***existing nonproduct output, and proposed pollution prevention options and*** *cost* ***allocation at the source or process*** *level* ***The remaining elements, time horizon*** *for* ***profitability analysis and profitability analysis, are recommended as important items for consideration but are not mandated.***

For companies wishing further information on TCA, the following NJDEP report is recommended:

Alternative Approaches to the Financial Evaluation of Industrial Pollution Prevention Investments, prepared for New Jersey Department of Environmental Protection by Tellus Institute, November 1991.

TCA software to assist in conducting financial analyses is also available, Please contact the Office of Pollution Prevention and Permit Coordination for more information.

TERMINOLOGY

The following definitions are commonly used in project financial evaluation. Many of these are referenced in the text which follows.

Annual Cash Flow - For an investment, the sum of cash inflows and outflows for a given year (see Cash Flow).

Break-Even-Point - The point at which cumulative incremental annual cash flows of an investment equal zero, i.e. the investment begins showing a positive cash flow. The Break-Even-Point occurs at the end of a project's investment Pay Back Period (see below).

Capital Budget- A statement of the firm's planned investments, generally based upon estimates of future sales, costs, production needs, research and development (R&D) needs, and availability of capital.

Cash Flow (from an investment) - The dollars coming to the firm (cash inflow) or paid out by the firm (cash outflow) resulting from a given investment.

Cost Accounting System - The internal procedure used to track and allocate production costs and revenues to a product or process. Defines specific cost/profit centers, overhead versus allocated costs, degree of cost disaggregation for specific processes and/or products.

Cost Allocation - A process within an internal cost accounting system of assigning costs and revenues to cost and profit centers for purposes of product pricing, cost tracking, and performance evaluation.

Discount Rate - The discount rate is either the interest rate at which money can be invested or borrowed. In profitability analysis, the discount rate is used in Net Present Value (NPV) calculations to express the value of a future expenditure in the present year. The discount rate is expressed as a percentage.

Discounted Cash Flow Rate of Return (DCRR) - See Internal Rate of Return.

Financial Accounting - The process that culminates in the preparation of financial reports for the enterprise as a whole, for use by parties both internal and external to the enterprise to evaluate current financial conditions and prospects.

Financial Reporting - Statements required by pronouncement, regulatory rule or customs including: corporate annual reports, prospectuses, annual reports filed with government agencies, descriptions of an enterprise's social or environmental impact.

Financial Statements - The principal means through which financial information is communicated to those outside an enterprise. Statements include the balance sheet, income statement, and statement of cash flows.

Full Cost Accounting - A method of managerial accounting which accounts for both the direct and indirect costs of an item. Full cost accounting uses historical data to assign all costs to a process, product or product line, most often for purposes of pricing.

Hurdle Rate - An internally defined threshold, or minimum acceptable level, set by an enterprise in relation to a given profitability indicator required for project approval, e.g. 15% Internal Rate of Return, two-year payback.

Incremental Cash Flow (of an investment) - The cash flow of an alternative practice (e.g. after a pollution prevention investment has been implemented) relative to the current practice. Incremental cash flow is calculated by taking the difference between the cash flow for the current practice and the alternative practice.

Internal Rate of Return (IRR) - The discount rate at which the net savings (or NPV) on a project are equal to zero. It measures at the balance point between the current outflow and inflows over time, and provides a basis for comparing the desirability of allocating funds to one versus another project. The IRR of an investment is compared to a company's desired rate of return.

ManagerialAccounting- The process of identification, measurement, accumulation, analysis, preparation, interpretation, and communication of financial information used by management to plan, evaluate, and control all activities within an organization to ensure appropriate use, and accountability for its resources. Capital budgeting is one component of managerial accounting.

Measure of Profitability - An index that helps to answer the question: are the future savings/revenue of a project likely to justify a current expenditure? Synonyms: "decision rule", or "financial index", or "profitability index", or "capital budgeting technique". Includes: NPV, IRR, payback, ROI.

Net Present Value (NPV) - The present value of the future cash flows of an investment less the investment's initial cost. An investment is profitable if the NPV of the cash flow it generates in the future exceeds its cost, that is, if the NPV is positive.

Payback Period - The amount of time required for an investment to generate enough cash flow to just cover the initial capital outlay for that investment.

Project Financial Analysis - Costing of a project's costs and savings, and then calculating the cash flow and/or profitability indicators for a project.

Project Justification Process - A general term for the procedures used by a firm to secure approval for a project.

Project Justification - A document prepared in the project justification process comprising a written description of the project, a project financial analysis, and a discussion of benefits and risks which are not quantified in the financial analysis. Often referred to as an Appropriations Request.

Return on Investment (ROI) - A measurement of investment performance, calculated as the ratio of annual net income (minus depreciation) over the initial investment amount.

Total Cost Assessment (TCA) - A comprehensive financial analysis of the costs and savings of a Pollution prevention project. TCA is a form of project financial analysis which accounts for the less tangible, indirect, and longer term costs and savings typical of prevention investments, and allocates such costs and savings to specific processes and product lines. The term Total Cost *Assessment* is used in recognition of the mix of quantitative and qualitative aspects of project evaluation, as well as the internal processes by which a company rethinks the nature and benefits of prevention investments. In general, a TCA approach makes adjustments to traditional project financial analysis by the use of four elements:

a) cost inventory: *inclusion in a project financial analysis of direct and indirect costs, tangible and less tangible, short and long term costs, in either quantitative or qualitative form;*

b) cost allocation: *internal allocation of environmental costs to product lines or processes through full cost accounting or similar procedures,*

c) time horizon: *evaluation of project costs and savings over a time horizon of 5-15 years;*

d) profitability. *application of profitability indicators which capture the full range of costs and savings of the project, e.g. NPV and IRR.*

ELEMENTS OF TCA

Four elements comprise the financial analysis of any capital investment: *cost inventory, cost allocation, time horizon for Profitability analysis, and profitability indicators.* These elements are conventional to any investment analysis, pollution prevention or otherwise. They also are closely linked in the sense that changing one is likely to lead to changes in the bottom-line for the project.

Although inventory, allocation, time horizon, and profitability measures apply to any project, pollution prevention investments have certain features which make a TCA approach particularly relevant. These include the long-term and uncertain nature of many costs and savings, and the critical role of current and future regulations in shaping project economics. Taken together, these features create the need for project analysis which differs from conventional practice. While managers must retain discretion in determining their company's approach to assessing project profitability, the guidance provided here is intended to assist in overcoming certain biases which penalize prevention investments vis a vis “end-of-pipe” or non-environmental investments which compete for limited capital resources.

Cost Inventory. Identifying all costs and savings associated with a pollution prevention investment is the first element of TCA. As in any industrial investment, such costs may be classified as one-time, capital costs incurred at the outset of the project, and recurrent, normally annual, operating costs which are incurred repeatedly over the life of the project. However, unlike most investments, environmental projects are associated with certain costs, savings and revenues, which are relatively uncertain in content (what are they?), magnitude (how large will they be?), and timing (at what point in the project life span will they occur?). This uncertainty stems from two conditions: (1) the complexity of assessing risks associated with the use of, transport of, and exposure to hazardous substances- and (2) changing regulatory and judicial decisions that result in upward and downward shifts in project costs.

Some costs are straightforward, though not necessarily routinely articulated by managers; for example, monitoring, training and preparing manifest forms for the off-site shipment of hazardous waste. Others, however, fall into the category of contingent costs, those which **may** materialize if certain events occur: exceeding a permitted emissions limit; an off-site spin during transport of waste; a leak in a lined and permitted hazardous waste landfill; disposal of wastes at an unpermitted site; or an acute event leading to an environmental release in an abutting neighborhood. While no firm expects such events, prevention investments which ***eliminate*** the risk altogether should be given credit for doing so in the context of project financial analysis. Quantifying such benefits in the form of avoided penalties, fines, or legal settlements is preferable. Qualitative treatment in an Appropriation Requests is a second option.

The uncertainty associated with estimating liability costs is also characteristic of many benefits of pollution prevention investments related to market performance of the firm. Investments that create advantages through enhanced corporate or product image are no less real than cost reduction advantages of lower waste disposal costs. Thus, for example, paper products made without chlorine bleaching and coated papers made without solvents or heavy metals may translate into measurable, though uncertain, market advantages created either by regulatory mandates or consumer preferences for “green products”. In these instances, projects may assume "a market-expansion" character and the revenue streams they are expected to generate become part of the project financial analysis as a revenue entry under operating costs.

In sum, while conventional project financial analysis practices generally include only the most obvious, direct, and tangible capital and operating items, TCA expands the inventory to encompass a broader range of costs, savings, and revenues. These may be classified as follows, with illustrations for each type of cost:

Direct Costs

Capital expenditures for the project

- buildings
- equipment
- utility connections
- equipment installation
- project engineering

Operation and maintenance expenses/revenues for both the project and current practice

- Operation of pollution control equipment for regulated chemicals
- Waste disposal (handling, hauling, disposal)
- Environmental insurance (acute events and gradual impairment)
- Waste Storage
- Tracking
- Notification
- Reporting
- Monitoring
- Testing

Cost Allocation. Allocation procedures assign costs to a product or process line. Such allocations in medium and large-size firms are typically the responsibility of financial and production staff,

- Recordkeeping
- Planning/modeling studies
- Training
- Inspections
- Manifesting
- Labeling
- Preparedness equipment and maintenance
- Medical surveillance
- Special waste taxes
- Revenue from sale of recovered product

Direct costs are costs that managers are very familiar with, but they may not be allocated rationally, and some of them may exist, but are not measured.

Liability Costs

penalties and fines

personal injury

private property damage

damages to natural resources

By definition, a pollution prevention project reduces or eliminates potential liability costs by reducing or eliminating the source of the hazard from the production process. However, liability costs are by nature difficult to estimate and equally difficult to locate at a point in the lifecycle of a project. By including estimates of future liability directly into a financial evaluation, the analyst introduces considerable uncertainty that top management may be unaccustomed, or unwilling, to accept as part of a project justification.

Firms currently use several alternative approaches to considering liability costs in project analysis. For example, in the narrative accompanying a profitability calculation, a firm may include a calculated estimate of liability reduction, cite a penalty or settlement that may be avoided (based on a claim against a similar company using a similar process), or qualitatively indicate without attaching dollar value the reduced liability risk associated with the pollution prevention project. Alternatively, some firms have chosen to loosen the financial performance requirements (e.g., raising the required payback period from 3 to 4 years, or lowering the required internal rate of return from 15 to 10 percent) of the project to account for liability reductions.

Revenues and Less Tangible Benefits:

increased revenue from enhanced product quality

increased revenue from enhanced company and product image

reduced health maintenance costs from improved employee health increased productivity

from improved employee relations

Some pollution prevention projects may increase profits by increasing revenues rather than by decreasing costs.

and are intended to properly debit and credit production processes/units, thereby providing the foundation for real-cost pricing based on "full-cost accounting": Proper allocation is indispensable to reliable investment profitability analysis. When costs are improperly allocated either by lumping into overhead accounts and/or by assigning them incorrectly to production processes, profitability analyses cannot proceed on a rational basis.

For purposes of investment analysis, the ideal cost accounting system has two primary features. First, the system should allocate all costs to the processes responsible for their creation. This is a perennial challenge to financial officers and cost accountants who oversee the placement of costs into either overhead or, alternatively, product or process accounts. Waste disposal costs, for example, are often placed in overhead accounts, while a more rigorous approach would assign such costs to an discrete operating unit or process in the firm's production system. In this fashion, the correct "signal" is sent to operations managers in exactly the same way consumers charged per bag or per pound of garbage pickup are induced to change their garbage generating practices. Under these conditions, managers are put on notice that their product or process is responsible for waste management costs and that elimination of such waste will enhance their unit's financial performance.

Second, costs should be allocated in a manner that is reflective of the way in which costs are actually incurred. Some firms, for example, allocate waste disposal costs across operating centers-administrative, research and development, and manufacturing–on the basis of floor space, rather than–on the quantity and type of waste generated by each. This impedes a rigorous estimation of the financial benefits of reduced waste generation by uncoupling points of generation from points of reduction.

Careful allocation requires commitment, time and financial resources, especially in large and complex production process. However, the start up costs of putting a revised cost allocation system in place can be spread over many future capital budgeting cycles and project evaluations. Thus, it should be viewed as an investment which will yield rich returns in terms of selecting the more profitable projects among competing options.

Time Horizon. Time horizons of five years or more enable the financial analysis to capture costs, savings, and revenues which occur well after the initial investment. This extends beyond the 2-5 Year time horizon used by many firms to evaluate investment profitability. The longer time horizon, preferably 10-15 years, is particularly critical to capturing out-year liability, recurrent savings due to waste avoidance, and revenue growth owing to market development of environmentally-friendly products. Without such a time frame, the financial analysis runs the risk of failing to capture the very benefits for which the pollution prevention investment is originally targeted. Of course, the readiness of firms to extend their investment analysis to this longer time horizon depends on numerous factors, including size, capital availability, and competition from alternative investments in the same or higher priority. Notwithstanding these limitations, a longer time horizon should be applied at a minimum to compare near and longer returns to a potential pollution prevention investment.

Financial Indicators. Financial indicators for pollution prevention projects should meet two criteria: 1) a capacity to incorporate all cash flows (positive and negative) over the life of the project; and 2) a capacity to integrate the time value of money through appropriate discounting of future cash flows. Indicators which meet these criteria are best equipped to capture the broadest range of costs, savings, and revenues, many of which may occur many years after the initial investment.

The Net Present Value (NPV), Internal Rate of Return, and Profitability Indicator (PI) methods meet both these criteria. Where projects are competing against each other for limited resources, the NPV method is preferred because there are certain conditions under which the

IRR or PI methods fail to identify the most advantageous project. The payback method, commonly used by small companies, does not meet either of these criteria. NPV, IRR, PI, and payback are introduced here in their simplest form:

Net Present Value (NPV) - Under the NPV method, the value of each cash flow, both inflows and outflows, is calculated and discounted to express current and future dollars in a single "present" value. The sum of the discounted cash flows is the project's NPV. A positive NPV means a project is worth pursuing; a negative NPV indicates it should be rejected or revisited to determine if all costs and savings are properly accounted for. If the availability of capital is constrained (as it usually is) or several projects are competing with one another, other things being equal, the project or combination of projects with the highest positive NPV should be chosen. The NPV method, particularly as applied to long-term projects with significant cash flows in later years, is very sensitive to the level of the discount rate. Thus, for a project with most of its cash flows in the early years, its NPV will not be lowered much by increasing the discount rate. On the other hand, the NPV of a project whose cash flows come later will be substantially lowered, rendering the project a much less attractive investment opportunity.

Internal Rate of Return (IRR) - The IRR method calculates the discount rate that equates the present value of a project's expected cash inflows to the present value of the project's expected costs. Thus, the basic formula to, calculate the IRR is the same as that for the NPV; for the IRR, the NPV is set to zero and the discount rate is calculated; for the NPV, the discount rate is known and the NPV is calculated. A project is worth pursuing when the calculated IRR is greater than the cost of capital to finance the project. Where several projects are vying for limited resources, all else being equal, the project with the highest IRR should be pursued.

Profitability Index (PI) - The profitability index is also known as the *benefitl cost ratio.* The PI is simply the present value of benefits (cash inflows) divided by the present value of costs (cash outflows), and shows the relative profitability of a project or present value benefits per dollar of costs. Projects with profitability indices greater than 1.0 should be pursued, and the higher the PI, the more attractive the project.

Payback - Payback is the simplest of the techniques for evaluating capital project investments. It provides a "quick-and-dirty" or "back-of-the-envelope" appraisal. While the payback calculation may suffice for a preliminary assessment, it should not be relied upon as the sole method for project evaluation. The payback period is the expected number of years required to recover the original project investment. The payback period can be calculated before or after taxes, and serves as a type of "breakeven" calculation in that if cash flows come in at the expected rate until the payback year, then the project will break even from a dollar standpoint. However, the regular payback does not account for the cost of capital, meaning that the cost of the debt and equity used in the investment is not reflected in the cash flows or the calculation. Another major drawback of the payback method is that it does not take account of cash flows beyond the payback year. The payback period does, however, provide an estimate of how long funds will be tied up in a project and is therefore often used as an indicator of project liquidity.

CONDUCTING THE ANALYSIS

The following steps comprise the actual project TCA. *P21FINANC,, a* spreadsheet software and User's Manual package for conducting profitability analysis based on Excel 3.0 software, is available from the Office of Pollution Prevention. if you do not own or have access to a computer, the spreadsheets can be completed manually as well. The Office of Pollution Prevention can assist you in preparing them.

Step 1. Assemble capital cost data for the proposed project. Enter all identifiable capital cost data for the pollution prevention project into a worksheet such that depicted in Table 1. Eleven cost categories are suggested, beginning with "purchased equipment" and ending with "salvage value". These should cover both direct and indirect capital costs, that is, those linked directly to the project, and those which result from changes in equipment, materials and other items in other components of the production process which are attributable to the pollution prevention project (e.g., additional wastewater treatment required to handle aqueous discharge after shifting from a solvent-based to an aqueous-based coating operation). In cases where a second alternative to current practice is identified through an initial screening, capital costs may be assembled for a later comparison of this second option against both current practice and the first investment option.

Step 2. Assemble operational cost data for the current and proposed project., Enter all identifiable operational cost data for both the (a) current process and (b) alternative process into a worksheet (Table 2). Seven cost categories are identified, ranging from raw materials/supplies to insurance. In

Step 3. Summarize capital and operating costs, and select financial assumptions. The **siimm** ation of capital plus operating cost difference between the current and alternative practice are the basic inputs into the financial analysis (Table 3). In addition, the following standard financial analysis input data is required: percent equity, percent debt, interest rate on debt, debt repayment years, depreciation period, income tax rate, escalation rate and discount rate. liability also appears in Table 3, requiring the analyst to provide the year expected and the amount which may be incurred. These data, of course, cannot be ascertained with complete certainty. Instead, they serve as "place- holders" for estimates developed elsewhere. Data entered here should be the end product of an off-line calculation of liability reflecting ***changes*** (current versus alternative practice resulting from the pollution prevention investment) in the nature and exposure of the firm to property or personal injury.

Step 4. Perform profitability analysis: Three indicators **summarize** the results of the profitability analysis (Table 4, bottom): NPV, IRR, and payback, calculated for both IO year and IS year horizons. Five year horizons are also available. These indicators flow from the revenue, operational cost/savings over the designated time horizon, together with the capital cost estimates.

APPENDIX G

Glossary

Consume - to change or alter the molecular structure of a hazardous substance within a production process.

Co-product - one or more incidental result(s) of a production process that is not a primary product of the production process and that is sold in trade in the channels of commerce to the general public in the same form as it is produced, for any purpose except the purpose of energy recovery.

DEQ- 1 14 - the reporting form issued by the Department which is used to fulfill the Environmental Release and Pollution Prevention reporting requirements of the environmental survey, Part U, pursuant to N.J.S.A. 34:SA-1 et seq.

Hazardous substance - any substance on the list established by the United States Environmental Protection Agency for reporting pursuant to 42 U.S.C. 11023, and any other substance which the Department defines as a hazardous substance for the purposes of the Act pursuant to N.J.A.C. 7:IK-3.5.

Hazardous waste - any solid waste defined as hazardous waste by the Department pursuant to N.J.S.A. 13:IE- I et seq.

Industrial facility - any facility having a Standard Industrial Classification, as designated in the Standard Industrial Classification Manual prepared by the Federal Office of Management and Budget, within the Major Group Numbers, Group Numbers, or Industry Numbers listed in N.J.S.A. 34.:SA-3 and which is subject to the regulatory requirements of the Solid Waste Management Act, N.J.S.A. 13:IE-1 et seq., the Water Pollution Control Act, N.J.S.A. 58:IOA-1 et seq., or the Air Pollution Control Act, N.J.S.A. 26:2C-1 et seq.

In-process recycling - returning a hazardous substance to a production process using dedicated equipment ,that is directly connected to and physically integrated with a production process or production processes and is operated in a manner that reduces the generation of nonproduct output or the multi-media release of hazardous substances.

Intermediate product - one or more desired result(s) of a production process that is made into a product in a subsequent production process at the same industrial facility, without the need for pollution treatment prior to its being made into a product. An intermediate product is not considered nonproduct output.

Manufacture z to produce, prepare, import, or compound a hazardous substance.

Multimedia release - the release of a hazardous substance to any environmental medium, or any combination of media, including the air, water or land, and includes any release into workplaces.

Nonproduct output (NPO) - all hazardous substances or hazardous wastes that are generated prior to storage, out-of- process recycling, treatment, control or disposal, and that are not intended for use as a product. Nonproduct output includes fugitive releases.

Pollution prevention - changes in production technologies, raw materials or products, that result in the reduction of the demand for hazardous substances per unit of product manufactured and the creation of hazardous products or nonproduct outputs; or changes in the use of raw materials, products, or production technologies that result in the reduction of the input use of hazardous substances and the creation of hazardous by-products or destructive results; or on-site facility changes in production processes, products, or the use of substitute raw materials that result in the reduction of the amount of hazardous waste generated and disposed of on the land of hazardous substances discharged into the air or water per unit of product manufactured prior to treatment and that reduce or eliminate, without shifting, the risks that the use of hazardous substances at an industrial facility pose to employees, consumers, and the environment and human health "Pollution prevention" includes, but is not limited to, raw material substitution, product reformulation production process redesign or modification, in-process recycling, and improved operation maintenance of production process equipment. "Pollution prevention' does not include any action or change entailing a substitution of one hazardous substance, product or nonproduct output for another that results in the creation of substantial new risk, and does not include treatment, increased pollution control, out-of-process recycling, or incineration.

Pollution Prevention Plan - -a plan required to be prepared by an industrial facility pursuant to N.J.S.A. 13:ID-41 and 42 and N.J.A.C. 7:IK-3 and 4.

Product - one or more desired result(s) of a production process that is used as a commodity in trade in the channels of commerce by the general public in the same form as it is produced. Products include intermediate products transferred to a separate industrial facility owned or operated by the same owner or operator.

Production process - a process, line, method, activity or technique-, or a series or combination of processes, lines, methods or techniques used to produce a product or reach a planned result.

Raw Material Substitution Certification - a list of individual hazardous substances used in specific targeted production process at a priority industrial facility, for which the owner or operator of the industrial facility has determined through preparation and completion of a Pollution Prevention Plan and has certified to the Department that it is **not** technically or economically feasible to reduce "the input-use" of the hazardous substance below current levels by replacing the hazardous substance with a different raw material in the specific production process.

Source - a point or location in a production process at which a nonproduct output is generated or released, provided, however, that similar, related or identical kinds of sources may be considered a single source for the purposes of the Act pursuant to the criteria at N.J.A.C. 7: 1 K-4.2.

TRI list - the Toxic Release Inventory (TRI) list established by the United States Environmental Protection Agency for reporting pursuant to 42 U.S.C. 11023.

Unit of product - a unit used to measure the total quantity of product(s), co- product(s) and/or intermediate product(s) produced by a production process, and which is not changed by an industrial facility from year to year.