

Planning for Profits

A Self-Assessment Guide
to Identifying Profit Opportunities
Through Pollution Prevention



The Florida Pollution Prevention Roundtable (FLPPR), in partnership with the Florida Department of Environmental Protection's (DEP) Pollution Prevention (P2) Program, has compiled the following self-assessment guide to help identify ways that your business can profit while protecting the environment.

The Florida Pollution Prevention Roundtable is a non-profit organization whose mission is to identify, coordinate and promote voluntary P2 activities and resources throughout the State of Florida. Membership is comprised of environmental professionals in industry, local and state government, and state universities.

The P2 Program offers non-regulatory, technical assistance to Florida's industries, businesses, and government agencies. Technical assistance provided by DEP staff will help businesses increase the efficiency of operations, protect worker health and become more profitable.

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Planning For Profits

How can this guide help me?

\$avings. If you knew there were \$100 bills hidden in your facility, would you take a good look around? Of course you would! By taking a critical look at your facility's operations, you can find ways to save money and improve efficiency.

How can you save money and improve efficiency? By reducing waste. But what is waste? Waste means any material, energy or other resource not incorporated into a product. These resources may be lost in the form of air emissions, water discharges, solid and hazardous waste or heat.

Companies can increase the efficiency of their operations by reducing waste. You are losing money through sewer pipes, air vents and waste shipments. The trick is to find the cash hidden in your facility before it has a chance to escape.

This guide can help your company reduce waste generation at its source - before it becomes a pollutant or lost resource. That is what **Pollution Prevention** is all about. Pollution prevention may be as simple as improving preventive maintenance and fixing leaks. It may also involve upgrading to an energy-saving technology, substituting non-toxic for toxic materials or making a fundamental change in product composition.

If you want to increase profits and reduce your company's impact on the environment, this guide is for you.

How do I use this guide?

This guide takes you step by step through the process of pollution prevention planning. First, use the manual as a framework for analyzing operations to understand where and how your company generates wastes. In doing so, you will be able to define the hidden costs these wastes impose on your company. Next, try some of the ideas presented in the guide to find effective pollution prevention alternatives that will improve operations and save money. Then, evaluate the performance of the changes you make using methods illustrated in the guide. Finally, consider making pollution prevention planning a part of your overall business strategy.

Many of the tools presented allow you to create charts, diagrams and other graphics that can serve as effective visuals to discuss environmental issues with employees or management. Because this guide is a generalized overview of pollution prevention planning, you can to adapt the approaches to your facility's needs.



Throughout this guide, shaded boxes will refer you to Appendices containing worksheets and other sources of helpful information.

Why Should I Use This Guide?

Have you had any minor compliance issues lately? Are waste disposal costs increasing or eating into your profits? Even if your company has no compliance issues, approaching potential environmental challenges in a more proactive way makes good business sense. You need to anticipate potential problems, instead of just reacting as they arise. This guide provides a systematic way to do this.

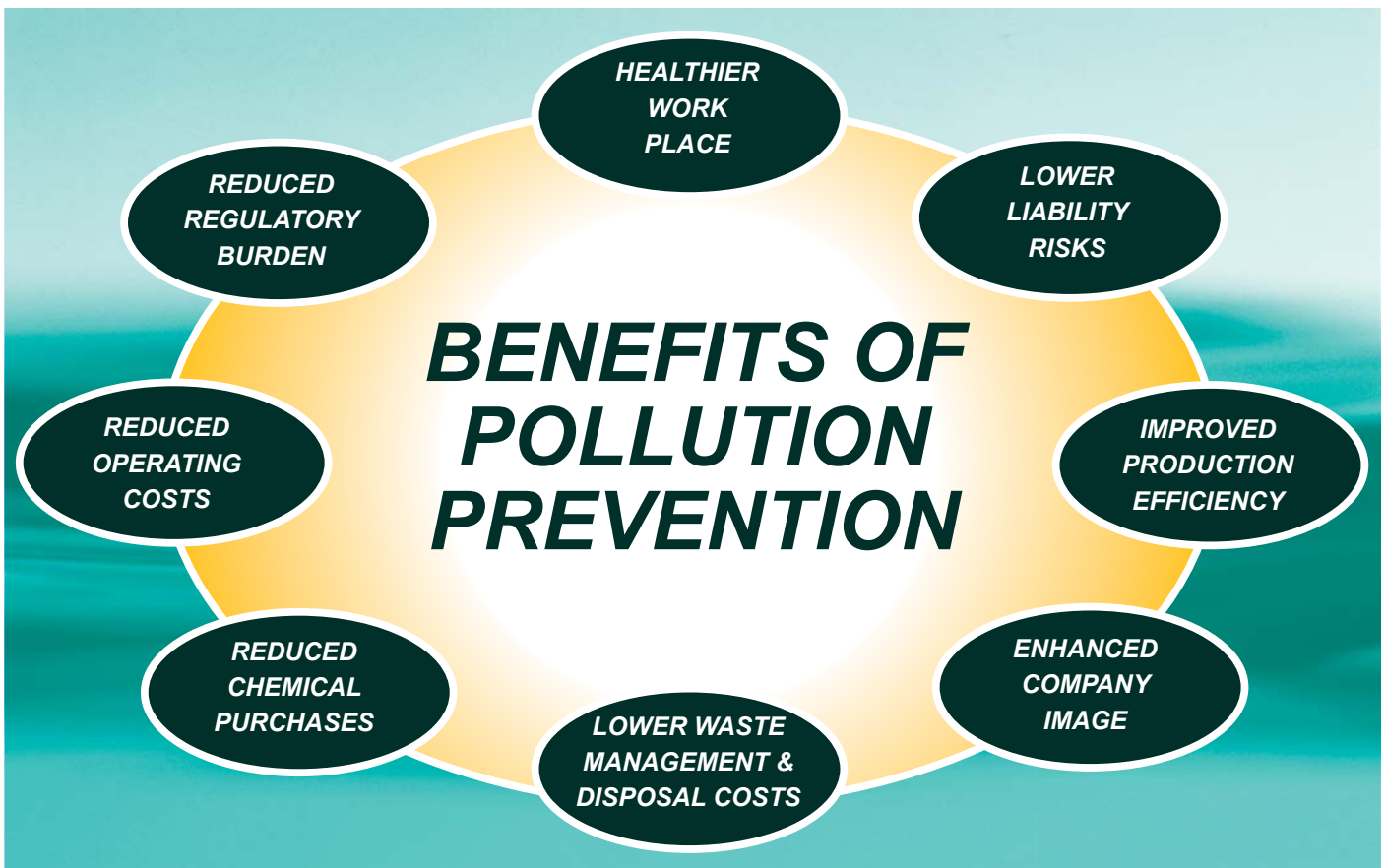
Maybe you do not know where to start or how to go about tackling this challenge. To get some ideas, you can call the Florida DEP's P2 Program or other resources listed in Appendix A. They will help you work through the pollution prevention planning steps found in this guide.



Need a Hand? If you need help with any of the pollution prevention planning steps, see Appendix A. It contains a list of state and national technical assistance resources.

Turn the page to see an overview of the pollution prevention planning process... otherwise known as the Six Steps to Savings. Each section that follows corresponds to a step in the planning process.

A Few More Reasons to Pursue Pollution Prevention



Pollution Prevention Planning

An Overview

six steps

1

Get Organized

Make sure **MANAGEMENT** supports the effort to investigate pollution prevention opportunities and make changes.

Form a **PLANNING TEAM**. Individuals from different departments of the plant can play roles in each step of the planning process.

Let everybody know what is going on. **SEEK INPUT** from personnel at all levels. They are your most valuable asset.

2

Analyze Processes

Take a critical **LOOK** at each step of your production process, from purchasing raw materials to shipping the finished product.

Pinpoint what materials are used and where wastes are generated.

Figure out the **TRUE COSTS** of waste generation, including disposal and regulatory costs.

These costs, along with other factors, will help you prioritize losses and target your pollution prevention efforts.

3

Identify Alternatives

The first step to finding effective ways to reduce material losses is to get at the **ROOT CAUSE** of the problem. What factors are responsible for creating the waste? Poor equipment maintenance? Type of raw materials used? Scheduling?

Once you have figured this out, it is time to **BE CREATIVE**. List as many alternatives as possible for reducing the loss.

Use group brainstorming, employee incentives or outside assistance to generate lots of ideas.



Refer to Appendix B for Details on Where to Look for Process Information.

Pollution Prevention Planning

An Overview

to savings

4

Evaluate Alternatives

You may be able to implement the simple, inexpensive projects right away without further study.

For more complex alternatives, determine which are feasible based on three major criteria:

- 1. Effectiveness**
- 2. Implementability**
- 3. Cost**

Select alternatives for implementation using one or more decision-making tools, such as Pareto charts, Grids or Cost/Benefit Analysis.

5

Implement Projects

SCHEDULE projects while keeping in mind resource, time and financial constraints.

ASSIGN responsibilities and establish a detailed timeline.

TALK to the workers who will be affected by the changes you'll make. Include them in the implementation phase.

Stay in touch after implementation, request employee **feedback** and work out any issues or problems.

6

Measure Progress

Track waste generation, material usage and cost savings as a result of the changes you have made.

Use a method of measuring pollution prevention that takes into account variations in production level.

Document results.

Publicize and celebrate your successes!

Now, **Go back to step 2.** Keep the momentum going. There is more work to do!

Get The Boss on Board

Management can demonstrate a commitment to pollution prevention by launching a program with slogans, logos and T-shirts... or by distributing a simple memo. Either way, it is the meaningful support of management that is critical to successful pollution prevention.

Management can show they are serious about examining and, if appropriate, modifying products or operations by:

- Establishing a pollution prevention policy;
- Allocating time and money to pollution prevention planning and implementation;
- Assigning responsibilities for tracking progress;
- Incorporating pollution prevention awareness into existing training programs for quality, compliance or health and safety; and
- Recognizing achievements through awards or bonuses.

Make It a Team Effort

Pollution prevention planning requires a variety of skills and access to different types of information. All employees have a role to play at some point in the process – gathering information, suggesting projects, evaluating alternatives or implementing projects. Establish a team to organize these planning activities. By going through the planning process, employees will gain a better understanding of the business and see the benefits of pollution prevention planning.

Who Should Be On The Planning Team?

The planning team should be made up of supervisors and workers from different parts of the company to provide a mix of insights, perspectives and expertise.

Employees who are familiar with some of the following issues will be helpful:

- Purchasing/finance/accounting.
- Facility and production processes.
- Waste management operations.
- Quality control requirements.
- Environmental regulations.

What Size Should the Team Be?

The size of your planning team depends on the size of your company. In smaller companies, employees often have multiple responsibilities, and owners are also workers, so the team may consist of only two or three people. In larger companies, the team might include representatives from each department.

2

Analyze Your Processes

Understanding waste generation and its cost to your business is crucial to finding ways to improve efficiency and save money.

This second step in the planning process involves a systematic assessment of your current operations to see where you should direct your efforts. To analyze your operations:

- 1** *Map out the steps in each process.*
- 2** *Determine the AMOUNT of raw materials used and wastes generated.*
- 3** *Determine the FULL COST of raw material use and waste generation.*
- 4** *Tour your facility and ask questions.*
- 5** *Target processes for pollution prevention.*

After step 5, you will be ready to identify alternatives for reducing wastes in the targeted processes.

1. Map Out the Steps In Each Process

Draw a diagram showing the inputs and outputs of each step in the production process, from purchasing raw materials to shipping finished products. Inputs include raw materials, water and energy. Outputs are products and waste.

Wastes are any losses, including spills, leaks, evaporative losses, cooling water, cleaning rags, unusable raw materials, sludge, spent chemicals, heat loss and defective products – anything not going into a useful product or by product.

This type of diagram, called a **PROCESS MAP**, is a useful tool because it:

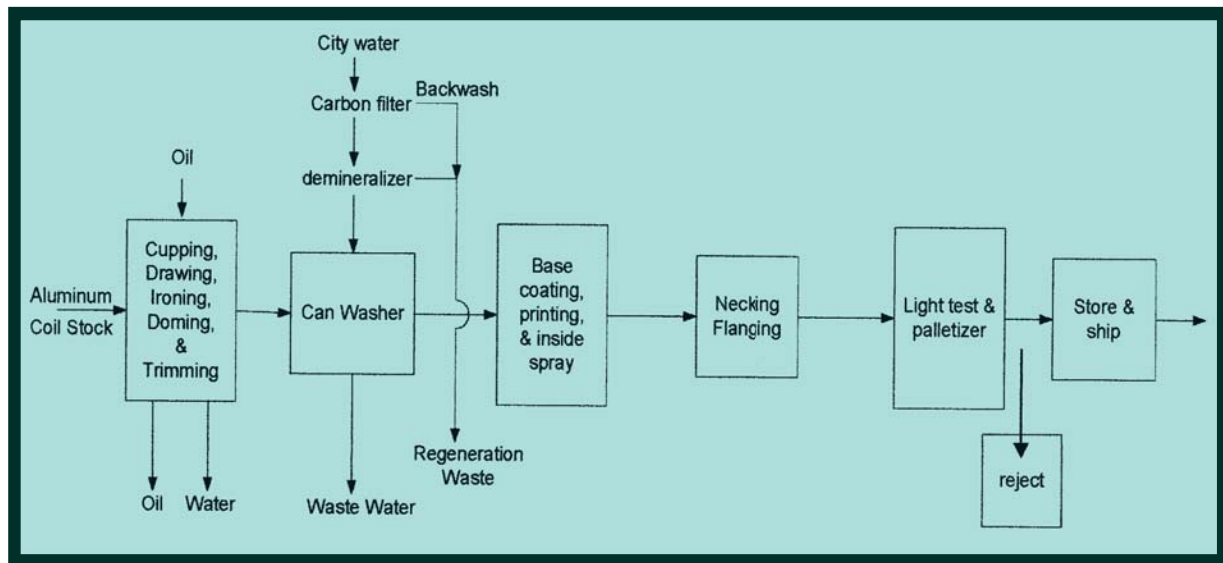
- Offers a visual image showing the relationship between different parts of the process.
- Provides the planning team with a common understanding of day-to-day operations.
- Pinpoints where your business generates waste.

Remember to show steps in your operation that are not directly part of the production process. These activities include intermittent operations (e.g., cleaning, tank dumps, oil/fluid changes) and support functions (e.g., chemical storage, labs, wastewater treatment, boilers). Many cost-saving pollution prevention opportunities can be discovered here.



Visit <http://teexcit.tamu.edu/tca/> for more information on a training course as well as freeware for P2 cost accounting.

Example Process Map For Can Production



Example Process Description For Can Production

Aluminum stock is uncoiled and lubricated with a synthetic oil while being cut and cupped. The cups are then conveyed to a body maker that forms the cans by ironing and drawing. A synthetic oil is used for coolant in this process (4 percent oil to water solution). Cans are then sent to be trimmed to specified lengths. After trimming, the cans are washed by a six stage system.

After washing, the cans are then dried with hot air in a drying oven and conveyed to base coating and painting. They are transferred to pin chains for drying and a bottom coat of varnish. They are dried in another oven and then conveyed to an inside spray machine where a coating is applied to the inside of the cans, and conveyed to another drying oven. A coat of wax is then applied to lubricate for flanging in the necker machine. After flanging, they go through the BPR (Bottom Profile Reform) machine that forms the can bottoms.

What Should Be Included in the Process Map?

Process maps should include the following information:

- All inputs and outputs of each production process.
- In-plant recycling systems.
- Material storage and handling systems.
- Wastewater treatment or pre-treatment systems and points of discharge.
- Air emissions (stack or fugitive) and any associated control equipment.
- Final repository (landfill, fuel blending, off-site disposal or recycle).

2. Determine the Amounts of Raw Materials Used and Wastes Generated

For each process, determine the annual amount of raw materials used and wastes generated. The reason for this step is to develop baseline data on your current operations. This information, together with cost calculations, will help you:

- Prioritize areas that need the most immediate attention;
- Evaluate proposed pollution prevention alternatives; and
- Measure success after you have implemented a project.



Where To Look For Process Information:

Most of the necessary information may already be in the facility. Your purchasing department will probably have the information you need on annual purchase amounts. Look for waste information on manifests, permits, and environmental reports.

See Appendix B for more hints on Where to Look for Process Information.

3. Determine the Full Cost of Raw Material Use and Waste Generation

First, figure out the raw materials cost for each process on an annual basis. Next, calculate what it costs to treat and dispose of each waste in the process. Finally, identify the hidden costs associated with compliance activities.

What Are the Hidden Costs?

The **FULL COST** of waste generation includes more than just treatment and disposal costs. You spend a lot of money complying with regulations for waste your business generates. These environmental expenses are often referred to as hidden costs because they are usually assigned to overhead and not to the processes responsible for them. Some of these costs are tough to track down, so it is OK to use estimates. Costs typically hidden in overhead include activities such as:

- Monitoring.
- Labeling.
- Insurance.
- Waste storage.
- Manifesting.
- Inspections.
- Reporting.
- Record keeping.
- Permits and fees.
- Pretreatment equipment.
- Safety training.
- Protective equipment.

As business expands, regulated material usage and waste generation often increase. These are just some of the hidden costs that a company could incur:

- Increased hazardous waste inspections, personnel training, and reporting requirements;
- Increased preparedness, prevention, and emergency posting requirements;
- Hazardous waste disposal fees; and
- Air permit preparation, reporting and maintenance.

Waste disposal costs are often just a fraction of the full cost of generating waste. Many pollution prevention projects will not appear to be justified if a company considers only the waste disposal costs as the likely savings.

4. Tour Your Facility and Ask Questions

Walk through the facility to complete and verify your process maps. Talk to the employees along the way to fill any gaps in information on material usage or waste generation. Doing so may be especially helpful for learning about intermittent and unplanned activities such as spills, clean-ups and rinses. Staff responsible for monitoring, manifesting and other compliance activities will be able to help estimate hidden costs.

Why Questions are Important

Let the employees know why the team is conducting the facility assessment and ask for their input. Ask questions about why things are done the way they are, even if it seems obvious. You may be surprised by the answer. Here are a few questions to get the team started:

1. Why is the process or chemical used?
2. What are the consequences of using this chemical or process
 - On costs?
 - On worker health and safety?
 - On the environment?
 - On compliance requirements?
3. How can we make the process better?
 - What if we simply did not use this chemical?
 - How can we use it more efficiently?
 - Can we substitute a safer chemical?



Make the Tour Efficient and Effective - See Appendix C to find:

- ***Tips for touring the facility.***

* ***10 questions to think about during the walk-through.***

5. Target Processes for Pollution Prevention

Your team has found a number of areas that could use some help. Where do you start? Begin by prioritizing pollution prevention opportunities. Consider issues important to your company, such as:

- Regulatory compliance.
- Cost of raw materials and energy.
- Cost of waste management.
- Worker health and safety.
- Availability of cost-effective alternatives.

Start with small projects if you have to, but just get started. Small improvements over the long-term can yield BIG results in the end.

A Picture Says It All

Small companies often need to prioritize opportunities based on cost. You may have heard of the 80/20 rule—about 80 percent of your full costs are caused by 20 percent of your waste streams or activities. A good way to get management’s attention is to illustrate the full cost of each waste stream on a Pareto chart (example shown below). This chart makes the most costly waste streams readily apparent. In this example, targeting waste streams ‘A’ and ‘B’ would be a good starting point.

Example Pareto Chart



3 Identify Pollution Prevention Alternatives

At this point, your team has focused in on a problem to address. The next step in your planning effort is to generate a list of possible pollution prevention alternatives to reduce losses.

This section offers some methods to generate pollution prevention ideas. First, address the root cause of the problem. Second, conduct a brainstorming session to conjure creative possibilities. To address the problem, also seek employee input to identify potential solutions. Finally, consider looking to outside resources for assistance.

Get to the Root of the Problem

Businesses generate waste for a variety of reasons including unnecessary purchases, outmoded processes, poor employee training and inadequate preventive maintenance. Your task is to figure out what factors are responsible for creating waste.

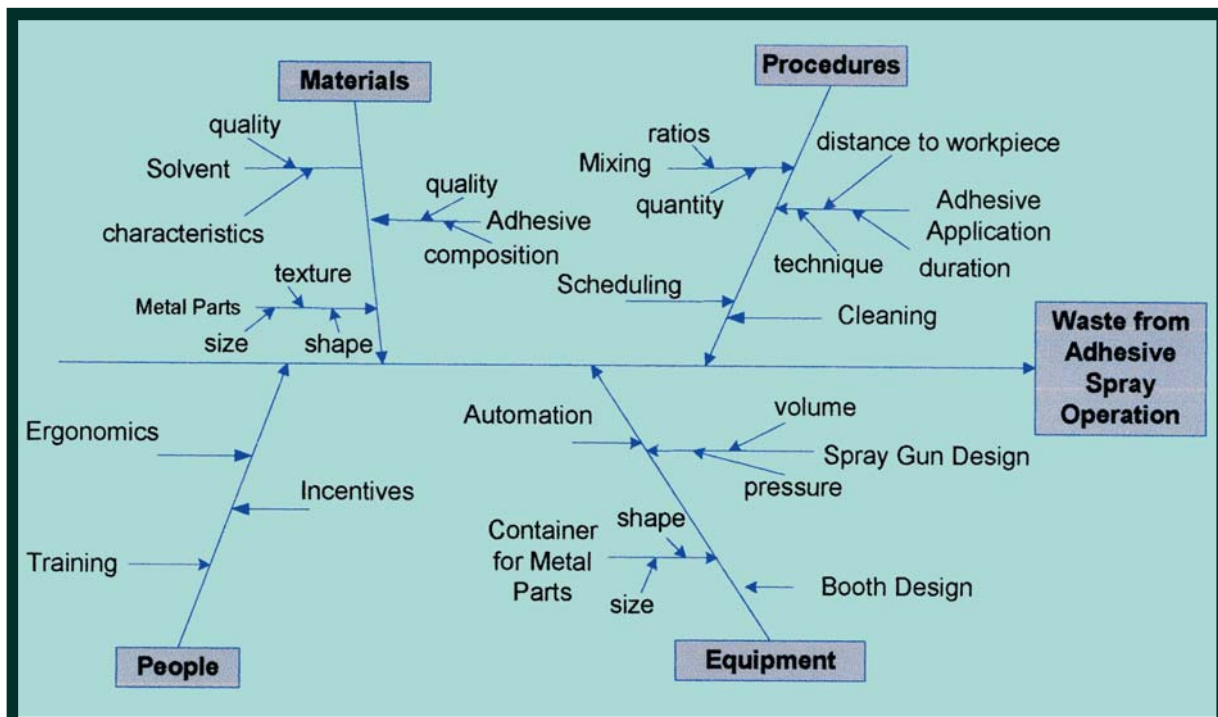
Ask Why?

One way to identify the cause of a problem is to ask “why?” several times. Asking “why?” multiple times gets past the procedural and equipment related causes to the human and psychological ones. This can lead to the root cause of the problem.

Create a Cause and Effect Diagram

A cause and effect diagram is another tool that can help your team understand why a problem occurs or why waste is generated. The diagram provides a picture that shows what factors affect a process and outlines possible causes of waste to explore in more detail. This type of diagram focuses on many possible causes of a problem.

Cause & Effect Diagram for Analyzing Adhesive Spray Wastes





Do you think a Cause & Effect Diagram might help your company? If so, Appendix D shows how to create one.

Use Brainstorming to Get Creative

Once your detective work has led you to the most likely cause(s) of a particular problem or loss, hold a brainstorm session. Group brainstorming is an effective technique for generating ideas for solving the problems and encourages spontaneous free flowing thought.

Brainstorming Tips

Assemble a diverse group. People who are not directly involved with the targeted process can often ask the best questions, such as “Why are we doing this?”

- State the problem clearly before you begin brainstorming so everyone is on the same page.
- Visit the work area. Make sure workers involved with the targeted process are in the brainstorming group.
- Display the process map. This will help group members visualize and explain ideas to others. Look at the processes that occur before and after the step under consideration.

A few rules for the brainstorming exercise will keep creativity flowing and prevent negative thinking from influencing the team members.

Brainstorming Rules

- *List every idea.*
- *No criticism or discussion.*
- *Conjure up outrageous alternatives.*
- *Stress quantity of alternatives, not quality.*
- *Build on alternatives posed by others.*
- *Have fun!*

It is not always necessary to go through a structured process such as group brainstorming to know what needs to be changed. If you already know what needs to be done, move on to the implementation phase. A typical mistake is to settle for an inadequate, small list of alternatives to solve a problem. The more alternatives you consider, the more likely you are to select the one that is best for your plant.

Consider a Range of Pollution Prevention Techniques

Pollution prevention techniques fall along a continuum from fundamental change in products and processes to increased efficiency in what already exists. During your brainstorming session, consider the following five categories of pollution prevention techniques:

Product Reformulation

Can you reformulate your product to reduce the amount or toxicity of substances in it? For example, paint and ink manufacturers have reformulated products to eliminate heavy metals.

Input Substitution

Could any raw materials be replaced with less toxic substitutes? Many metal working firms have replaced chlorinated solvents with aqueous cleaners.

Process Redesign

Are there alternative ways of making your product that could reduce water, energy and raw materials use, or waste generation? Some printed wiring board manufacturers have switched to a direct metallization process for making through-holes conductive. This change eliminates the use of formaldehyde and may also reduce water and energy usage as well.

Process Modernization

Are there ways to modify or replace existing equipment that would cut raw material use or waste generation? Using an automated high volume, low pressure (HVLP) paint spray gun instead of a manual spray gun can reduce overspray.

Improved Operation and Maintenance

How can we reduce the needless waste of the materials we store, transport, handle and use? Examples include: computerizing inventory control, repairing leaks, installing overfill alarms and segregating wastes.

Consider a Range of Good Operating Practices

First In First Out (FIFO) - Use the oldest products or ingredients first. This avoids waste caused when materials exceed their shelf life or expire.

Just in Time Delivery and Schedule Sharing - Arrangements are made with suppliers to deliver materials just before they are needed. This reduces the amount of material stored on-site which lowers the risk of leaks and spills.

Limited Ordering - There is a tendency to order large quantities of material in order to obtain a volume discount. However, process changes may result in the material no longer being needed, or extra material may expire before it can be used. Both of these situations can result in excess waste. Companies should carefully consider their actual material needs and order accordingly.

Reuse and Recycle

Can any of your waste be recycled and/or reused, preferably without leaving the production process? One recycling technique involves installing a hard-piped solvent distillation unit capable of reclaiming spent solvents for reuse.

Encourage Employee Participation

In many cases, the people working on the shop floor already have ideas for reducing waste but have never had the opportunity to express them. Develop an easy way for employees to make suggestions. Offer a bonus or other incentive 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.

Seek Outside Help

To supplement your list of ideas, consider turning to external sources of pollution prevention information: talk with vendors, get in touch with your trade association or industry peers, look in industry-specific journals and books and attend workshops and industry trade shows.

Call one of the many technical assistance resources available to Florida companies. These resources will provide your team with assurance that it has not overlooked simple proven techniques already used by other companies.



See Appendix A for a list of technical assistance resources. Appendix E contains a list of “Good Operating Practices” applicable to all industries.

4

Evaluate Alternatives

Sounds Good, But Is It Right For Us?

Your team has generated a long list of pollution prevention alternatives for each targeted process. The next step is to determine which projects are feasible and prioritize them for implementation.

Eliminate alternatives that are clearly unacceptable. Screen out any ideas shifting pollutants from one waste to another after they have already left the process.

Alternatively, you might find that some ideas are so straightforward, inexpensive and effective that no further assessment is needed in order to implement them. Make these cost-effective, low-tech pollution prevention changes first. These types of projects typically involve training and awareness, procedural changes, waste stream segregation, improved maintenance and inventory control; payback is often immediate. Move onto more capital-intensive alternatives as time and money permit.



Appendix F is a worksheet your team can use to assess environmental, technical and personnel issues associated with proposed projects.

Determine What Is Feasible

Judge the advantages and disadvantages of the more complex alternatives based on three key criteria: effectiveness, implementability and cost.

1. Effectiveness

What is the alternative’s potential for reducing losses from the process under consideration?

For example, the proposed project may eliminate or reduce use of hazardous material or allow your company to recover valuable by-products.

2. Implementability

Will the alternative work for us?

Your team will want to know how easy or difficult it will be to implement the project in terms of:

- System requirements and equipment reliability.
- Production and product quality issues.
- Worker acceptance and staffing needs.

3. Cost

What would the alternative cost? Will it be profitable?

The selection of a pollution prevention alternative will be heavily based on how it affects the bottom line. Every company has its own approach to the economic evaluation of capital investments, and each uses different criteria to justify these investments. Make sure your economic evaluation fits in with your company's approach.

Also, be sure to consider how the proposed project affects environmental costs. Perhaps your project will reduce regulatory requirements or lower liability concerns. Standard analyses often overlook these sources of potential savings. Keep a permanent record of the alternatives considered and your reasons for rejecting those not implemented. This may help you avoid repeating this effort in future years. For those alternatives you do want to implement, documenting the evaluation results will come in handy when it comes time to sell the project to management.

Select Alternatives For Implementation

Bubble up /bubble down is a neat trick for prioritizing among a large number of pollution prevention alternatives. First, the team lists the alternatives for a given process on a flip chart. Then, the group discusses the first two alternatives on the list to decide which of the two are better in terms of effectiveness, implementability and cost. The better one bubbles up to the top of the list.

Next, the team looks to the next unique pair. If item two bubbled up on the last round, the next unique pair would be one and three. If not, the unique pair is two and three. As alternatives bubble up, they become part of new pairs to be evaluated. For example, if the team decides that six is better than five, it then asks whether it is also better than four. If so, is it better than three; and so on. When the alternative stalls, the team goes back down the list to find the next unique pair and the process continues. Feasible alternatives readily bubble up, while the undesirables quickly bubble down.

Criteria Matrix

Another way to decide among pollution prevention alternatives is to use a criteria matrix. The first step is to list the alternatives down one side of a table. The team selects criteria to be considered and writes them across the top of the matrix. For example, a matrix could use effectiveness (E), implementability (I) and cost (C) as the criteria. Your team may choose to consider more specific criteria such as those used for targeting processes such as, compliance, health and safety, waste reduction, reduce costs and energy use. Next, the team must agree on a scoring system, such as rating on a scale of 1-10 or 1-5. Some teams use a scale of +, -, 0. Finally, rate the alternatives and total their scores.



For details on conducting an economic evaluation of pollution prevention projects, refer to <http://teexcit.tamu.edu/tca/>

5

Implement Projects

Your team may find a pollution prevention alternative that would benefit your company for each of the targeted processes. The projects selected are both technically possible and profitable. However, few companies are able to invest immediately in every project that appears promising. Resource, time and capital constraints often make it necessary to set priorities and implement changes over time. So, schedule projects for implementation with these constraints in mind.

IMPLEMENTATION SCHEDULE

PROJECT	Start Date	Target Date	Goal	Leader
1				
2				
3				
4				
5				

Establish a timeline for each project and assign responsibilities to your team. Schedule simple investments first because they provide quick, money-saving results. Achieving obvious success early on helps keep the momentum going.

Once your team knows what changes will be made, set goals for each pollution prevention project. Goals should be realistically achievable, easily understood, measured and supported by the people they affect. A goal may be 25 percent reduction in rubber scrap per part produced or a goal may be to eliminate a cleaning operation all together.

Tips for Successful Implementation

To ensure success your company will need to get the active cooperation of all employees. These three tips will help make implementation go smoothly:

Tip 1: Involve Employees. Make sure those affected are involved with implementing the change from the beginning.

Tip 2: Provide Training. Provide the necessary training for workers to operate the new equipment and to use new procedures. Explain the environmental and financial advantages of the new process.

Tip 3: Stay in touch. Implementation does not end with the installation of new equipment and/or new work practices. Encourage comments from all affected workers and be prepared for fine-tuning.



Questions about financing your project? Refer to Appendix A.

6

Measure Progress

Is it Working?

Tracking the progress of each project is critical to show that your investment was beneficial and that material losses are being reduced. Documenting success also sets the stage for additional pollution prevention. The best way to measure the progress of your pollution prevention project is to:

- 1. Calculate Cost Savings:** Is the project meeting expected economic benefits, such as net operating cost savings and payback? Compare actual savings to those projected in your economic evaluation in Step 4 of the planning process.
- 2. Calculate Changes In Waste Generation Or Material Use:** Calculate the results of the pollution prevention project. Use the materials accounting and waste generation information your team collected as part of Step 2 in the planning process as the basis for comparison.

Account for Production Variations

If quantities of waste or chemical use decrease after your company introduces a pollution prevention technique, the improvement might be attributed to the pollution prevention effort or it might have resulted from decreased production. To get an accurate measure of losses prevented as a result of a pollution prevention project, correct for changes in production rate. One way to do this is by measuring material use or waste generation per unit-of-product.

Selecting Unit-of-Product

A unit-of-product is an evaluation unit reflecting the level of production or activity associated with the use of a material or generation of a waste. For some firms this will be as easy as keeping track of the amount of product produced annually (e.g., a chair manufacturer could use the number of chairs). For other measures of production levels should be used, such as pounds, square feet or gallons of product manufactured.

Example of Unit-of-Product Used by Different Industries	
Industry	Unit of Product
Metal Finishing	Square feet substrate plated or coated
Paper Recycling	Tons of paper produced
Electronics	Number of passes substrate makes through process
Pharmaceutical	Kilograms of product produced



Not sure what all this means? Check out this link to a training course and freeware for P2 Total Cost Accounting: <http://teexcit.tamu.edu/tca/>

This training course is designed for Environmental Professionals and other non-accountant industry personnel that helps you understand the impact of environmental costs, provide instruction on comparing the cost of one process to another and provides a tool for communicating costs and benefits of Pollution Prevention projects to facility management.

Documenting Pollution Prevention Progress

Tracking the progress of your P2 projects and documenting the results is critical. This documentation can justify both the initial investment and future P2 projects. Appendix G contains a sample form for documenting your results. These records can be helpful for identifying future projects and for reinforcing your company's commitment to pollution prevention.

Publicize Success Stories

Early successes can help build enthusiasm for pollution prevention among workers and management, perhaps making it easier to gain approval and funding for future pollution prevention changes. Document the results of your projects and let everyone know how these changes are working out.

Other ways to highlight achievements:

- Recognize and reward the efforts of individuals who provided suggestions that were implemented.
- Use a newsletter, memo or bulletin board to highlight project savings, waste reductions, energy savings and product quality improvements resulting from pollution prevention projects.
- Grab some positive media attention by putting together a news release for local newspapers. Emphasize benefits for the company and for the surrounding community.
- Check availability of grants.



Malcolm Brandt, owner, receiving the Governor's Award. Mary Lou Rajchel, Council President is shown to the right.

Example Media Release

DEP Central District P2 Project in Enforcement (PiE) Success Story:

Windsor Metals (Osceola County)

Windsor Metal Finishing (Windsor), located in Kissimmee, Florida, is a custom applicator of high-performance architectural coatings serving the fabricated aluminum building products market. The coated products are used structurally in buildings and thus must meet strict specifications to maintain their integrity, even in corrosive coastal conditions.

DEP first became involved with Windsor via an enforcement case. Windsor offered to resolve the issue by implementing pollution prevention projects that would benefit the environment by conserving raw materials and minimizing waste on site. Windsor went above and beyond Department requirements by spending three times the amount of money designated for offset, and by installing state-of-the-art, smart electrostatic coating guns for the priming and coating process and by upgrading all five guns rather than two (as specified in the project).

In 2003 Windsor elected to invest the entire cumulative savings of \$310,000 recovered by the P2 project. P2 staff took the lead on providing the narrative for the Governor's Award application. Windsor won second place and opted to re-apply in 2004. They consequently won first place in 2004.

Windsor used 40 percent less coating and solvent materials as a result of switching to the smarter electrostatic guns between 2001 and 2002. The actual reduction was from 6,444 gallons, projected from 2001 use to an actual 2,653 gallons used in 2002. Air emissions were reduced in one year by nine tons of Volatile Organic Carbons (VOCs) and six tons of Hazardous Air Pollutants (HAPs). Paint booth filters now last more than twice as long and the filter waste, which must be managed off-site as hazardous waste, has been reduced by 42 percent. The number of 55-gallon drums sent off site for disposal dropped from 67 (weighing 10,050 pounds) in 2001 to 39 (weighing 5,850 pounds) in 2002. The reduction would have exceeded 50 percent annually if the newer guns had been used the entire year. A grand total of \$234,638 was saved in 2002 by implementing the smart gun metal coating technology. The P2 project paid for itself ten times just during the first year!

The benefits achieved from working with the DEP's Central District staff convinced Windsor to investigate further P2 initiatives including the feasibility of applying a new generation of high performance powder coatings that were being introduced into the marketplace. These offered the advantage of essentially no VOC or HAPs emissions. The new powders were intended to initially augment Windsor's architectural finishing product lines, with a view to eventually replace the liquid coatings as powder becomes more accepted and specified by the architectural community.

Beyond Planning For Profits

Repeat the Planning Process

If pollution prevention is to take root and prove genuinely successful in your facility, make sure your pollution prevention team does not wither after it has made a few improvements. Repeat the steps outlined in this guide to search for new pollution prevention opportunities. Update process maps and revisit your list of opportunities on a scheduled basis. Develop more accurate data on material use and waste generation. Select new targets for pollution prevention efforts.

Remember that pollution prevention alternatives take shape against the backdrop of pending regulations, shifting costs of raw materials and disposal, and changing public concerns and customer demands. Being aware of these changes can help you identify new pollution prevention opportunities or make a case for changes that might previously have been unattractive.

Integrate Pollution Prevention into Business Practices

Each successful pollution prevention experience provides incentive for management to support and diversify pollution prevention within your company. With time, pollution prevention can become an integral part of the company's infrastructure and operating practices. For example, as your company develops new processes or products, you may consider how to design them with pollution prevention in mind.

The Quality Connection

If your company has embraced the principles of Total Quality Management (TQM), you will recognize that pollution prevention and TQM share central beliefs. Like TQM, pollution prevention requires the active and sustained commitment of a wide range of personnel: from top management to purchasers, research and development personnel and production line workers. Both programs also call for continuous incremental improvements, each of which moves your firm closer to the ultimate goal of best possible quality or of least possible losses. Use your quality management system to integrate and sustain pollution prevention efforts.

Environmental Management Systems

Is your company ready to take environmental management a step further? Pollution prevention planning provides a foundation for developing an environmental management system (EMS) that can help your company meet business and environmental goals. An EMS is a more formal and comprehensive way to review operations for better environmental performance. An EMS can cover pollution prevention, energy use, natural resource issues, regulatory compliance, emergency planning, communication with interested parties and other environmentally related issues. With an EMS, environmental issues can become integrated into all facility operations.

Every company can benefit from an EMS, regardless of whether the facility chooses to pursue ISO (International Organization for Standardization) 14000 certification. ISO 14000 is the international standard for environmental management, much like ISO 9000 is the standard for quality management.



For more information about ISO 14000 visit www.iso.org

APPENDICES

State and National Technical Assistance Resources

There are many local pollution prevention programs in the State of Florida. Contact the Florida Pollution Prevention Roundtable or Florida DEP's P2 Program to locate a pollution prevention specialist in your area.



STATE

The Florida Pollution Prevention Roundtable is a not-for-profit corporation whose mission is to establish a statewide forum for identifying, coordinating, and promoting pollution prevention activities and resources throughout the State of Florida. www.flppr.net



The Florida Department of Environmental Protection's Pollution Prevention Program has staff throughout the state available to assist businesses, industry, and other organizations with the implementation of successful pollution prevention strategies. www.FloridaP2.org



The National
Pollution Prevention
Roundtable

NATIONAL

The National Pollution Prevention Roundtable is a not-for-profit organization devoted solely to pollution prevention. The mission of the Roundtable is to provide a national forum for promoting development, implementation and evaluation of efforts to avoid, eliminate or reduce pollution at the source. www.p2.org



The Pollution Prevention Resource Exchange is a national network of regional information centers: NEWMOA (northeast), WRRRC (southeast), GLRPPR (Great Lakes), Zero Waste Network (southwest), P2RIC (plains), Peaks to Prairies (mountain), WRPPN (Pacific southwest), PPRC (northwest). www.p2rx.org



The Environmental Protection Agency manages several pollution prevention projects and programs covering all media including air, waste, water, energy, purchasing and design. www.epa.gov/epahome/p2pgram.htm

Where to Look for Process Information

1. Environmental Records
SARA 313 Form R
Hazardous Waste Manifests and Annual Reports
Wastewater Discharge Permits
State Air Source Registration Records
Laboratory Waste Analysis and Flow Measurements
Previous Environmental Audit Reports
Consumptive Use Records
Discharge Monitoring Reports
Annual Operating Reports for Air Sources
2. Process Schematics
Facility Blueprints
Schematics of Storage, Processing and Shipping Areas
Piping Diagrams
Process Maps or Other Process Descriptions
Equipment Lists
3. Technical Data on Substances and Processes
Material Safety Data Sheet (MSDS)
Maintenance Procedures and Records
Production Line Scheduling Records
Production Line Job Sheets, Batch Make-Up Records and Mix Tickets
Equipment Operating Manuals
4. Technical Data on Products
Customer Specifications
Quality Control Records
Product Data Sheets
5. Other Business Operations Records
Chemical Inventory Records
Chemical Purchasing Data
Product Sales Records
Waste Transporter Invoices
Scrap Sales and Recycling Records
Organizational Charts
6. Financial Records
Department Cost Accounting Reports
Treatment and Disposal Cost Records
Chemical Purchasing Cost Records

Appendix C

Tips for Touring the Facility

- Schedule the tour and publish it in advance
- Let workers know why you are doing this; ask for suggestions for improvements
- Examine intermittent operations such as maintenance procedures
- Discuss some of the ideas you have already thought of with the workers
- Cover all areas where materials are used or processed
- Follow the path the materials take, from the receiving dock, along the process flow, and ending with the product storage and shipping areas, as well as waste treatment or storage areas
- Check the actual process against the process map your team has created
- Ask why things are done in a particular way. Remember you may be surprised by the answers you hear.

Ten Questions to Think About During the Walk-through

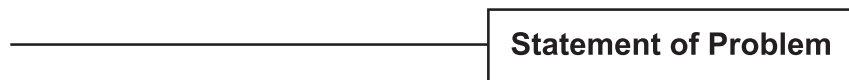
1. Does our facility show signs of poor housekeeping (e.g. cluttered walkways, unswept floors, uncovered drums)?
2. Where do we notice waste being generated from the processes in our facility (e.g. dripping water or steam, leaks, spills, evaporation, drag-out)?
3. Is there discoloration or corrosion on walls, work surfaces, ceiling and walls or pipes?
4. Do we see smoke or dirt or smell fumes to indicate material losses?
5. Do we smell strange odors, or experience eye, nose or throat irritation when we first enter the workplace?
6. Are there open containers, stacked drums, inadequate shelving or other indicators of poor storage procedures?
7. Are all containers labeled as to their content and hazards?
8. Is emergency equipment (fire extinguishers, spill kits, phones) available and visible to enable rapid response to a fire, spill or other incident?
9. Are off specification parts or scrap lying around?
10. Are outdated materials, stock or items that we no longer use sitting in storage? Is stock managed by First In - First Out procedures?

Appendix D

How to Make a Cause and Effect Diagram

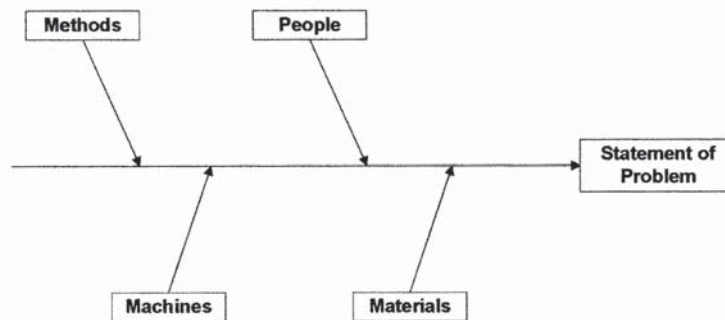
{Adapted from Pojasek, R.B (1996) Using Cause and Effect Diagrams in Your P2 Program, Pollution Prevention Review 6(3):99-105.}

A cause and effect diagram is a valuable problem-solving tool for gathering information on common pollution prevention problems. To construct the diagram, draw a horizontal line with a box on the right hand side. In the box write the loss that the team has selected to focus on. It is useful to think of the loss in waste as the effect and some aspect of the production process or operation as the cause.



Cause Categories

Four basic cause categories are typically used: people, methods, machines and materials. Other cause categories may be added (e.g. measurements, surroundings, policies). Cause categories are placed in boxes at the end of diagonal lines radiating out from the horizontal line:



Think about what each of these cause categories means:

- **People** includes all workers and managers. Factors such as their knowledge, training, certification capabilities and attitudes, should be included in the evaluation.
- **Methods** focuses on issues such as process work flow, work procedures and standard operating procedures.
- **Machines** includes all machinery, equipment and instrument controls as well as factors such as adjustments, maintenance and tooling capability.
- **Materials** includes all expendable inputs to the process and their characteristics such as supplies, changes and variability.

Working Through the Cause and Effect Diagram

The team can start with any major cause category to identify potential causes for the loss of waste. For example, they might start with **People**. They could ask questions such as:

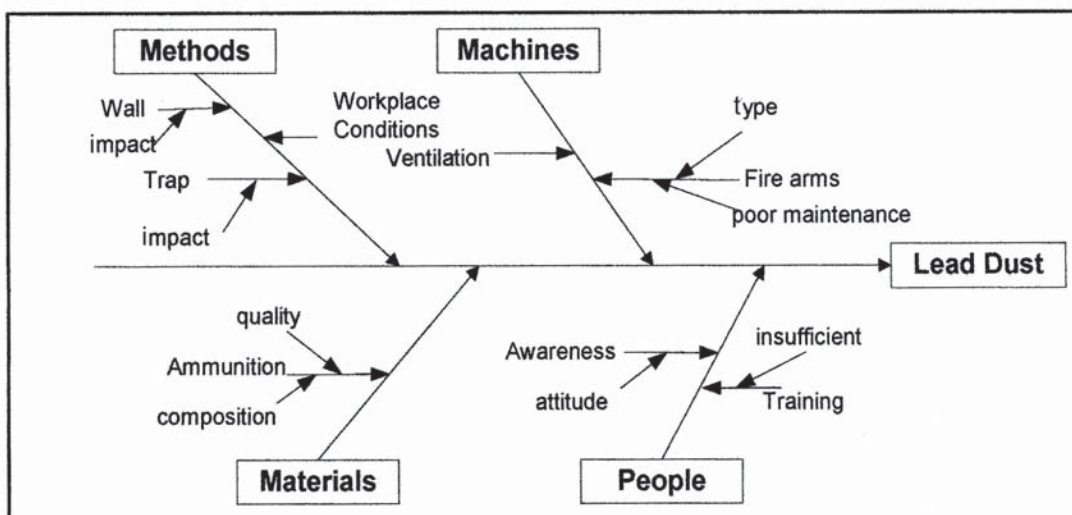
- What are people contributing to loss?
- Why are people doing what they are doing?
- Who are the people involved and what are their job classifications?
- When are people causing this loss?

Appendix D continued

Enter the answers to all the questions on the diagram and move on to another cause category. Repeating sub-causes in several places is acceptable if the team feels there is a direct multiple relationship. This effort will ensure that the team creates a complete diagram and fully understands the issues. If questions are slow in coming, use the major cause categories as catalysts. For example “What in our methods is causing...?” or “What in our materials is causing...?”

Refining the Analysis

When the initial effort is complete, the team should review each major cause category. Look for causes that appear in more than one category. This is an indication of a most likely cause. You can also poll the team members or estimate the percentages that a given cause contributes to the problem in order to come up with additional most likely causes. Circle these causes on the diagram. Next, review the most likely causes and ask: Why is this a cause? Asking “Why” will help you get to the root cause of the problem. Show the diagram to a few other people to get their opinion. Consider posting it in an accessible location and allowing many people to get involved in working on and understanding the process. The completed cause and effect diagram can then help a team to prepare to brainstorm a variety of alternatives for addressing the loss.



Appendix E

Good Operating Practices

Provide employee education and training for:

- Operation of the equipment in order to minimize energy use and material waste
- Proper materials handling in order to reduce waste and spills
- Importance of pollution prevention in terms of economic and environmental ramifications

Purchasing

- Use “Just-in-Time” ordering system
- Establish centralized purchasing programs; track and record chemical purchases
- Order reagent chemicals in exact amounts
- Encourage chemical suppliers to become responsible partners (e.g., accept outdated materials)
- Review material procurement specifications
- Avoid collecting free samples of process chemicals from vendors – only accept amounts needed for testing purposes

Storage

- Utilize a dedicated/protected storage area
- Space containers in storage areas to facilitate inspections
- Label all containers
- Stack containers according to manufacturer’s instruction to prevent cracking and tearing
- Separate incompatible materials in storage such as cyanides and acids
- Raise containers off the floor in storage area to inhibit corrosion from sweating concrete

Handling/Use

- Track material use
- Pre-inspect parts to prevent processing of obvious rejects
- Establish written procedures for process formulation and additions
- Use the minimum amount of non-hazardous materials (e.g., absorbent, water) needed to clean up hazardous spills
- Use process baths to the maximum extent possible
- Implement Statistical Process Control to improve efficiency of chemical use
- Eliminate obsolete processes and/or unused or infrequently used processes
- Reuse cleanup solvent
- Use mechanical wipers on mixing tanks
- Use a cleaning system that avoids or minimizes solvents; clean only when needed

Preventative Maintenance

- Maintain equipment history cards on equipment location, characteristics, and maintenance
- Maintain a master preventive maintenance schedule
- Keep vendor maintenance manuals handy
- Maintain a manual or computerized repair history file

Waste Segregation

- Prevent mixing of hazardous with non-hazardous wastes
- Store material in compatible groups
- Include careful labeling to ensure identification of wastes which have the potential for recycling or resale

Leak/Spill Prevention and Control

- Employ a controlled method of adding makeup water to process tanks
- Install overflow alarms on all process tanks
- Construct secondary containment with segregation that would permit reuse of spilled material
- Prevent/contain spill and leaks by installing drip trays and splash guards around processing equipment

Appendix F

Example Project Assessment Worksheet

Targeted Pollution Prevention Alternative: _____

Issues to Consider

Comments

Equipment

- 1) Does this option have a proven track record?
- 2) Will the vendor guarantee this system?
- 3) Are materials and parts readily available?
- 4) Can the system be easily serviced?
- 5) Is there vendor support available for start-up, testing, training and repair?
- 6) Does the system require new utilities?

Environmental

- 1) Will this option create less waste or decrease the use of toxic substances?
- 2) Could this option shift pollutants from one environmental medium to another?
- 3) Will new permits be required?

Product and production

- 1) Will this alternative adversely affect productivity?
- 2) Will this alternative adversely affect product quality?
- 3) Can the equipment fit in existing space?
- 4) Will installation stop production? How long?

Employees

- 1) Will this alternative require additional staff?
- 2) Does the alternative alleviate or create health and safety problems?
- 3) Will additional training be required for this option?
- 4) Will worker acceptance be an issue?
- 5) Will the alternative help reduce regulatory paperwork?

Appendix G

Documenting Pollution Prevention Progress

Pollution Prevention Progress

Material/ Waste	Reduction Goal	Start Date	Completion Date	% Reduction	Savings
1					
2					
3					
4					
5					
6					
7					