An Organizational Guide to Pollution Prevention

U.S. Environmental Protection Agency
Office of Research and Development
National Risk Management Research Laboratory
Center for Environmental Research Information
Cincinnati, Ohio

NOTICE

The U.S. Environmental Protection Agency through its Office of Research and Development funded and managed the research described here under Contract #68-C7-0011, Work Assignment #3-20, to Science Applications International Corporation. It has been subjected to the Agency's peer and administrative review and has been approved for publication as an EPA document. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

FOREWORD

The U.S. Environmental Protection Agency is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the Agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. To meet this mandate, EPA's research program is providing data and technical support for solving environmental problems today and building a science knowledge base necessary to manage our ecological resources wisely, understand how pollutants affect our health, and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory (NRMRL) is the Agency's center for investigation of technological and management approaches for preventing and reducing risks from pollution that threaten human health and the environment. The focus of the Laboratory's research program is on methods and their cost-effectiveness for prevention and control of pollution to air, land, water, and subsurface resources; protection of water quality in public water systems; remediation of contaminated sites, sediments and ground water; prevention and control of indoor air pollution; and restoration of ecosystems. NRMRL collaborates with both public and private sector partners to foster technologies that reduce the cost of compliance and to anticipate emerging problems. NRMRL's research provides solutions to environmental problems by: developing and promoting technologies that protect and improve the environment; advancing scientific and engineering information to support regulatory and policy decisions; and providing the technical support and information transfer to ensure implementation of environmental regulations and strategies at the national, state, and community levels.

This publication has been produced as part of the Laboratory's strategic long-term research plan. It is published and made available by EPA's Office of Research and Development to assist the user community and to link researchers with their clients.

E. Timothy Oppelt, Director
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ABSTRACT

This *Pollution Prevention (P2) Guide* provides information to help organizations get P2 programs started or to re-evaluate existing P2 programs. It presents an alternative method for working on P2 projects and four approaches to implementing a P2 program in an organization. This *Guide* was not written to provide a "one-size-fits-all" formula for starting or improving a P2 Program. The intention is to spark some ideas and provide tools that can be used to successfully complete an organization's P2 mission.

Also, the *Guide* is *not* intended to be an exhaustive review of case studies and company examples. It does not include information on state P2 planning requirements. In order to keep this document a reasonable length, these examples have been cited in the references section, and supplemental information is provided on the CD-ROM that accompanies this *Guide*. There are many U.S. Environmental Protection Agency (EPA) programs that support the practice of P2, including Environmental Accounting Project, Design for Environment, P2 Resource Exchange, Environmentally Preferable Purchasing, Sustainable Industry Project, Performance Track Program, and other initiatives across the Agency. Internet links to these programs and other information are provided on the CD-ROM.

An Organizational Guide to Pollution Prevention is organized into three basic sections:

1.	**Basic P2 Concepts and Tools (Chapters 1-4)**	Introduction to P2, Getting Started, P2 Program Elements, and P2 Tools
2.	**P2 Program Implementation Approaches (Chapters 5-8)**	Traditional Approach, EMS Approach, Quality Approach, and Finding Your Own Way to Implement P2
3.	**Companion CD-ROM**	Supporting P2 Information

ACRONYMS

ACC = American Chemistry Council

BAT = best available technology

BMP = best management practice

CSI = Common Sense Initiative

DfE = Design for Environment

EHS = environment, health, and safety

EMAS = eco-management and audit scheme

EAP = Environmental Accounting Project

EMP = environmental management program

EMS = environmental management system

EPA = Environmental Protection Agency

EPP = Environmentally Preferable Purchasing

FDA = Food and Drug Administration

ISO = International Organization for Standardization

JIT = just-in-time

MSDS = material safety data sheet

MSWG = Multi-State Working Group

NGO = non-government organization

OSHA = Occupational Safety and Health Administration

P2 = pollution prevention

P2Rx = P2 Resource Exchange

PCB = polychlorinated biphenyl

PSM = process safety management

QA/QC = quality assurance/quality control

SGP = Strategic Goals Program

SOP = standard operating procedure

TQM = total quality management

VOC = volatile organic chemical

WBCSD = World Business Council for Sustainable Development

XL = eXcellence and Leadership

CONTENTS

EXECUTIVE SUMMARY

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The EPA acknowledges the efforts of the principal authors of this *Guide*–Dr. Robert Pojasek (President, Pojasek & Associates) and Mr. Cam Metcalf (Executive Director, Kentucky Pollution Prevention Center). This *Guide* was prepared in fulfillment of Contract Number 68-C7-0011, Work Assignment #3-20, by Science Applications International Corporation, under the sponsorship of the EPA. Ms. Emma Lou George was the EPA Project Officer. Ms. Lisa Kulujian served as the SAIC Project Manager.

E.1 Introduction to P2

P2 has evolved substantially in its first decade. In 1988, the EPA published the *Waste Minimization Opportunity Assessment Manual* (EPA/625/7-88/003). This publication was revised and reissued in 1992 as the *Facility Pollution Prevention Guide* (EPA/600/R-92-088). Large numbers of these publications were distributed in the United States and internationally, and the information was well received. These publications have been included on the CD-ROM.

P2 programs provide many benefits to the organizations that use them. These include:

- Reduced operating costs
- Improved worker safety
- Reduced compliance costs
- Increased productivity
- Increased environmental protection
- Reduced exposure to future liability costs
- Continual improvement
- Resource conservation
- Enhanced public image

There are a number of impediments that P2 programs must address. These include:

- Capital requirements
- Specifications
- Regulatory issues
- Product quality issues
- Customers' acceptance
- Immediate production concerns
- Organization image concerns
- Available time/technical expertise

A five-step model is presented showing an alternative approach using the P2 tools discussed later in this *Guide* (Chapter 4). This is contrasted to the traditional approach to P2.

E.2   Getting Started With P2

Chapter 2 provides information on getting started with the P2 program process. First, set the boundaries around the program by deciding how P2 will be defined. Definitions from the EPA, United Nations Environment Program, and the World Business Council for Sustainable Development are presented. The user can choose to add elements from cleaner production and eco-efficiency to create a unique P2 definition that is broader than EPA's definition.

It is possible to use the P2 program to help an organization attain a goal of sustainable development. In addition, it is possible to integrate P2 into core business practices like six sigma, zero waste, and other company programs such as:

- Environmental management systems (EMS)
- Quality management initiatives
- Preventive maintenance
- Health and safety programs
- Insurance/risk management

Although a commitment to the P2 program should begin with management (i.e., top-down approach), line employees can often suggest valuable improvements in operations and procedures (i.e., bottom-up approach). The P2 tools presented in this *Guide* are well suited for encouraging employee participation as well as management recognition.

There is a substantial body of literature that describes, analyzes, and evaluates P2 efforts in the United States and internationally. It is clear that, like quality, P2 is a mindset that needs to permeate into the culture of the organization. Some have said that P2 is a way of life, not a new program. P2 requires many changes in behavior that cannot be simply demanded. Empowering employee teams to fully implement the new P2 behaviors is central to successful change management.

E.3   P2 Program Elements

P2 program planning should begin with the preparation of a *vision statement*, a *mission statement*, and a *statement of goals*. If your organization already has formal statements, it is important to align the P2 program with these statements. These statements and goals will help provide a good foundation for the P2 plan that your organization develops. Next, it is important to see how the P2 program aligns with the organization's guiding principles (also known as the core values). These items will help ensure that the program is understood and compatible with other initiatives in the organization.

The EPA has found that P2 programs often have similar program elements. They have published in the *Federal Register* six important elements that would be found in many programs of this nature. These elements include the following:

1. Provide top management support
2. Characterize the process
3. Perform periodic assessments
4. Maintain a cost allocation system
5. Encourage technology transfer
6. Conduct program evaluations

There may be other elements that can be included in the organization's P2 program. One good source is the American Chemistry Council's Responsible Care® Program's P2 Code. In addition, the organization must be certain to include the planning requirements that may be specified in its state environmental regulations.

To be truly successful, P2 requires a systematic, integrated, consistent, and organization-wide approach. This approach can be achieved through comprehensive P2 planning. Although you can learn from others' P2 success stories, real P2 success comes from the persistent application of the P2 philosophy and guiding principles in each organization's specific environment. Success is measured differently in each organization. It cannot be achieved simply by copying others.

E.4   P2 Tools

P2 teams can use a variety of specialized tools. These tools provide visual aids that are essential for communicating P2 information to management, other workers, and other interested parties. Tools also help P2 teams gather information and provide problem-solving and decision-making guidance. Finally, by using the tools, the P2 team is in a better position to construct an action plan for each P2 project included in the program. This allows for consistent tracking by the P2 oversight committee.

P2 tools are Systems Approach tools. The Systems Approach looks at the whole organization, and the parts, and the connections among the parts. These tools help point out how things can be changed to conserve the use of a resource or prevent the waste from occurring. This is fundamentally different from having an external assistance provider suggesting a way to change the process without considering the system.

These P2 tools are derived from quality programs and are widely used throughout the world. The application of the quality improvement tools used in the Systems Approach is a powerful force in eliminating environmental inefficiencies and preventing pollution.

The P2 tools are:

- Process characterization with hierarchical process mapping
- Resource accounting using the process maps as a template
- Selection of P2 opportunities using a Pareto diagram with appropriate cost information
- Analysis of the root cause of the problem using a cause-and-effect diagram
- Generation of alternative solutions using brainwriting
- Selection of an alternative for implementation using bubble-up/bubble-down
- Implementation of the alternative using an action plan

Checklists are also useful to help the P2 teams review the process and ensure that their work is complete.

Tools take time to master, but they help foster skills that the P2 team needs to characterize the process, solve problems, and make decisions. Making P2 a way of life takes more than words; it requires action. Action plans provide documentation for accomplishing the goals decided upon by using the tools. It makes it easier to track P2 progress over time.

E.5   Traditional Approach to P2 Implementation

The P2 approach provided in the previous EPA publications is presented along with process maps depicting each of the steps. This traditional approach has a "top-down" focus. It starts with getting management approval with pre-set program goals. This is communicated to the workforce using a policy statement. A P2 task force is organized and conducts a preliminary P2 assessment.

From this information, a P2 program plan is prepared with clear objectives and a firm schedule. Now a detailed P2 assessment is conducted to start the implementation phase. Checklists and worksheets are provided to help the team collect data and information. This assessment team will review the data and visit the sites where the P2 activity is planned to take place.

The team will derive P2 options (called *alternatives* in this *Guide*) and screen them with a criteria matrix. A feasibility analysis is performed to make a final determination based on technical, environmental, and economic factors. At this point, the traditional approach requires the preparation of a formal, written P2 assessment report to present the analysis to management for a decision.

Once the work begins, it is reviewed and adjusted to make sure it meets the objectives. The final step in the traditional program is to measure P2 progress. Data is acquired from the implementation phase and analyzed.

Previous P2 publications provide guidance on how to maintain the P2 program. Five activities are detailed as follows:

- Integrating the P2 program into other formal corporate initiatives
- Providing the proper amount of P2 education
- Communicating and soliciting of suggestions
- Providing for proper incentives for participating
- Implementing public outreach and education

P2 practitioners found this approach to be useful for very small organizations. Another method, called *Nothing to Waste*, has also been shown to be very effective with very small organizations and uses the tools presented in Chapter 4.

E.6   EMS Approach to P2 Implementation

The international voluntary standard for environmental management systems (EMS), known as ISO 14001, is an effective tool for implementing P2 alternatives. It is the intent of this standard to establish and maintain a systematic management plan designed to continually identify and reduce the environmental impacts resulting from an organization's activities, products, and services. An EMS promotes important planning and improvement elements needed in the design of multimedia source reduction and recycling programs.

As an initial step in developing a comprehensive EMS, most organizations find it helpful to complete an objective gap analysis of their existing environmental system. This enables the organization to compare its systems against ISO 14001 and highlight areas that require attention under the EMS development phase.

The preparation of the EMS includes the following steps:

- Environmental policy, management commitment, and scope of the EMS
- Communication of the EMS policy
- EMS planning
- EMS implementation
- Monitoring and measurement

An EMS establishes specific objectives, targets, and time frames for implementing P2 initiatives, improving environmental performance, and maintaining compliance, including compliance with state P2 planning requirements. Environmental management programs (EMP) are used to achieve the EMS objectives and targets.

Organizations are discovering that their investment in an EMS is leading to improved environmental performance and compliance with benefits for the environment and the community. An EMS provides a good method for establishing and implementing a P2 program. To achieve maximum environmental benefits, the EMS should embody the "plan, do, check, and act" model for continual improvement.

E.7   Using a Quality Model to Implement P2

P2 results are the *outcomes* of the *performance* of the P2 program and **not** a measure of the performance itself. Furthermore, P2 results by themselves offer little diagnostic value. They do not indicate whether an organization could have done better or if they really exceeded expectations. A model that focuses on measuring performance has been developed in the United States and is known as the Malcolm Baldrige National Quality Award. It measures six performance categories (i.e., leadership, strategic planning, other interested party involvement, information and analysis, employee participation, and process management). A seventh category captures the results. The Green Zia Program (New Mexico Environment Department) has adapted this quality model to measure environmental excellence. From the perspective of the organizations using this model, it is a prevention-focused, performance-driven EMS. Performance can be measured on a 1,000-point scale. This is a unit-less number and does not need to be normalized like other environmental metrics. Results are measured in three parts: environmental results, results of the interested party involvement, and financial results.

In order to increase the performance score, organizations must demonstrate how they leverage the various performance activities with other performance criteria. The organization also needs to find a way to integrate each of the eleven guiding principles with the proper criteria in the model. This facilitates the integration of the P2 program into the organization.

A five-step process is offered to improve or develop a P2 plan using the quality model concepts. The steps are as follows:

1. Plan and develop your P2 program
2. Develop your facility's P2 opportunities
3. Implement your P2 program alternatives
4. Maintain your P2 program
5. Measure your progress toward zero waste and emissions

The use of the Systems Approach and the quality model provides a means of creating a sustainable P2 plan for your organization. Your ISO 14001, Global Reporting Initiative, CERES Principles, Responsible Care® Program, balanced scorecard, six sigma, ISO 9000, and other environmental and quality initiatives will help the organization score points in each of the criteria. All these programs help contribute to environmental excellence. This quality model simply provides a means of providing a common thread on how they are related and allows you to see just how effective they are at driving environmental performance in your organization.

The P2 plan should be integrated with the core business practices. "Oh, that is something that the environmental coordinator is doing!" – such an attitude can only limit results. By making the P2 plan more businesslike, the possibilities for P2 within the organization are significantly enhanced.

E.8 Finding Your Own Way to Implement P2

Three approaches to implementing a P2 program have been presented in Chapters 5–7. This chapter discusses some of the items that are covered in these approaches to provide you with some ideas for planning and implementing a P2 program that is specific to your organization's requirements and culture. The following categories are presented that a P2 program could choose to address:

- Extent of planning
- Leadership
- P2 goal setting
- Focus on results
- Information and analysis
- Process management
- Employee participation
- Focus on interested parties
- Guiding principles or core values
- P2 program elements

E-9. CD-ROM

This *Guide* has been issued with a companion CD-ROM. It provides supporting information on all the topics and additional materials that may be required to plan and implement a P2 plan for your organization.

All the referenced material is accessible using the CD-ROM, including the previous EPA P2 publications and associated checklists. Information on a large number of EPA and state P2 activities is also included. The CD-ROM is divided into the following sections:

- P2 checklists
- Links to information on the P2 tools
- Information on EMS to support P2 implementation
- Information on the quality (Green Zia) model to support P2 implementation
- Other P2 manuals
- Other sources of useful P2 information

CHAPTER 1

Introduction
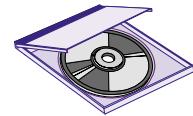
EVOLUTION OF POLLUTION PREVENTION (P2)

Pollution prevention (P2) has evolved substantially in its first decade. In 1988, the U.S. Environmental Protection Agency (EPA) published the *Waste Minimization Opportunity Assessment Manual* (EPA/625/7-88/003). It contained over 34 pages of checklists and worksheets and focused on hazardous waste minimization. The first revision, *Facility Pollution Prevention Guide* (EPA/600/R-92/088), was released in 1992. It contained only 10 pages of checklists and worksheets, and added new topics, including energy conservation and the design of environmentally compatible products. The EPA distributed many copies of these publications to requestors in the United States and internationally, and the information was well-received by the environmental community. The EPA prepared many successful project reports and case studies based on this approach. Copies of these publications are available on the CD-ROM that accompanies this *Guide*, and the "traditional" P2 approach that they describe is covered in Chapter 5 of this *Guide*.

This *Guide* presents an alternative approach to implementing P2 in your organization. As you will see, it documents how P2 is moving from a specialized environmental initiative to a mainstream business activity. Employees can now become increasingly involved in P2 and reduce their reliance on "outside experts" using defined checklists and databases of "proven solutions" that may overlook P2 opportunities. Employees can use process mapping to better understand the organization's main and supporting processes and widely accepted problem-solving and decision-making tools to find new P2 opportunities and prepare cogent, written action plans. Many business managers are already familiar with these tools since they are already used to improve operations. No matter what method is selected to implement P2 activities, these tools should help improve communication within an organization and communication with other interested parties. This *Guide* is intended to assist any organization in developing, implementing, and maintaining a P2 program. It should help your organization decide which program elements to include and the general approach for sustaining this important business practice.

During the evolution of P2, some environmental professionals have continued to focus on regulatory compliance. This has been a reactive focus, as compliance activity is usually undertaken in response to a new or changed regulation at the Federal, state, or local level. Prevention, on the other hand, is anticipatory. Action is taken not on the waste or use of a regulated material, but on the circumstances and conditions that may generate waste or a regulated material. The focus in P2 is on

This Guide *presents an alternative approach to implementing P2 in your organization.*

P2 is moving from a specialized environmental initiative to a mainstream business activity.

the organization's main and supporting processes, not on the resulting waste or use of a regulated material.

Many states have enacted P2 and toxics use reduction planning legislation. This legislation has had the unintended effect of making P2 a regulatory compliance effort and has done little to integrate P2 into core business practices. It is important to understand the organization's main and supporting processes and all of the individual work steps so that when the process is changed, the regulatory requirement is not triggered. By seeking to avoid the need for regulatory compliance (i.e., compliance through P2), environmental professionals become important resources to the organization's work function; managers of organizations are beginning to recognize the value of these environmental professionals as they reduce the costs associated with compliance activities.

An organization's management is always searching for the newest trend to enhance its value and financial viability. Many organizations use a version of a management practice called lean manufacturing. Lean generally focuses on "the elimination of all waste from all business practices*."* Much has been written on seven types of organizational wastes: over-production, waiting time, transport, variable process, inventory, motion, and defective goods. Environmental wastes are rarely included in these programs because many organizations rely on the environmental function to manage these wastes in accordance with regulations. Many organizations with a strong focus on quality have weak P2 programs because the environment and quality programs have not been sufficiently integrated. This *Guide* focuses on the integration of P2 into core business practices. It will present P2 as a necessary component of many common organizational management programs and show you how to use the same problem-solving and decision-making tools used in these programs.

Many advocates for sustainability have called for a shift to biologically-inspired production models. They seek not merely to reduce waste but to eliminate the generation of waste altogether. As a result, there is a growing trend for organizations to set goals of zero wastes and/or zero emissions. Organizations like DuPont, Xerox, Collins Pine, and Interface have joined these ranks. The zero-waste trend stems from a long-standing tradition of setting zero defects, zero injuries, and zero incidents goals. Having a strong P2 program is a vital aspect of any program that is set on eliminating wastes from the organization. However, integrating a strong P2 program with many other programs in the organization is still essential to realizing these goals. Some organizations are implementing programs that direct them toward a sustainable performance level. Elimination of wastes and conservation of resources are important first steps in such programs.

This *Guide* is not intended to be an exhaustive review of case studies and company examples. In order to keep this *Guide* to a reasonable length, examples have been cited in the references section of each chapter and links have been provided in the CD-ROM that accompanies this *Guide*. In addition, many EPA and other programs support P2 efforts; e.g., Environmentally Preferable Purchasing (EPP), Design for Environment (DfE), Environmental Accounting Project (EAP), P2 Resource Exchange (P2Rx) and a number of other voluntary programs. Links to these programs are provided on the CD-ROM. This CD-ROM will also provide more detailed supporting information on many of the concepts described in the *Guide*.
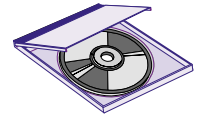
BENEFITS OF P2

The benefits of practicing P2 have long been noted. Despite the clear advantages, however, some managers are still reluctant to recognize the P2 efforts that are underway in their organizations. To provide better focus on the benefits, environmental coordinators are now showing how P2 is enhancing other management initiatives by linking P2 to the core values of the organization. It may be best to think of the following categories of benefits in this new light.

- Reduced operating costs
- Improved worker safety
- Reduced compliance costs
- Increased productivity
- Increased environmental protection
- Reduced exposure to future liability costs
- Continual improvement
- Resource conservation
- Enhanced public image

Reduced operating costs. P2 activities usually save an organization money in the long term. Many P2 projects have good returns on investment and short payback periods. Even if an organization is not subject to complicated regulations, P2 can still result in cost savings by reducing energy and water use while increasing materials productivity. Organizations may also save money in solid waste disposal costs, new material costs, and improved operating efficiency. Unfortunately, too few P2 professionals communicate the economic benefits of P2 progress to management.

Improved worker safety. Reducing the use of toxic materials in the workplace should be a major component of P2. By reducing or eliminating toxic substance use, the safety of the work environment can be improved and the use of personal protective equipment requirements decreased. Also, reducing the likelihood of leaks, spills, and harmful releases can decrease worker, visitor, and contractor exposure to those

substances. These steps will produce cost savings through material loss prevention and may result in reduced insurance rates as medical claims and disability leaves decrease. Better labor relations can also result from improved worker safety. Unfortunately, there have been cases where P2 activities have *inadvertently* decreased worker safety hazards (e.g., substituting the flammable solvent isobutyl alcohol for the halogenated solvent 1,1,1-trichloroethane which is non-flammable but a worker health issue). It is important that P2 does not trade off environmental improvement with workplace health and safety. Ergonomics can also be influenced by P2 efforts.

Undertaking P2 projects can reduce regulatory exposure and, in some cases, eliminate the need for permits, manifesting, monitoring, and reporting.

Reduced compliance costs. Undertaking P2 projects can reduce regulatory exposure and, in some cases, eliminate the need for permits, manifesting, monitoring, and reporting. This is referred to as *avoiding the need for regulatory compliance.* Keeping up with regulatory requirements and submitting the required reports can be an expensive and time-consuming process that, if eliminated, saves money. For example, the U.S. Air Force has initiated a program known as Compliance Through Pollution Prevention (Reference 1-1). The Air Force is trying to achieve and remain in compliance by using P2 instead of classical environmental engineering and regulatory compliance techniques. Some organizations have been able to change their regulatory compliance status (e.g., move from a large quantity generator of hazardous waste to a small quantity generator) through the use of P2 activities.

P2 can improve an organization's material productivity through more efficient use of raw materials due to improved processes and operations.

Increased productivity. P2 can improve an organization's material productivity through more efficient use of raw materials due to improved processes and operations. For example, an organization that produces large quantities of wastes (discharges, emissions, spills, and leaks) might be using old technologies to produce its products, or its processes might be poorly controlled and inefficiently operated. Sometimes small process improvements involving material substitutions and changes in operating procedures can result in increased product yield and better quality.

Increased environmental protection. Many waste disposal and treatment methods are less protective of the environment than previously estimated. These methods may only move environmental contaminants from one medium to another. They may cause problems in the future that are not yet apparent. P2 reduces the generation of wastes (discharges, emissions, spills, and leaks) at the source, resulting in less toxic waste, and thus assures improved environmental protection.

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Reduced exposure to future liability costs. Reduction of potential long-term liability from waste disposal, emissions, and discharges has become an important concern in recent years. Some past disposal practices, although legal, have caused environmental damage for which organizations have been held liable, creating a large liability expense and damaging their public images. P2 can help reduce long-term liability by reducing the amount and toxicity of waste generated.

Continual improvement. Successful implementation of a P2 program can be an integral part of a company's continual improvement or quality improvement program. Reducing wastes and improving efficiency are goals of both P2 and continual improvement. Many organizations use continual improvement to constantly change certain work processes in order to improve them. To clarify the use of the term "continual improvement," the following distinction is made:

> "Continuous improvement—happening all the time, everything moving forward at once; often used in quality programs"
>
> "Continual improvement—happening all the time, but not everything moving forward at the same time and rate; often used by auditors of Environmental Management Systems and in other environmental programs."

The term continual improvement is used throughout this text.

Resource conservation. P2 will lead to the use of less energy and water. All resources, materials use, and waste reduction can be monitored in the same program. Traditionally, most organizations had separate programs (e.g., water conservation or energy efficiency) for resource conservation and P2. However, these programs are related in many ways; both are necessary to improve efficiency and to meet the organization's goal of sustainability.

Enhanced public image. P2 can help an organization gain a favorable image with the community by showing that they are willing to make changes to improve the environment and move towards sustainability. Some organizations have used their "green" image to successfully distinguish themselves in the marketplace, thus adding to their intangible goodwill market value.

IMPEDIMENTS TO P2 USE

A number of impediments commonly hinder successful implementation of a P2 program. It is important to recognize these impediments and address each of them during implementation. Management's commitment to addressing these issues is a key element of the success of the P2 program.

- Capital requirements
- Specifications
- Regulatory issues
- Product quality issues
- Customers' acceptance
- Immediate production concerns
- Organization image concerns
- Available time/technical expertise
- Inertia

Successful implementation of a P2 program can be an integral part of a company's continual improvement or quality improvement program.

P2 will lead to the use of less energy and water.

Capital requirements. Implementation of P2 measures might require capital investment. Such projects may need to be justified economically and are subject to the availability of capital in the organization. Capital justification protocols may not recognize the "hidden" costs that are avoided and the reduction in the organization's financial overhead burden resulting from P2 measures.

Specifications. Specifications can be both an incentive and an impediment. For instance, specifications may stipulate certain materials be used in the manufacture of a product, or that virgin materials be used rather than recycled. This can lead to the use of materials that are damaging to the environment, or the unnecessary use of virgin materials where recycled would suffice.

Regulatory issues. It may be necessary to obtain a new or modified permit or other governmental approval before implementing a process change or material substitution. This can be time-consuming and costly. For example, if a process is regulated by the Food and Drug Administration (FDA), all process changes require submittal of an application for approval, and new equipment must be inspected and approved by the FDA. In some cases, clinical trials of a substance, such as a drug, must be repeated to demonstrate efficacy. Unfortunately, P2 changes may occur faster than the government can respond. Many permit changes can take long periods of time to attain in even the most efficient governmental agencies.

Product quality issues. Organizations have great concern for the quality of the products and services they offer. Some P2 projects may affect product quality, even when properly implemented, and thus may be regarded with skepticism. For example, the use of mineral oils instead of mineral spirits (that have high volatile organic chemical [VOC] emissions) to carry dyes to fabrics may mean that some of the oils will remain on the fabric once it is dried, thereby changing the "feel" of the fabric and possibly the value of the finished product.

Customers' acceptance. The customer ultimately defines product quality; anything that affects the quality, or even the perception of quality, may affect acceptance by the customer. Customers often have a greater influence on how an organization operates than other outside parties. Some large organizations have encouraged their supply chains to adopt P2 behaviors to further the competitive advantage of the entire value chain.

Immediate production concerns. Implementation of P2 projects are often viewed by production as requiring time, money, and personnel, all of which are usually in short supply. Production quotas must be met as a first priority. After all, meeting the customers' demands is what pays the bills. However, production often finds the means to improve productivity, and P2 needs to be seen in this same light.

Organization image concerns. Organizations may be hesitant to admit that the "old way" may not be the best way. Once easy-to-implement P2 practices such as improved operations are underway, for example, some organizations may resist publicly acknowledging the changes out of concern that such acknowledgment might expose previous, less environmentally sound practices. However, the implementation of P2 practices provides managers with an opportunity to lead the organization through changes that will benefit everyone.

Available time/technical expertise. Some organizations may lack sufficient time or technical expertise to develop and implement P2 practices. Even though many state and federal technical assistance programs (References 1-2, 1-3, 1-4) are available at little or no cost, some organizations simply fail to take advantage of them.

Inertia. Whenever a production system is in place and working with some degree of success, there is a tendency to leave well enough alone. The old adage "if it ain't broke, don't fix it" still prevails in most organizations. Overcoming resistance to change is a major challenge for P2.

Even though many state and federal technical assistance programs are available at little or no cost, some organizations simply fail to take advantage of them.

Overcoming resistance to change is a major challenge for P2.

P2 IN STEPS

Previous editions of this *Guide* have defined a path (adapted from Figure 3 in EPA/600/R-92/088) depicting how P2 should be implemented (see Figure 1-1).
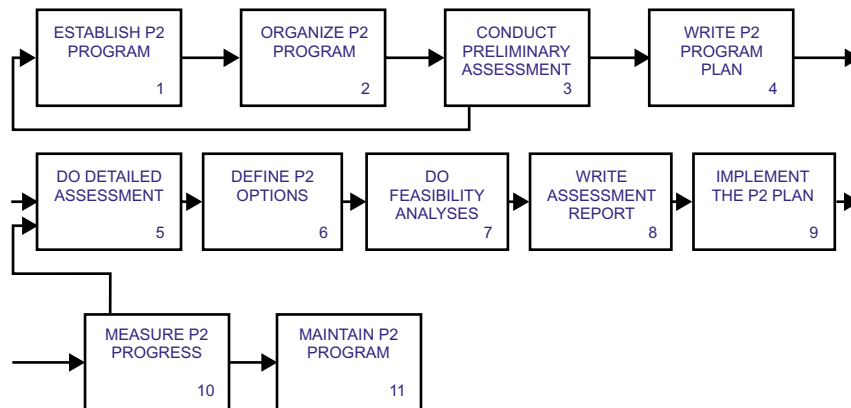
Figure 1-1. Process Map of a Traditional P2 Program.

Following is an alternative view of P2. The primary difference lies in the fact that the P2 Program is established after much of the information has been gathered rather than in the first step of the program. It also uses quality tools that have been adapted to P2 programs and published in the literature. This view of P2 consists of five simple steps (see Figure 1-2):

The primary difference lies in the fact that the P2 Program is established after much of the information has been gathered rather than in the first step of the program.
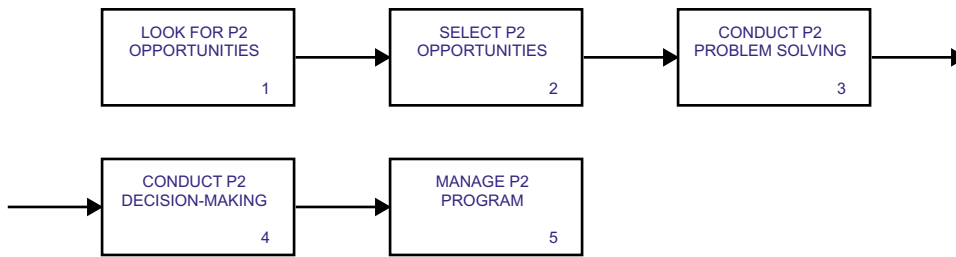
Figure 1-2. An Alternative Approach to a P2 Program.

While these steps will be discussed in more detail in Chapter 4 of this *Guide*, it is important to highlight some of the differences between the methods described here and the methods contained in the traditional approach to P2.

Step 1. Looking for P2 Opportunities

- Process mapping
- Main process/supporting processes
- Maps as information templates

The process maps become templates for maintaining information about the process.

All of the organization's processes are characterized in detail using a tool known as process mapping. This tool allows the information to be aggregated to a higher level when necessary. All supporting operations (ancillary and intermittent) are examined and linked to the main processes. Nothing is missed using this visual tool. All resources (e.g., energy, water, and materials) are accounted for at the work-step level (i.e., at the lowest level in the process maps as they define the actual work task that is being performed). The process maps become templates for maintaining information about the process. The costs of using and losing resources can also be collected by work-step using the process maps as templates. Traditional P2 methods have relied on a walk-through process assessment to gather information on P2 opportunities.

Step 2. Selecting P2 Opportunities

- Rank ordering
- 80/20 rule
- Pareto chart
- Monetary metrics

Every process in every organization will produce P2 opportunities.

Every use of a resource in a process represents an *opportunity* to conserve the use of that resource. Every loss of a resource in a process represents an *opportunity* not to lose that resource. Every process in every organization will produce P2 opportunities. It is possible to rank P2 opportunities using monetary units and also to construct a Pareto chart. This chart will show that 20% of the P2 opportunities represent 80% of the true costs of environmental management of the uses and losses. No matter how the P2 opportunities are selected, it is important to have the organization keep its collective eye on the most important ones. Many organizations select a manageable number of P2 opportunities to work on each year. Ideally, P2 opportunities should be selected from every department in the organization to ensure that everyone stays involved.

Step 3. P2 Problem Solving

Once the P2 opportunities are selected, the use and loss of resources are seen as "problems." Worker teams are assembled to address these problems using root cause analysis to first ask *why* each is a problem. A simple cause and effect (fishbone) diagram can help the team examine how materials, machines (technology), methods, and labor contribute to the problem. This visual tool can communicate the causes of the problem to all levels of the organization. In fact, the cause-and-effect diagram is the most widely used problem-solving tool in the world.

With this important information gathered and analyzed, the team can now search for alternatives to solve the problem using tools like brainstorming and brainwriting. It is important to remember the adage that "the only way to find a good P2 alternative is to find many alternatives." In the past, many P2 problem-solving efforts centered on finding the "right answers" instead of searching for alternatives. Previous P2 success stories should be used only to provide ideas to the team using this problem-solving method. Because workers often wish to be involved in solving problems associated with their work, home-grown solutions are often more readily implemented than expert-generated solutions from the outside.

A simple cause-and-effect (fishbone) diagram can help the team examine how materials, machines (technology), methods, and labor contribute to the problem.

- Root cause analysis
- Cause and effect diagrams
- Fishbone diagrams
- Brainstorming
- Brainwriting

Step 4. P2 Decision-Making

Now the team must select an alternative to implement. A good tool for doing this is known as *bubble-up/bubble-down*. It is a forced-pair comparison of all the alternatives. Some teams prefer to use a criteria matrix or selection grid for rating each alternative against a predetermined set of criteria. Alternatives that are inexpensive and easy to implement go to the top of the list using the bubble-up/bubble-down tool. These "low hanging fruit" or "quick win" alternatives can often be implemented without much further study. More effective alternatives may require additional study. In some cases, a detailed feasibility study must be prepared. It is always beneficial from a team development perspective to have the "quick wins" precede these more complex programs.

To implement the alternatives, a written action plan should be prepared and submitted to management for review and approval. The key component of the P2 plan at the facility will be the action plans that are being implemented during the current year.

Now the team must select an alternative to implement.

- Bubble-up/bubble-down
- Criteria matrix
- Action plan

To implement the alternatives, a written action plan should be prepared and submitted to management for review and approval.

Step 5. P2 Program Management

This *Guide* suggests ways an organization can establish, implement, and manage its P2 program. The activities described in Steps 1

through 4 will take place within that program. While Steps 1 through 4 apply to many organizations, P2 program management (Step 5) must be designed to fit the culture of the organization using P2. The organization must provide training for the people participating in the program. There must be understandable policies and a management commitment. Relationships to other organizational programs must be clearly defined. Oversight for the P2 program can be provided in the form of program audits, by both internal and third parties. Finally, there must be a way to measure progress and evaluate the effectiveness of the P2 program. Some information that enables organizations to adapt the program management to their own culture is provided in Chapters 5 through 7.

ORGANIZATION OF THIS *GUIDE*

This *Guide* will provide information to help organizations get their P2 programs started or to help re-evaluate existing P2 programs. Chapter 2 provides some advice on how to get started with the P2 program process. The planning of the P2 program is covered in Chapter 3 and is discussed along with some planning elements that should be addressed. Most P2 programs can use tools (discussed in Chapter 4) to facilitate communication within the organization and between organizations. Tools that support the five-step model described previously are presented in Chapter 4. These tools can also be used in all of the implementation models covered in this *Guide*. Several models are presented to help in implementing the P2 program. A traditional P2 implementation model is presented in Chapter 5. It can be used with or without the tools presented in this *Guide.* Also presented is a version of this model called "Nothing to Waste" that is particularly useful to small organizations. Chapter 6 shows how an environmental management system (EMS) may be used to implement a P2 program. Chapter 7 presents a quality model that can be used to implement a P2 program. Chapter 8, the final chapter, examines how individuals can design and implement their own P2 programs from the materials presented in this *Guide.*
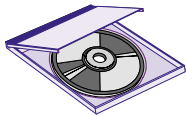
A companion CD-ROM is included to provide supporting information on all of these topics and additional information that may be required to plan and implement a P2 program for your organization. All of the referenced material is accessible through the CD-ROM. The following information is provided on the CD-ROM:

- P2 Checklists
- Links to Information on the P2 Tools
- Information on EMS to Support P2 Implementation
- Information on Quality Model to Support P2 Implementation
- Other P2 Manuals
- Other Sources of Useful P2 Information

The CD-ROM should be useful as your organization develops the P2 Program.

REFERENCES

1-1.   *Compliance Through Pollution Prevention (CTP2): Implementation Guide.* U.S. Air Force Material Command, Wright-Patterson AFB, December 2000.

1-2.   National Pollution Prevention Roundtable (NPPR) Web Site
http://www.p2.org/

1-3.   National Institute for Science and Technology Manufacturing Extension Program (NIST MEP) Web Site
http://www.mep.nist.gov/

1-4.   Small Business Development Centers (SBDC) Web Site
http://www.sbaonline.sba.gov/SBDC/

Other Sources of P2 Information

EPA Environmentally Preferable Purchasing (EPP) Program
http://www.epa.gov/opptintr/epp/

EPA Environmental Accounting Project
http://www.epa.gov/opptintr/acctg/

EPA Design for Environment
http://www.epa.gov/dfe/

EPA P2 Programs and Initiatives
http://www.epa.gov/opptintr/p2home/programs/index.htm

EPA P2 Resource Exchange (P2Rx)
http://www.p2rx.org/

EPA Sustainable Industry
http://www.epa.gov/sustainableindustry/

State P2 Programs
http://www.epa.gov/opptintr/p2home/resources/statep2.htm

CHAPTER 2

Getting Started

So you have decided to move from conducting specific P2 projects to having a formal P2 program. Maybe you are just trying to revive an older P2 program in your organization. In either case, this section of the *Guide* will provide you with information to consider before beginning your P2 program planning process.

HOW TO DEFINE P2

It is important to decide how you will define P2. In order to know what you can include in your P2 program, it helps to know what is possible. There are many definitions available to choose from and many programs that are closely related to P2. We will present a few P2 concepts to help you determine where you wish to focus your efforts. First, the definition of pollution prevention adopted by the U.S. Environmental Protection Agency (EPA) is provided in Box 2-1.

> **Box 2-1. Pollution Prevention Definition**
>
> *Pollution prevention* means "source reduction" (as defined under the Pollution Prevention Act) and other practices that reduce or eliminate the creation of pollutants through:
>
> - increased efficiency in the use of raw materials, energy, water, or other resources, or
> - protection of natural resources by conservation.
>
> The Pollution Prevention Act defines *source reduction* to mean any practice that:
>
> - reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal
> - reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.
>
> Under the Pollution Prevention Act, recycling, energy recovery, treatment, and disposal are not included within the definition of pollution prevention. Some practices commonly described as "in-process recycling" may qualify as pollution prevention.
>
> From Hank Habicht's EPA memorandum of May 28, 1992 (Reference 2-1)

The EPA definition stresses the importance of placing source reduction at the top of a "waste management hierarchy." Recycling, proper treatment, and safe disposal of the residues are farther down the hierarchy. There are other similar P2-like concepts that some feel compete with the EPA definition.

In order to know what you can include in your P2 program, it helps to know what is possible.

The EPA definition stresses the importance of placing source reduction at the top of a "waste management hierarchy."

The international community has adopted the term *cleaner production.* As you can see from the definition of cleaner production in Box 2-2, it has a broader meaning than the one we give to the term P2. The final term *eco-efficiency* is used extensively in the sustainable development arena and is defined in Box 2-3.

Cleaner production *is the continuous application of an integrated preventative environmental strategy applied to processes, products, and services.*

Box 2-2. Cleaner Production Definition

Cleaner production is the continuous application of an integrated preventative environmental strategy applied to processes, products, and services. It embodies the more efficient use of natural resources and thereby minimizes waste and pollution as well as risks to human health and safety. It tackles these problems at their source rather than at the end of the production process; in other words, it avoids the 'end-of-pipe' approach.

For processes, cleaner production includes conserving raw materials and energy, eliminating the use of toxic raw materials, and reducing the quantity and toxicity of all emissions and wastes.

For products, it involves reducing the negative effects of the product throughout its life-cycle, from the extraction of the raw materials through to the product's ultimate disposal.

For services, the strategy focuses on incorporating environmental concerns into designing and delivering services.

United Nations Environment Program (Reference 2-2)

Box 2-3. Eco-efficiency Definition

Eco-efficiency is the efficiency with which ecological resources are used to meet human needs. It is expressed as the ratio of an output—the value of products and services produced by a firm, a sector, or the economy as a whole—to the "input"—the sum of environmental pressures generated by the firm, sector, or economy. Measuring eco-efficiency depends on identifying indicators of both input and output.

The World Business Council for Sustainable Development (WBCSD) (Reference 2–3) considers that eco-efficiency places seven demands on a firm:

1. Reducing material intensity of goods and services
2. Reducing energy intensity of goods and services
3. Reducing toxic emissions
4. Enhancing material recyclability
5. Maximizing sustainable use of renewable resources
6. Extending product durability
7. Increasing the service intensity of goods and services

All three of these terms—pollution prevention, cleaner production, and eco-efficiency—address:

1. Elimination of process losses at the source without resorting to end-of-pipe pollution control devices.
2. Conservation of resources (including energy, materials, and water) that are used in the process or operation.

There are also some differences between these terms. For example, **eco-efficiency** looks at maximizing the sustainable use of renewable resources while **cleaner production** focuses on the more efficient use of natural resources. **P2** looks at the protection of natural resources by conservation. All of the definitions address hazards to public health and the environment and seek to reduce toxic emissions and the use of toxic raw materials. However, only cleaner production addresses the need to consider whether there is a shift in risk from the environment to worker safety as a result of changes made in the process.

Consider whether there is a shift in risk from the environment to worker safety as a result of changes made in the process.

Eco-efficiency and cleaner production address processes, products, services, and life cycle issues. P2 considers "in-process recycling" while eco-efficiency considers "enhancing material recyclability."

The authors use the term P2 throughout this *Guide.* However, you can choose to add elements of cleaner production and/or eco-efficiency to your program if you wish to do so. The definitions of these terms are provided to help you see what is possible. There are organizations already incorporating many of these additional items into their P2 programs. P2 can be defined more broadly than EPA originally intended.

The authors use the term P2 throughout this Guide. *However, you can choose to add elements of cleaner production and/or eco-efficiency to your program if you wish to do so.*

P2 can be defined more broadly than EPA originally intended.

SUSTAINABLE DEVELOPMENT

P2 plays an important role where the goal is sustainable development. There are many definitions of sustainable development. The following definitions provide broad and operational perspectives to cover the range of components that are commonly included under the sustainability umbrella. According to the World Commission on Environment and Development, "sustainable development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations." An operational definition of sustainable development is "Good stewardship of natural resources such that long-term productivity may be maintained or improved with minimal, if any, adverse impacts on the environment and worker health and safety."

P2 plays an important role where the goal is sustainable development.

If your organization is interested in a sustainable development goal, it is important to consider setting a goal of zero waste or zero emis-

Consider setting a goal of zero waste or zero emissions.

sions (Reference 2–4). For some organizations, this goal may seem unrealistic. However, many organizations reach these goals by converting previously unused wastes into other products and driving their programs to near zero waste. This zero concept is very popular in the quality movement and more particularly with a program referred to as "six sigma" (i.e., attaining the goal of only 3.4 defects per million operations instead of the 35,000 to 60,000 defects per million operations that most very competitive organizations now tolerate). This number of defects is very close to zero. Some organizations have extended the six sigma approach to regulatory compliance issues where they consider a "notice of violation" a defect. However, more progressive organizations use six sigma to *prevent* regulatory compliance issues.

INTEGRATING THE NEW P2 PROGRAM INTO CORE BUSINESS PRACTICES

Organizations considering a P2 program may already have compatible programs in place. When getting started with a P2 program, look around to see what other types of "prevention" programs already exist in the organization. Box 2-4 lists some prevention-oriented programs that currently exist in many organizations. Can the P2 program be tied to any of these or similar programs? The integration of the P2 program into existing core business practices can help small organizations find resources to start a new P2 program and large organizations consolidate existing programs, allowing each to remain competitive in the global marketplace as they implement P2.

When getting started with a P2 program, look around to see what other types of "prevention" programs already exist in the organization.

Box 2-4. Typical Prevention Programs in Industry

- Environmental management systems
- Quality management initiatives
- Preventive maintenance
- Health and safety programs
- Insurance/risk management

Environmental Management Systems

One program that may be compatible with a new or revised P2 program is an environmental management system (EMS). One popular EMS format, known as ISO 14001, has been issued by the International Organization for Standardization (Geneva, Switzerland). ISO 14001 is a management system standard, not a performance standard, providing a general framework for organizing the tasks necessary for effective environmental management. This approach may prove effective in encouraging the organization to take an active, preventive, and systematic approach to managing its environmental impacts. This *Guide* will provide some methods you can use to emphasize P2 within an EMS (see Chapter 6). An EMS protocol requires the organization to

This Guide *will provide some methods you can use to emphasize P2 within an EMS.*

consider the **prevention of pollution,** compliance with all legal requirements, and continual improvement. Like P2, an EMS seeks to integrate environmental concerns into core business practices.

Quality Initiatives

Quality initiatives focus on preventing defects in processes, products, and services. These initiatives often declare a "war on waste." However, too few also consider air emissions, water discharges, solid and hazardous wastes, and spills and leaks to be a waste. Organizations develop ISO 9000 programs to deal with quality. ISO 9000 programs are prepared in the same format as the ISO 14001 program. Quality initiatives have evolved just as P2 has been defined and refined. Many people have less than fond memories of certain management fads like "Total Quality Management (TQM)." Despite the approaches and fads that cycle in and out, most organizations would agree that quality refers to everything an organization does to provide goods and services that meet customer requirements, the way that organization's employees interact together, and the organization's expectations of its suppliers and other interested parties. Developers of P2 programs should become familiar with the quality improvement initiatives in the organization.

Quality initiatives focus on preventing defects in processes, products, and services.

Some organizations use the Baldrige criteria to judge their overall operating performance. The Malcolm Baldrige National Quality Program is the Presidential Award program in the United States (Reference 2-5). These performance-based criteria are currently used in approximately 50 countries and 44 of the 50 states to help improve competitiveness in both manufacturing and service businesses. An environmental excellence program has been developed in New Mexico using the Baldrige model. This Green Zia Program is used to rate organizational environmental programs that "go beyond mere compliance." This program (Reference 2-6) helps an organization establish core values for its program and demonstrates how quality and P2 can be effectively integrated. A set of criteria and a rigorous scoring system allow any organization to track and search for trends in its continual improvement using a unit-less score. This eliminates the need to "normalize" for production. These concepts are covered in Chapter 7.

The Baldrige criteria are currently used in approximately 50 countries and 44 of the 50 states to help improve competitiveness in both manufacturing and service businesses.

Preventive/Predictive Maintenance

Preventive and/or predictive maintenance is designed to keep machinery from breaking down. Unscheduled equipment downtime often leads to the generation of wastes in organizations. There are a number of Internet sites dedicated to the topic of preventive/predictive maintenance (Reference 2–7). The principles from this field are applicable to P2 programs.

Unscheduled equipment downtime often leads to the generation of wastes in organizations.

Safety

Many environmental managers are gaining some oversight of the safety function in their organizations. Organizations track safety closely because it impacts worker compensation rates and related insurance costs. P2 training and safety training are often combined in organizations to stress the prevention message. Safety has always had its focus on *preventing* incidents and exposures. There is information on safety available on the Internet (Reference 2-8).

Insurance/Risk Management

Insurance companies and organization risk management professionals frequently audit organization processes and facilities to prevent property loss and other forms of insurable risk. P2 programs should collaborate with risk management personnel, whether in the company or sent by the insurance company.

WHO SHOULD IMPLEMENT P2?

Many states have legislatively mandated programs that require P2 planning (Reference 2-9) while others have programs that encourage voluntary P2 planning (see the CD-ROM for further information on these statutes). The focus of most state P2 planning programs is the environmental manager. However, it is becoming clear that operational changes not commonly controlled by the environmental manager are needed to make P2 work. Recognizing this point, many organizations are establishing **multi-functional teams** to provide oversight of their waste-elimination efforts. These teams often include environment, operations, accounting, and a variety of other internal service providers and functions. Representatives from upper management are often essential members of such P2 oversight teams.

Although a commitment to the P2 program should begin with management (i.e., top-down approach), line employees can often suggest valuable improvements in operations and procedures (i.e., bottom-up approach). For maximum effectiveness, workers need to be directly involved in P2 program development. The Quality model (Chapter 7) stresses this need by dedicating one of its seven performance criteria categories to worker involvement. Many organizations use P2 tools to give everyone a common frame of reference and to enhance problem-solving and decision-making skills. Management can authorize and give responsibility to worker teams to implement the P2 program. Management should also monitor all P2 efforts periodically. Whether an organization runs a service business or operates in a manufacturing setting, it can implement a successful P2 program.

Safety has always had its focus on preventing incidents and exposures.
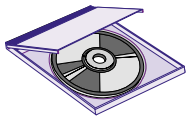
Many states have legislatively mandated programs that require P2 planning while others have programs that encourage voluntary P2 planning.

For maximum effectiveness, workers need to be directly involved in P2 program development.

WHEN WILL YOU BEGIN?

As mentioned previously, you may have already started your P2 efforts. Perhaps you have had some P2 successes and are now seeking ways to formalize and sustain the program. Maybe this is the first time you have formally looked at eliminating waste from the organization. If so, you might wish to start by preparing a list of all the projects you have implemented in the past two or three years that would fit under the heading of P2. Make sure that representatives of all parts of the organization participate in the creation of this list. As you begin to focus on P2, many organizations are able to double or triple the number of P2 projects appearing on their listing of past accomplishments. As more people get involved in P2, they may begin to recognize that they have most likely been doing some of this all along. Resolve to keep this list current and share it with regulators, customers, suppliers, community organizations, and all other interested parties. Then prepare to start your new P2 program.

As more people get involved in P2, they may begin to recognize that they have most likely been doing some of this all along.

LESSONS LEARNED FROM PAST P2 PROGRAMS

There is a substantial body of literature on P2 efforts in the United States and internationally. References to much of this P2 literature is included on the companion CD-ROM. Some of the lessons learned during those efforts specific to the preplanning phase are described in the following paragraphs.
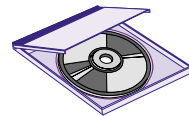
The implementation of P2 projects can yield some modest, immediate benefits. However, the big payoff from P2 often requires a program that is integrated into the operations of the organization and supported for a minimum of two to three years. Like quality, P2 is a mindset that needs to permeate into the culture of the organization. One of the greatest P2 myths is that a P2 program is a "quick fix" used to turn around organizations. Many P2 programs do not offer instant financial success. P2 is a long-term effort with *both* long- and potential short-term bottom-line benefits.

Like quality, P2 is a mindset that needs to permeate into the culture of the organization.

P2 is a long-term effort with both *long- and potential short-term bottom-line benefits.*

P2 success requires full financial support as well as management commitment. Resources that will be needed include funds, people, training, facilities, support structure, and, in some cases, the adoption of new technology. Often projects that are already funded can be turned into P2 projects by emphasizing different aspects. Other financial commitment concerns will be covered in Chapter 4.

P2 success requires full financial support as well as management commitment.

Some have said that P2 is a way of life, not a new program. P2 requires many changes in behavior that cannot be demanded. The goal of P2 is to institutionalize the philosophy and guiding principles as part of the organization. This can only be accomplished by continual actions that reinforce P2 behaviors. Since people resist change, a move to new prevention methods involves a campaign for their hearts as well as their minds.

P2 is a way of life, not a new program.

The goal of P2 is to institutionalize the philosophy and guiding principles as part of the organization.

Change occurs because people as a group accept it. Approach such change deliberately. Involve the organization's members and listen to them. Be responsive to their needs and ideas. When change represents a new work style for people, allow time to adjust to it and experiment with it. An idea approached as a pilot project may be accepted more readily than one imposed as a permanent change. You can combat resistance by surrounding the organization's members with a network of familiar activities, support, and guidance. Encourage them to feel anchored to the direction and mainstream activities of the organization.

Change management is a fundamental and critical element of P2 program implementation. Failure to develop bureaucracy-elimination initiatives, communication improvement, and training programs sends mixed signals to the employees. Empowering teams to fully implement the new P2 behaviors is central to successful change management.

Many P2 consultants and P2 technical assistance providers have tried to sell P2 as an environmental program. Your organization will probably find greater success by linking P2 to its strategic needs. Address the true scope and impact of P2 as part of managing your business needs. To increase your effectiveness, integrate the P2 program into the organization's core business practices. The business case needs to be made for all P2 projects. Success needs to be measured economically, as well as in volume and weight.

DEALING WITH CHANGE

Instituting a P2 program can facilitate change in an organization. Technical savvy and operational knowledge are not sufficient by themselves. Everyone in the organization must change to make P2 work. This will not be easy. There are seven things you should consider when you start a P2 program in your organization:

- **Present reason for change.** If you want people to change, persuade them of the need for change. This might be accomplished as part of a "war on waste" or related to issues surrounding competitive advantage. The very reasons that organizations are trying to become "lean" are the same reasons that P2 should be an integral part of that program. What is management pointing to when it seeks change? How is P2 related to that change? Moving more money to the bottom line is important in a private organization. Maintaining the same mission with fewer funds is a common cause for many not-for-profit and government organizations. Many times money has something to do with the need for change. This should make P2 very attractive.

Change management is a fundamental and critical element of P2 program implementation.

Empowering teams to fully implement the new P2 behaviors is central to successful change management.

The business case needs to be made for all P2 projects.

Instituting a P2 program can facilitate change in an organization.

Everyone in the organization must change to make P2 work.

The very reasons that organizations are trying to become "lean" are the same reasons that P2 should be an integral part of that program.

- **Offer a compelling vision.** The concept of having a P2 vision will be covered in the next chapter. Everyone will be asking, "How will things be better with the change?" All P2 projects must fit the vision and must be related to the reason for change previously stated. Finding the right vision will be challenging. However, once found, it will provide the rallying call that is often missing in a P2 program.

- **Show results quickly!** Many successful P2 programs gain momentum when economic benefits are demonstrated. P2 programs should pay for themselves. Do not measure progress by the number of activities (i.e., P2 opportunity assessments, P2 teams in action, opportunities identified, etc.) or pounds or volume of waste avoided. P2 goals are best measured in dollars—enough dollars to provide an incentive to keep the P2 program going from year to year. It could even be treated as a profit center in a private sector organization. All organizations can support value-added programs.

- **Communicate, then communicate some more.** You can never do enough to get the P2 message across to all interested parties—workers, suppliers, regulators, customers, the community, and all other interested parties. Keep the communication simple so everyone can understand what is going on. "Walk the talk" at all levels of the firm, even top management. Provide incentives for suppliers to join the program. Show the customers how the program can benefit them. Join in the regulators' voluntary programs that encourage waste reduction.

- **Build a strong, committed management P2 guiding team.** This high-level oversight team should sponsor all P2 efforts while articulating the P2 vision, fostering communication, eliminating obstacles, coaxing the short-term wins, serving as mentors to the worker P2 teams, and embedding new approaches into the organization's culture. Generally, whenever such a team is present, the P2 program has a much higher level of success. Implementation of P2 through the intervention of only vendors, consultants, and technical assistance providers reduces the chance of success. The P2 program must be internalized, continuously reinforced, and rewarded by management in order to yield long-term results.

- **Add some level of complexity to the P2 program.** This may sound counter-intuitive, but breakthrough complex change may be easier to accomplish than incremental change. Integrating P2 into core business practices instead of relegating it to environmental personnel is one way to accomplish this goal. To maximize integration, change every-

Finding the right vision will be challenging. However, once found, it will provide the rallying call that is often missing in a P2 program.

You can never do enough to get the P2 message across to all interested parties—workers, suppliers, regulators, customers, the community, and all other interested parties.

The P2 program must be internalized, continuously reinforced, and rewarded by management in order to yield long-term results.

To maximize integration, change everything at the same time.

thing at the same time. P2 should be a collaborative effort with operations department efforts to increase productivity.

- **As stated previously, people do not resist their own ideas.** Involve the organization's members in the change. Rely on outside expertise and technical assistance only to *facilitate* internal change. Provide the needed resources required to *initiate* the P2 program. People who participate in deciding what P2 changes are needed and how they will occur are more likely to support the changes and advance the program. Provide training and lessons learned to increase the success of the P2 program.

Chapter 3 will describe some of the elements that will help make the P2 program work and thrive.

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CHAPTER 3

P2 Program Elements

P2 PROGRAM PLANNING

Before planning begins, the team seeking to implement the P2 program should consider preparing a ***vision statement***, a ***mission statement***, and a ***statement of goals.*** If similar statements already exist for the organization, you should see how P2 fits into these existing statements. If the organization has no formal statements, the P2 program team may wish to draft these statements to help provide some focus to their efforts. It is important not to get side tracked on trying to differentiate between vision statements, objectives, values, purpose, guidelines, covenants, standard of performance, mission statements, core values and guiding principles. For the purposes of talking about P2 planning, we will adopt some simple definitions that can be modified as you see fit.

A vision statement represents what the organization wants in terms of P2. A mission statement identifies what the organization needs to accomplish, in the future, in the key areas that affect P2 and its business. A mission statement specifies an organization's purpose or "reason for being." It is the primary objective toward which the organization's plans should be aimed. The mission is something to be accomplished, while a vision is something to be pursued. Goals establish the metrics that will be used to measure progress. Indicators are used to measure progress along the way. These statements and measures will help provide a good foundation for the P2 plan that your organization develops. Some of these statements may already have been formulated in an ISO 14001 effort or other EMS initiative. Planning provides an organization with a time frame in which to ask questions related to the enactment of P2 programs (see Box 3-1). Considering these questions will encourage the proper thought and analysis for your planning effort.

Before planning begins, the team seeking to implement the P2 program should consider preparing a **vision statement,** *a* **mission statement,** *and a* **statement of goals.**

A vision statement represents what the organization wants in terms of P2. A mission statement identifies what the organization needs to accomplish, in the future, in the key areas that affect P2 and its business.

Goals establish the metrics that will be used to measure progress. Indicators are used to measure progress along the way.

Box 3-1. Questions to Consider During the P2 Planning Process

Where are we right now?
Where do we want to go?
How do we get there?
When do we want to arrive?
Who will get us there?
What will it cost?
How do we measure results?
Who will help accomplish the plan?
When will each goal be completed?
What are the expected results?

Vision Statement

A key component of a P2 Plan is the ***vision statement***. It provides a way of seeing or conceiving what the organization wants to achieve in the P2 program. The vision of the organization usually provides a concise word picture of the organization at some future time. This helps set the overall direction of the organization. The vision statement defines what the organization strives to be. (If you are seeking environmental excellence, the criteria described in Chapter 7 may be helpful in defining what you want to achieve.)

Sustainable development programs, like "The Natural Step," have successfully posed a vision of the future framed by four system conditions. Reviewing a vision statement from a sustainable development program such as this can help you develop a general direction, image, and philosophy to guide your organization in its P2 program.

It is difficult to find a perfect example of a vision statement. Several samples are provided so you can see how others have addressed this issue. Does your organization already have a vision statement? How would the statement change if some element of P2 or sustainable development were added to it?

Sample Vision Statements

At Olin, we sum up our commitment to achieving excellence in the realms of workplace health and safety with one phrase: The Goal is Zero. As this phrase indicates, our health and safety programs begin with the premise that no amount of workplace injuries or illnesses is acceptable. These initiatives not only make good ethical and moral sense, but they respond to what our customers demand and our communities expect. This includes operating in a safe and environmentally sound manner, practicing good product stewardship in teaching others how to safely and properly handle our products, and providing our employees with the training and resources to do the right thing.

Reference: http://www.olin.com/environment/default.asp

We are dedicated to transforming DuPont into a sustainable growth company. We will hold onto the core values that define "who we are" but reshape our portfolio as needed to achieve growth in the new global economy. We will intensify our efforts to reduce our environmental footprint by beginning the transition to renewable feedstocks and energy. We will expand our market focus and begin to understand how we can deliver the miracles of science to a much greater percentage of the world's population than we do today. And, we will strive to increase shareholder value in a way that is less "materials and energy" intensive and more "knowledge and service" intensive.

Reference: http://www.dupont.com/corp/environment/comment.html

The National Park Service strives to facilitate a culture of environmental stewardship and sustainable development.

Reference: http://es.epa.gov/oeca/fedfac/complian/emsrcemp.pdf

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> The USPS is committed to conducting all of its activities in a way that protects human health and the environment.
>
> In establishing environmental policies and practices the USPS will, as appropriate, promote the sustainable use of natural resources and protection of the environment through conservation, recycling, and reuse of material in its own operations.
>
> The USPS encourages the use of non-polluting technologies and waste minimization in the development of equipment, products, and operations. Awareness of environmental responsibilities and adherence to sound environmental practices is encouraged.
>
> Reference: http://www.usps.gov/environ/textmirr/webpages/envco.htm#INTRO

Mission Statement

The second component of a P2 plan is the ***mission statement***. This statement needs to "send forth" the people in an organization to take P2 actions that will accomplish the vision statement. A good mission statement should include all of the essential components of an organization's future thrust and communicate a positive feeling that will guide others to action. Think of the mission statement as providing the overriding purpose of P2 in the organization. An effective statement should explain how P2 could be integrated into other business initiatives.

As with the vision statements above, there are many ways to express an organization's mission. Some examples are provided here to help your organization begin the task of preparing a mission statement. If your organization already has a mission statement, how would it change with some P2 or sustainable development clauses added to it? Does the P2 program 's mission reflect the mission of the organization as a whole?

The second component of a P2 plan is the **mission statement**. *This statement needs to "send forth" the people in an organization to take P2 actions that will accomplish the vision statement.*

Think of the mission statement as providing the overriding purpose of P2 in the organization. An effective statement should explain how P2 could be integrated into other business initiatives.

Sample Mission Statements

The Environment, Health, and Safety Program will be implemented and maintained and will provide reasonable assurance that the corporation

- complies with all applicable governmental and internal health, safety, and environmental requirements.
- operates plants and facilities in a manner that protects the environment and the health and safety of its employees and the public.
- develops and produces products that can be manufactured, transported, used, and disposed of safely.
- recognizes and responds to community concerns about chemicals and our operations.
- makes health, safety, and environmental considerations a priority in planning for all existing and new products and processes.
- reports promptly to officials, employees, customers, and the public information on health or environmental hazards, and recommends protective measures.

- counsels customers on the safe use, transportation, and disposal of chemical products.
- extends knowledge by conducting or supporting research on the health, safety, and environmental effects of products, processes, and waste materials.
- works with others to resolve problems created by past handling and disposal of hazardous substances.
- participates with government and others to create responsible laws, regulations, and standards to safeguard the community, workplace, and environment.
- promotes the principles and practices of Responsible Care by sharing experiences and offering assistance to others who produce, handle, use, transport, or dispose of chemicals.

Reference: http://www.unioncarbide.com/respcare/1998/whoweare.html

We affirm to all our stakeholders, including our employees, customers, shareholders and the public, that we will conduct our business with respect and care for the environment. We will implement those strategies that build successful businesses and achieve the greatest benefit for all our stakeholders without compromising the ability of future generations to meet their needs.

We will continuously improve our practices in light of advances in technology and new understandings in safety, health and environmental science. We will make consistent, measurable progress in implementing this Commitment throughout our worldwide operations. DuPont supports the chemical industry's Responsible Care® and the oil industry's Strategies for Today's Environmental Partnership as key programs to achieve this Commitment.

Reference: http://www.dupont.com/corp/environment/commitment.html

Statement of Goals

The third basic component of a P2 plan is the ***statement of goals***. Goals are specific statements that express where the organization wishes to go within a specific time period (e.g., this financial quarter). The quantitative measures used are absolute. Goals can be defined in action plans prepared to help implement the P2 program. Action plans are discussed in Chapter 4. Setting goals and objectives in a P2 program are also addressed in Chapter 6.

Goals can be defined in action plans prepared to help implement the P2 program.

Many P2 programs state quantitative and specific goals of both a short-term and long-term nature. Sometimes the goals are set during the initial planning period of the P2 program. In other cases, the goals are to be set after much more information has been gathered and analyzed. Once the goals are set, it is important to measure their progress over time.

Some quality experts feel that goals actually tend to hold an organization back because no one ever tries to exceed the goals by a significant amount. These people have suggested that organizations constantly measure their continual improvement effort in specific areas.

Indicators

During the planning stage, many organizations start considering the use of **indicators**. An indicator is a metric that helps you understand where you are, which way you are going, and how far you are from where you want to be. Indicators can be based at the organizational level (e.g., environmental training hours per worker, conservation of resources, reduction in emissions, good housekeeping, operational and maintenance practices) or at the government level (e.g., area-wide greenhouse gas concentrations, biodiversity in major rivers, acres of trees impacted by acid rain). Indicators are used to express the outcomes of the performance improvements that are made in the P2 program and are further covered in the "results" section of the quality model presented in Chapter 7. These environmental results actually link the performance indicators with the cost to and benefits for the organization.

An indicator is a metric that helps you understand where you are, which way you are going, and how far you are from where you want to be.

Sustainable development programs use indicators that link economy, environment, and the community. The element of community represents both workers and the other *interested* parties associated with the organization. Examples of indicators are given in Box 3-2 (Reference 3-1).

Sustainable development programs use indicators that link economy, environment, and the community.

Box 3-2. Examples of Indicators

- Number of people going to clinics for respiratory problems
- Ratio of renewable to non-renewable energy consumption
- Public awareness of hazardous materials/waste issues as measured by annual survey
- Tons of waste landfilled annually
- Recycling rate as a percentage of material generated
- Percentage of residents, businesses, and institutions that participate in recycling programs
- Recycled water use
- Mass of pollutants in wastewater
- Number of enterprises adopting ISO 14001 standards
- Number of hazardous materials incidents
- Number of schools that integrate and progressively update environmental education in their curricula
- Number of organizations with formal pollution prevention plans

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These components of the P2 plan help determine the strategy of the organization's P2 program. The strategy or actions decided upon reflect the way the organization plans to achieve its objectives and goals. Organizations should develop strategies for every goal that it plans to implement. A good way to develop these strategies is by preparing an action plan. This tool and other tools useful in implementing P2 programs are discussed in Chapters 6 and 7.

Organizations should develop strategies for every goal that it plans to implement. A good way to develop these strategies is by preparing an action plan.

CORE VALUES

Because the P2 program deals with change in the organization, it is essential that you express the core values that must be achieved as

you integrate key business requirements within a results-orientated P2 framework. These core values are also referred to as **_guiding principles_**. They will help bridge the gap between the various components discussed previously by identifying the fundamental, underlying beliefs that guide the actions within the organization. All organizations have a set of core values, although in some cases they do not exist in written form.

Each element of the organization's P2 program should link itself with the organization's core values.

Each element of the organization's P2 program should link itself with the organization's core values. Certainly, there are no prescriptive ways to do this. Each organization must approach these core values in a manner that fits the local organizational culture.

Following are examples of several core values that could be reflected in a P2 program. Paying particular attention to how these core values relate to the organization's core values is a very important component of a P2 program (References 3-2, 3-3).

Interested-Party–Driven P2

This core value recognizes what various interested parties would like to gain from a P2 program and ensures to it that they get what they want.

This core value recognizes what various interested parties would like to gain from a P2 program and ensures that they get what they want. If P2 saves money, managers and shareholders will support it. If P2 helps an organization stay in compliance, regulators will support it. If P2 helps improve working conditions, employees will support it.

A P2 program should work to build trust, confidence, and loyalty by not just meeting interested party requirements, but going the extra distance to reduce waste and conserve resources.

By comparing your program with other P2 programs, your organization's commitment to P2 and sustainability can be differentiated from that of the competition.

By comparing your program with other P2 programs, your organization's commitment to P2 and sustainability can be differentiated from that of the competition. This unique focus, which probably fits well within your organization's culture, should leave the interested parties delighted—not just satisfied—by the P2 program.

Interested Parties Include:

- Customers
- Employees
- Suppliers
- Regulators
- Public groups and non-government organizations (NGOs)
- Community Groups

Leadership

All senior leaders in the organization must create an interested-party orientation. They must set clear and visible P2 values and have

high expectations. These values and expectations are reinforced by a substantial personal commitment to the P2 program. Leaders should serve as role models throughout the organization, thus reinforcing the P2 core values at all levels. In other words, they should "walk the talk." Management must have active, visible leadership roles in the ongoing strategic planning process to incorporate P2 into all business functions. Leadership's commitment to environmental performance is demonstrated through consistent decisions on resource allocations such as money and employees for P2 program implementation and evaluation. If the P2 program is perceived as just another environmental initiative, this leadership core value cannot be realized.

Continual Improvement

Every organization must strive for continual improvement. The organization should also have a commitment to the continual elimination and reduction of waste. These goals can be accomplished by encouraging creativity, maintaining a continual improvement environment, and recognizing and rewarding employees for doing a good job. Employees at all levels and in all areas of the organization should be actively involved and contribute ideas for P2 and P2 program improvement.

The P2 program cannot be oriented to simply completing individual P2 projects. It must take the knowledge gained and use it to address other P2 opportunities. This use of "lessons learned" fosters continual improvement. The P2 program must always strive for zero waste, zero emissions, and conservation of all resources. Zero is where continual improvement should strive to be.

Valuing Employees

An organization's P2 success depends increasingly on the knowledge, skills, innovative creativity, and motivation of its workforce. Employee success depends increasingly on being given opportunities to learn and practice new skills. Organizations need to invest in the development of their workforces through education, training, and opportunities for continuing growth. Such opportunities include enhanced P2 awareness and rewards for demonstrated P2 knowledge and skills. On-the-job training offers a cost-effective way to train and better link P2 training to work processes. Education and training programs may need to utilize advanced technologies, such as computer-based learning and satellite broadcasts. Increasingly, training, development, and work units need to be tailored to a diverse workforce and to more flexible, high performance P2 work practices. These items will prepare employees and the organization for success.

Designing Quality and Prevention Together

By building quality into products and services in the production process, an organization reduces the need to correct problems downstream. This mind-set leads to prevention rather than detection. A P2 program provides an effective process for evaluating, planning, and controlling changes to existing products and the design of new products that would generate less waste in the production process and at the end of their useful life.

For years, P2 technical assistance providers have recognized the importance of design as a means of P2 progress through a concept called "Design for Environment." However, instead of handling this as a separate initiative, the need for design changes must infuse all P2 activities as a core value. Successful organizations charge their P2 multifunction teams with the responsibility for creating high-quality products that are inexpensive to manufacture while using fewer toxic materials and generating less waste. Whenever possible, these organizations involve key suppliers at an early stage of the new product development in order to determine the types and constituents of wastes, and to address potential health and safety issues. Many quality philosophies work very well in P2 programs.

Long-Range Outlook

To achieve P2 goals, organizations must make long-term commitments to all interested parties—customers, employees, suppliers, regulators, shareholders, the public, and the community. To develop a long-range outlook, an organization must anticipate many types of change, including:

- Strategic moves by competitors
- Evolving regulatory requirements
- Technological developments
- Stakeholder expectations
- Community expectations

Management by Fact

Many organizations rely on anecdotal information to indicate their progress. In the P2 field, mountains of case histories feed this tendency.

By contrast, management relies on specific, measurable data. The P2 feedback system must be built on objective data and analysis, all of which are quantitative and can be charted over time. Most of this information can be gathered quite easily, with no need for sophisticated statistical techniques. The information needs to be comprehensive and timely enough for all levels of workers to understand the current performance of the P2 program.

A P2 program provides an effective process for evaluating, planning, and controlling changes to existing products and the design of new products that would generate less waste in the production process and at the end of their useful life.

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The P2 feedback system must be built on objective data and analysis, all of which are quantitative and can be charted over time.

The information needs to be comprehensive and timely enough for all levels of workers to understand the current performance of the P2 program.

When an organization has this information, it has positioned itself to monitor its progress efficiently. It can then compare its performance to that of competitive or benchmarked organizations and evaluate its P2 action.

Partnership Development

Successful organizations build internal and external partnerships to help them accomplish their overall P2 goals. Examples of internal partnerships include better labor-management cooperation, employee development, cross-training, and the creation of worker P2 teams. Some organizations have concerted training programs and active employee involvement. This engenders good communication between management and workers. Employee involvement needs should be assessed often to ensure that sufficient resources are provided to assist these programs in their P2 efforts.

Successful organizations build internal and external partnerships to help them accomplish their overall P2 goals.

External partnerships include cooperation with customers, suppliers, regulators, and other outside organizations and interested parties. For example, hotels and hospitals can create partnerships to improve their similar work processes and benchmark their gains with each other. Many trade associations have created partnerships for P2 best practices. Strong partnerships with key suppliers that are mutually beneficial can improve cost competitiveness, quality, and overall responsiveness, as well as minimize toxics use and waste. Key suppliers can participate in the development and design of shipping and packaging materials that incorporate good ergonomics and reduce or eliminate other wastes. It is helpful for the external partners to have a financial or other stake in the achievement of the organization's goals for the P2 program.

External partnerships include cooperation with customers, suppliers, regulators, and other outside organizations and interested parties.

Corporate Responsibility and Citizenship

Successful organizations always address their corporate and citizenship responsibilities. Corporate responsibility refers to the basic expectations of the organization and includes business ethics and the protection of public health, safety, and the environment. Corporate citizenship refers to the leadership and support of publicly important purposes, such as education, environmental excellence, improved industry and business practices, and the sharing of nonproprietary P2-related information. Leadership as a corporate citizen also entails influencing other organizations, private and public, to partner for these purposes.

Corporate citizenship refers to the leadership and support of publicly important purposes, such as education, environmental excellence, improved industry and business practices, and the sharing of nonproprietary P2-related information.

Fast Response

Permits and regulatory compliance often add significant time to organizational decision-making. Success in globally competitive markets demands ever-shorter cycles for introductions of new or improved

products and services. Also, a faster and more flexible response to interested parties is now a more critical requirement. Major improvements in response time often require simplification of work units and processes together with timely incorporation of P2 into the design phase (e.g., design for environment). To accomplish this, the P2 performance of work processes should be among the key process measures. Other important benefits can be derived from this focus on time. Time improvements often drive simultaneous improvements in organization, quality, P2, cost, and productivity. Hence, it is beneficial to integrate response time, quality, P2, and productivity objectives.

SELECTING PROGRAM ELEMENTS

P2 programs are composed of a number of program elements. Different organizations often mix and match these elements to construct a program that meets the intent of their P2 vision. A number of states have enacted P2 planning legislation. These acts contain a wide variety of different planning components. More information can be found on the CD-ROM that accompanies this *Guide*. In 1989, the EPA specified six program action elements that should be considered for organizations seeking to prepare waste minimization programs as required by the Resource Conservation and Recovery Act (RCRA). (See 54 *Federal Register* 25056–25057) This guidance was finalized on May 28, 1993 (58 *Federal Register* 31114-31120). All organizations generating hazardous waste in the United States must certify on their manifest forms that they have a program in place that meets these requirements. These six program elements are:
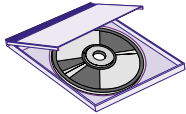
1. Provide top management support
2. Characterize the process
3. Perform periodic assessments
4. Maintain a cost allocation system
5. Encourage technology transfer
6. Conduct program evaluations

Let's take a brief look at each of these elements. Keep in mind that individual organizations may include additional elements in their P2 programs for their own purposes or to comply with state P2 planning requirements. The number of elements used and the degree to which each element is stressed should be a function of the group implementing the P2 program in each organization.

1. Provide Top Management Support

Top management support is essential for ensuring that P2 becomes an organizational goal. You will remember that leadership is considered to be an important core value. Most articles written on quality programs list upper-level management support as the single most im-

P2 programs are composed of a number of program elements. Different organizations often mix and match these elements to construct a program that meets the intent of their P2 vision.

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portant program element. Management should encourage employees at all levels of the organization to identify opportunities to reduce waste generation and promote energy and water conservation. Management should also encourage employees to adopt the P2 philosophy in day-to-day operations and identify new opportunities at meetings and other organizational functions. P2 should be a process of continual improvement when incorporated into an organization's policy. Ideally, a P2 program should become an integral part of management's strategic plan to increase productivity and quality.

Some techniques top management can use to demonstrate their support are:

- Serve on the P2 oversight committee and be active in approving strategic P2 goals.
- Include P2 goals in business planning efforts that are independent of the environmental program. Integration into core business practice is key to the long-term viability of P2 efforts.
- Revise the compensation/merit system to recognize P2 contributions.
- Ensure that P2 action plans with measurable goals be put in writing.
- Commit the organization to implementing P2 action plans.
- Provide training for all employees on how resource use and production losses result from wasteful work processes.
- Publicize P2 results.

2. Characterize the Process and Assess P2 Opportunities

Some P2 assessments focus on wastes being generated by a facility's main processes. In contrast, process characterization leads to the identification of all P2 opportunities (including those in related ancillary and intermittent operations), not just the ones uncovered in a limited P2 assessment or walk-through. Both resource use and loss are considered.

An effective way to conduct process characterization is through the use of hierarchical process maps. These maps (see Chapter 4) can be used to analyze all processes, including ancillary and intermittent operations. An organization using this assessment method can also examine energy and water use, landscaping, commuting, noise, odor, and other aspects of their operations. These process maps can also be used as templates for collecting information on resource use and the loss of resources, with the information organized by work step. Some organizations use process maps as a means for maintaining a resource use and loss accounting system to track the types and amounts of resources involved, including the rates and dates they are used or lost.

Process characterization leads to the identification of all P2 opportunities (including those in related ancillary and intermittent operations), not just the ones uncovered in a limited P2 assessment or walk-through.

Process maps can also be used to assess the costs of resource use by work step. These costs can then be used to rank order opportunities for P2 and charge back the costs to the processes and products that are responsible for creating the waste—a sort of internal "polluter pays" principle. It is very important to focus not on the wastes, but rather on the processes and products that are responsible for them. Every resource used in a process represents an opportunity to conserve the use of that resource, and every loss or waste from a process represents an opportunity not to generate that loss or waste.

3. Perform Periodic P2 Assessments

In the Systems Approach, P2 assessments are used to verify and update process maps. As each P2 opportunity is examined, a P2 assessment can be used to gather new information (including cost data) necessary to support the use of other Systems Approach problem-solving and decision-making tools.

The organization should decide the best method to use for performing P2 assessments and related data gathering. Once this is decided, individual processes and procedures should be reviewed periodically. In some cases, performing complete resources balances for some work steps in the process maps can be helpful. P2 assessment teams can revisit existing process maps or prepare new ones. Process maps from the main process can be linked to process maps of related ancillary and intermittent operations that support these processes. Process maps can be prepared for different products or families of products. The end goal may be to have a complete "book of process maps" after a number of years of periodic P2 assessments.

True costs associated with resource use and loss will change over time. Periodic P2 assessments can be used to update the cost information in the process map templates. Many organizations track resources used and lost by a variety of means and then normalize the results to account for variations in production rates. Each organization should find the best method to account for the true costs of resource use and loss in its operations.

Analyzing the cost and benefits of each P2 opportunity is an important process, especially when the true costs of managing environmental wastes, discharges, and emissions are considered. Organizations should establish a good method for selecting P2 opportunities to include in the P2 program each year. Assessments should support and invigorate a P2 program. They should not be the basis upon which the P2 program is built.

4. Maintain a Cost Allocation System

The EPA suggests that organizations track all the costs associated with resource use and loss and charge them back to the pro-

cesses and products responsible for these costs instead of assigning them to facility overhead. These costs include those that flow from the general ledger, the cost of resources lost in the waste itself, and the activity-based costs of managing the losses. When all these categories are included, it is not uncommon for a company's waste costs to be increased by three to five times.

Not all processes and products use and lose resources equally. Ideally, each product should bear the burden of all the environmental, health, and safety services that it uses. Managers are encouraged to utilize accounting systems that generate valid product costs, reflecting the true costs involved in producing and delivering the organization's products and ensuring proper environmental management of resources, wastes, emissions, and discharges. This is good business because it will avoid putting an unfair overhead burden on cleaner products; such products can then be sold for less money or as "premium" products.

The limitations of traditional performance measurements, particularly those methods related to overhead allocation, can produce misleading or incorrect information. Whenever possible, accounting procedures and paperwork should be simplified, eliminating non-value adding activities while providing accurate information for decision-making and audit requirements. They should also be consistent. Financial personnel, for example, should be using the same source data as other personnel. Managerial accounting methods can be used like project management methods in most organizations. Such information can be reconciled on a periodic basis as it is allocated to products and families of products. Further information on environmental accounting can be found on the CD-ROM.
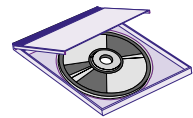
5. Encourage Technology Transfer

It is important for an organization to seek or exchange technical information on P2 from other parts of the organization, other companies, trade associations, professional associations, consultants, vendors, and university or government technical assistance programs. A considerable amount of time, effort, and taxpayer money has already been invested by public technical assistance programs and universities to research P2 alternatives for specific industries and processes. Although it is risky to use this information as a "silver bullet" for the P2 problems faced by any particular organization, the information does offer some potential technology options that facilities can consider when they generate and prioritize P2 alternatives.

Organizations are encouraged to share the nonproprietary knowledge they have gained in their P2 programs through trade associations and other information clearinghouses. Many P2 award programs require the participants to share the information that was submitted in the application for the award.

The EPA suggests that organizations track all the costs associated with resource use and loss and charge them back to the processes and products responsible for these costs instead of assigning them to facility overhead.

Not all processes and products use and lose resources equally. Ideally, each product should bear the burden of all the environmental, health, and safety services that it uses.

It is important for an organization to seek or exchange technical information on P2 from other parts of the organization, other companies, trade associations, professional associations, consultants, vendors, and university or government technical assistance programs.

Organizations are encouraged to share the nonproprietary knowledge they have gained in their P2 programs.

6. Conduct Program Evaluations

Organizations should implement any cost-effective recommendations identified by their P2 program planning efforts. They are encouraged to conduct periodic evaluations of P2 program effectiveness to provide feedback and to identify potential areas for improvement.

Organizations should implement any cost-effective recommendations identified by their P2 program planning efforts. They are encouraged to conduct periodic evaluations of P2 program effectiveness to provide feedback and to identify potential areas for improvement. During the evaluation, it is important to determine what was learned from each P2 activity and how that information will be utilized in constructing P2 action plans for the coming year. P2 programs can also be benchmarked against others. Reviews can be conducted internally or performed with an independent third party. Many companies now accept the practice of using third-party individuals because they already are employing them in their ISO 9000 and ISO 14001 programs. The quality model (see Chapter 7) also offers a way to measure progress made by a P2 program and have it scored by an independent team of trained examiners.

Other Program Elements

There may also be other elements that can be included in the program. For example, the American Chemistry Council's (ACC) Responsible Care® Program has a "Pollution Prevention Code of Management Practices" (Reference 3-4). One of the items required in this program is: "Inclusion of waste and release prevention objectives in research and in design of new or modified facilities, processes, and products." The National Pollution Prevention Roundtable has published a white paper on facility pollution prevention planning (Reference 3-5) that could also be helpful in finding other P2 program elements.

The ACC's P2 Code states that each member company shall have a P2 program that shall include the following:

1. "A clear commitment by senior management through policy, communications, and resources to ongoing reductions at each of the company's facilities in releases to the air, water, and land, and in the generation of wastes.
2. A quantitative inventory at each facility of wastes generated and releases to the air, water, and land, measured or estimated at the point of generation or release.
3. Evaluation, sufficient to assist in establishing reduction priorities, of the potential impact of releases on the environment and the health and safety of employees and the public.
4. Education of, and dialogue with, employees and members of the public about the inventory, impact evaluation, and risks to the community.
5. Establishment of priorities, goals, and plans for waste and release reduction, taking into account both community concerns and the potential health, safety, and environmental impacts as determined under Practices 3 and 4.

6. Ongoing reduction of wastes and releases, giving preference first to source reduction, second to recycle/reuse, and third to treatment. These techniques may be used separately or in combination with one another.

7. Measurement of progress at each facility in reducing the generation of wastes and in reducing releases to the air, water, and land by updating the quantitative inventory at least annually.

8. Ongoing dialogue with employees and members of the public regarding waste and release information, progress in achieving reductions, and future plans. This dialogue should be at a personal, face-to-face level where possible, and should emphasize listening to others and discussing their concerns and ideas.

9. Inclusion of waste and release prevention objectives in research and in design of new or modified facilities, processes, and products.

10. An ongoing program for promotion and support of waste and release reduction by others, which may, for example, include:

    a) sharing of technical information and experience with customers and suppliers.

    b) support of efforts to develop improved waste and release reduction techniques.

    c) assisting in establishment of regional air monitoring networks.

    d) participation in efforts to develop consensus approaches to the evaluation of environmental, health, and safety impacts of releases.

    e) providing educational workshops and training materials.

    f) assisting local governments and others in establishment of waste reduction programs benefiting the general public.

11. Periodic evaluation of waste management practices associated with operations and equipment at each member company facility, taking into account community concerns and health, safety, and environmental impacts and implementation of ongoing improvements.

12. Implementation of a process for selecting, retaining, and reviewing contractors and toll manufacturers taking into account sound waste management practices that protect the environment and the health and safety of employees and the public.

13. Implementation of engineering and operating controls at each member company facility to improve prevention and early detection of releases that may contaminate groundwater.

14. Implementation of an ongoing program for addressing past operating and waste management practices and for working with others to resolve identified problems at each active or inactive facility owned by a member company taking into account community concerns and health, safety, and environmental impacts."

LESSONS LEARNED

The creation and maintenance of a P2 Program necessitates an overall plan. P2 does not just happen. To be truly successful, P2 requires a systematic, integrated, consistent, organization-wide approach. This approach can be achieved through comprehensive P2 planning. A clear and understandable vision that can be made real by the organization is of primary importance for success in the program. Without a mission, the organization can have difficulty moving toward success. Everyone in the organization must see how he or she can contribute to P2 success. Top leadership must begin to understand the P2 philosophy and the application of the core values. Many times P2 starts with the individual efforts of a "champion." It may catch on with a particular process area or product group. To have it take hold organizationally, a P2 planning effort is required.

To be truly successful, P2 requires a systematic, integrated, consistent, organization-wide approach. This approach can be achieved through comprehensive P2 planning.

P2 often requires the development of awareness to accomplish the improvement effort. The building of awareness can come from training. Such training can be accomplished in a formal setting or on the job. Some larger organizations have trained facilitators on staff who work with the members of a team, managers as well as workers, as they address each specific improvement effort. Smaller companies rely on the use of P2 technical assistance providers to facilitate these efforts with on the job training assistance and other guidance. No matter how it is accomplished, the training, either formal or informal, must be effective and timely, and pursued continuously.

P2 often requires the development of awareness to accomplish the improvement effort.

Within an organization, informal groups have their own leaders and "rules" that determine, for example, the pace of work or the relationship with the top management. If the informal organization and its leaders accept a proposed change, events will proceed more smoothly; if they oppose it, change may be nearly impossible. Identify these informal group leaders. Get to know them and spend time listening to their opinions and perspective. When you understand their needs and concerns, you will better understand how the P2 changes you seek can be implemented more effectively.

Although you can learn from others' P2 success stories, real P2 success comes from the persistent application of the P2 philosophy and core values in each organization's specific environment.

Although you can learn from others' P2 success stories, real P2 success comes from the persistent application of the P2 philosophy and core values in each organization's specific environment. Success is measured differently in each organization. It cannot be achieved by simply copying others.

When you tailor the P2 program to your organization's vision, mission, and goals, you speed its acceptance by the members of the organization. The P2 program's overall success will be ensured.

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       2001Green_Zia_Criteria.pdf

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3-4.   American Chemistry Councils Responsible Care® Web Site
       http://www.americanchemistry.com

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       Paper on Facility Planning
       http://www.p2.org/inforesources/facil-pl.html

CHAPTER 4

P2 Tools

USING P2 TOOLS

P2 teams can use a variety of specialized tools to get their work accomplished. These tools provide visual aids that are essential in communicating P2 information to management, workers, and other interested parties. Tools also help P2 teams gather information and provide problem-solving and decision-making guidance to the P2 team. Finally, by using specialized tools, the P2 team can construct an action plan for each project covered by the program. This plan allows for consistent tracking by the P2 oversight committee.

There is an endless variety of different problem-solving and decision-making tools available. Most of these tools have been used throughout the world in a variety of quality programs for more than 50 years. Only in the past 10 years or so have they been applied to P2 projects. Many small organizations have learned these tools by using the Environmental Justice manual entitled, *Nothing to Waste* (Reference 4-1). Larger organizations have often learned the tools through the various types of quality programs that have come and gone over the years. The problem is that environmental managers are often unfamiliar with such tools. This is beginning to change as more organizations seek to integrate environmental programs into their core business practices. This integration effort helps align the ways problems are addressed and solved within the organization. Keeping the P2 program independent of mainstream operations activities may limit the program's efficiency and effectiveness.

SYSTEMS APPROACH TOOLS

An organization acts as a *system* that functions as a whole through the interaction of its parts. The Systems Approach looks at the whole organization, and the parts, and the connections between the parts. The functionality of the parts depend on how they are connected, rather than what they are. The parts of a system are all connected directly or indirectly. Therefore, a change in one part affects all the other parts. Given this interdependence, tools that address the complexity of organizations are important. There are several reasons why the Systems Approach tools meet this need and work so well in the planning and implementation of your P2 program.

First, processes that use resources and generate wastes do not always provide synoptic information clearly suited for checklist-style presentation. Instead, these processes are more than likely intertwined with other situations such as emotional distress or political issues that

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Includes:
- ☐ Using P2 Tools
- ☐ Systems Approach Tools
- ☐ Checklists
- ☐ Lessons Learned
- ☐ References

Specialized tools provide visual aids that are essential in communicating P2 information to management, workers, and other interested parties. Tools also help P2 teams gather information and provide problem-solving and decision-making guidance to the P2 team.

The Systems Approach looks at the whole organization, and the parts, and the connections between the parts.

arise within the organization—which in turn may stem from some difficulty with the way things work (or don't work). Because of these entanglements, too much time and energy may be spent trying to understand the situation before ever getting on to the problem-solving stage. Systems Approach tools can help.

The Systems Approach tools cut through such situations. They facilitate problem solving by allowing the workers to understand why a regulated or expensive resource is being used or a waste is being generated. These tools point out how things can be changed to conserve the use of that resource or prevent the waste from occurring. This is fundamentally different from having the environmental coordinator or external assistance provider suggest a way to change the process without involving the workers in decision-making.

The Systems Approach relies on intra-organizational teams, not individual experts, to make decisions. It requires team members to analyze a resource or waste problem thoroughly, determine the underlying root cause, and generate possible alternatives. Based on this, the problem solvers can make an objective, rational, comparative evaluation. This is not to say that the team should not use the proper expertise as a resource to their work. It should. However, responsibility for decision-making should rest in the hands of team members who will implement and evaluate the proposed measures.

Because the Systems Approach is interactive and based on workers' own decision-making efforts, team members feel they "own" a portion of the analysis. Of course, employees have preferences and different points of view, and because the Systems Approach tools are "team-friendly," they allow for this. This involvement is important because an answer imposed from outside is less likely to work than one arrived at within the organization.

Another consideration is the overall management process in the organization. It is important to identify the process-related reasons for resource use and loss before you can convince a manager to change the process to avoid them. In this context, the Systems Approach provides management with a reasonably accurate profile of process problems. It makes clear that, unless the problems are corrected, these and similar problems are likely to recur. Effective planning, including the revision of current strategies and policies, benefits from the use of the Systems Approach.

Checklists do have a place in P2 programs. Throughout the Systems Approach, it is useful to make lists of questions and answers for anything related to each of the tools. Such lists form an outline of the entire problem situation and are important entries in any record of the process. Some sample checklists can be found on the CD-ROM that accompanies this *Guide.*

Using the Systems Approach Tools

Many organizations are finding they have to adapt to survive in the global economy. Managers are learning new ways to run their organizations, and workers are learning how to contribute their knowledge to improving processes. By learning how to monitor, control, and constantly improve production and various supporting systems, organizations are better able to provide their customers and other interested parties with what they want, when and how they want it. These business practices lead to better decisions for the interested parties and for the organization—workers and managers alike.

The principles of quality improvement can be useful tools for achieving environmental excellence. Just as defect prevention is better than the "find and fix" approach to quality control, P2 is preferable to "end-of-pipe" control. The application of the quality improvement tools used by the Systems Approach is a powerful force in eliminating environmental inefficiencies and preventing pollution.

The application of the quality improvement tools used by the Systems Approach is a powerful force in eliminating environmental inefficiencies and preventing pollution.

Process Mapping

Getting to know more about the uses and losses of resources in a process and clarifying all that you already know are the two basic tasks of process characterization. These tasks involve information gathering, listing, sorting, and comparing.

Process characterization is the step where the bulk of your learning about the process takes place. This is where your existing systems knowledge regarding the process is revealed and organized and where new knowledge comes easily because the process-mapping tool makes all process relationships "visible." You will find that you no longer need to restrict yourself to the main process. It is now possible to look at all supporting operations—both ancillary and intermittent—to see how they impact the main process.

Process characterization is where your existing systems knowledge regarding the process is revealed and organized and where new knowledge comes easily because the process-mapping tool makes all process relationships "visible."

Consider that every time a laboratory sample is taken to monitor a process, the laboratory creates a waste. This waste could be prevented if the sample were not taken in the first place. Of course, some monitoring is necessary and perhaps even required. This circumstance presents an opportunity to improve the efficiency of the monitoring process. Maybe you could make an argument to the regulatory agency for less monitoring based on your organization's compliance record. For example, the use of sensors for continuous monitoring would offer an alternative to traditional "grab" samples. An argument could be made and supported by the P2 program to change the sampling, thereby reducing the wastes produced in the laboratory.

Process characterization makes P2 opportunities visible. Worksheets probably do not do this effectively. Diagrams are often a better tool. Connections between all work steps help clarify the causes
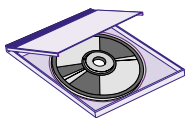
Connections between all work steps help clarify the causes for resource use and waste generation.

for resource use and waste generation. Every use of a resource in a process represents an opportunity to conserve the use of that resource. Every loss of a resource in a process represents an opportunity to avoid that loss. Taking advantage of these opportunities benefits everyone in the organization. The discovery, correction, and prevention of waste generation should be the responsibility of everyone in the organization.

An effective means to characterize processes is with a hierarchical process map (Figure 4-1). In most organizations, process documentation is typically organized into categories such as company, facility, product line, and department. Much process documentation is then carefully filed away in reports or databases that most people do not review on a regular basis. This information may take the form of process flow diagrams, flow charts, value stream maps, process and instrumentation diagrams, machine configurations, arrow diagrams, box diagrams, floor plans, or other schematic depictions. All of these process characterizations suffer from complexity—too many objects on a single page.

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It has been widely recognized that most people can only "see" up to six objects at a time and comprehend visually what they mean. Hierarchical process maps allow only three to six objects on a page.

It has been widely recognized that most people can only "see" up to six objects at a time and comprehend visually what they mean. Hierarchical process maps (Reference 4-2) allow only three to six objects on a page. The entire process must be depicted in three to six boxes. Sub-processes can be used to provide detail at the next level but are also restricted to the three-to-six-box rule. The assemblage process steps constitutes a node tree which establishes the relationship and connections between the work steps at each level. In a Systems Approach, every work step is connected to every other work step in this diagram, which depicts the entire *system.* There are two very important rules associated with process mapping:

The assemblage process steps constitutes a node tree which establishes the relationship and connections between the work steps at each level. In a Systems Approach, every work step is connected to every other work step in this diagram, which depicts the entire system.

1. The process maps must help the P2 team understand the process better than they could through other means.
2. These same process maps must help the P2 team communicate what they plan to accomplish to management and other interested parties.

Figure 4-2 shows examples of process maps. You can find other examples of process maps on the CD-ROM accompanying this *Guide*.

Using Maps as a Template

Some organizations think of a process as a single box with its inputs and outputs. Using this model, it is difficult to change an entire process to make P2 happen. By using the process map as a template, process documentation can be organized by, and linked to, individual work steps in the process at the lowest level. All standard operating procedures (SOPs), best management practices (BMPs), regulations,
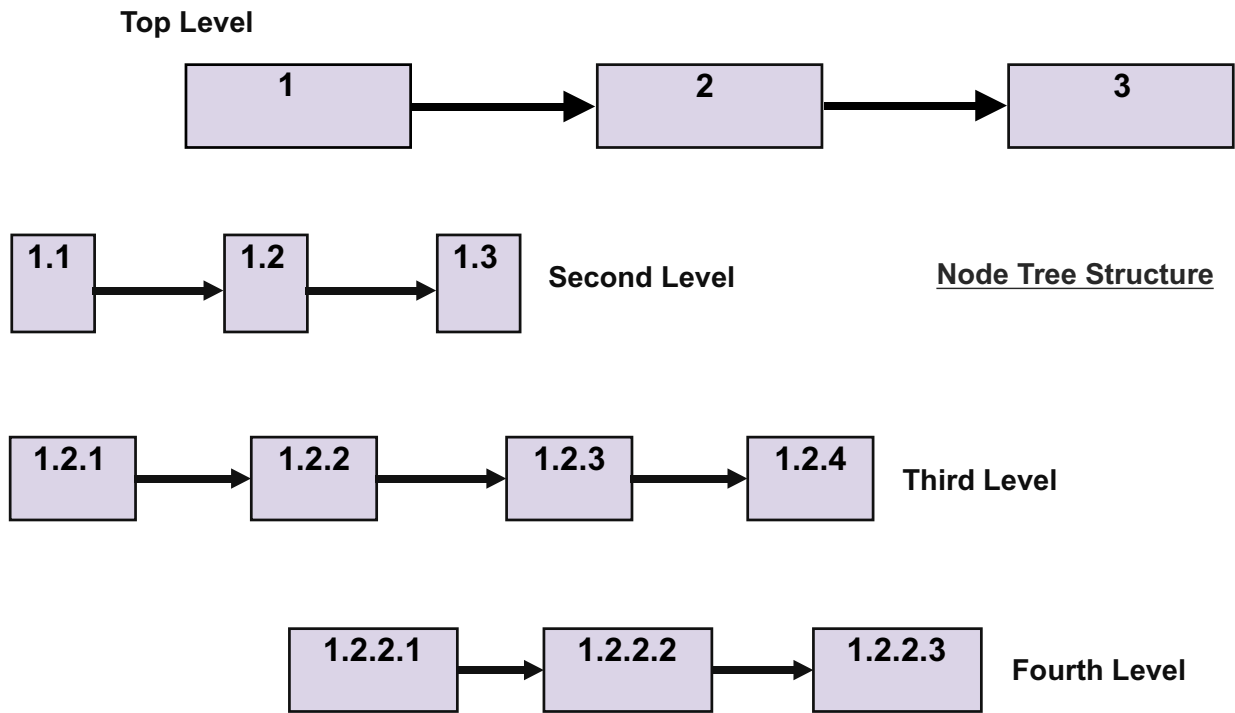
Top Level

| 1 | → | 2 | → | 3 |

| 1.1 | → | 1.2 | → | 1.3 | **Second Level**

| 1.2.1 | → | 1.2.2 | → | 1.2.3 | → | 1.2.4 | **Third Level**

| 1.2.2.1 | → | 1.2.2.2 | → | 1.2.2.3 | **Fourth Level**

Figure 4-1. Hierarchical Process Map Structure.

maintenance requirements, glossaries of terms, and material safety data sheets (MSDSs) can be filed by work step using the process maps. What you may find when using the process maps is that many problems are associated with a single work step. It may then be easier to focus the P2 activity on that work step. This focus is necessary to help P2 activities succeed in the day-to-day operation of the organization.

While many process map designers simply use pencil and paper, hierarchical process maps can also be computerized using inexpensive, off-the-shelf software commonly used to prepare organizational charts (e.g., VISIO®). If the organization decides to computerize the process information, everyone involved in a particular work step can have access to all the information on that work step using an Intranet or other electronic or hard copy means. Using process maps as a template helps an organization keep track of resource use and loss by each work step in a main process, or in supporting ancillary and intermittent processes.

Using process maps as a template helps an organization keep track of resource use and loss by each work step in a main process, or in supporting ancillary and intermittent processes.

All resources (e.g., energy, water, and materials) can also be tracked (Reference 4-3) on the same process map (Figure 4-3). The term *non-product use* means that the resource does not become part of the interim or final product. The term *non-product loss* means that the resource is lost in that work step as a waste, discharge, or emission. Process losses can be classified by medium (air, water, solid waste, spills/leaks, and accidental losses). Costs can also be tracked by pro-

Prepress / Press / Postpress

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│ and Design        │──▶│ Photography/Image│──▶│ Platemaking  │
│ Production        │   │ Processing       │   │     1.3      │
│     1.1           │   │      1.2         │   └──────────────┘
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│  1.2.1   │  │  1.2.2   │  │ 1.2.3  │  │  1.2.4   │  │ 1.2.5  │
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┌──────────┐  ┌──────────┐
│ Exposure │  │  Plate   │
│ to Light │─▶│Processing│
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│ (Preparation)│  │ Sheet-fed)   │
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│Cutting/Folding│ │Binding/Finishing│
│     3.1      │─▶│     3.2      │
└──────────────┘  └──────────────┘
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Inputs and outputs diagram:

Inputs (top):
- Paper, Glue Spray → Art/Copy Assembly and Design Production 1.1
- Film Wash Water, Developer, Fixer, Cleaning Solution, Chemical Storage Containers → Graphic Arts Photograghy/Image Processing 1.2
- Plates, Water, Developer, Gum Arabic → Planographic Platemaking 1.3

Outputs (bottom):
- Waste Paper, VOCs ← 1.1
- Used Film, Rinse Water; Spent Developer and Fixer, Silver, VOCs; Dirty Rags, Empty Containers ← 1.2
- Used Plates, Rinse Water, Spent Developer ← 1.3

Figure 4-2. Hierarchical Process Maps.

Figure 4-2. Hierarchical Process Maps (continued).
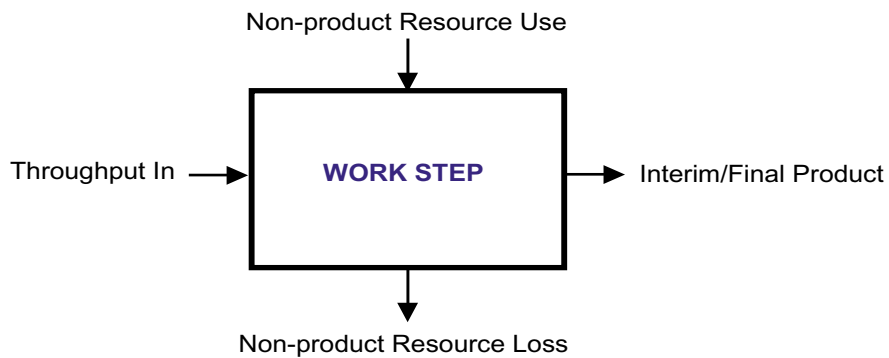
Figure 4-3. Using the Process Map as a Resource Accounting Template.

cess work step. Spreadsheets can be linked to the objects in a computerized process map, as well as to word processing files. Keeping track of this information is useful for helping rank-order P2 opportunities by cost. This can all be accomplished using your organization's charting software.

Determining the Cost of the Loss

Gathering accurate cost information is important for justifying investment in P2 alternatives.

Gathering accurate cost information is important for justifying investment in P2 alternatives. This cost typically needs to be collected by work step because this is where the P2 will be applied. There are three types of costs that should be tracked:

1. General ledger costs
2. Cost of the lost resources
3. Activity-based costs associated with the management of the non-product loss

For each loss identified in the process map, the P2 team should examine the "chart of accounts" to see if the cost is tracked by the accounting department in the general ledger. For example, if an organization generates solid waste, there may be a cost for the disposal contractor in the general ledger. The chart of accounts provides a vendor number and/or other code for this payment category. It is important to remember that the general ledger typically tracks *only* money that goes in and out of an organization (i.e., payment for invoices and payroll and revenues or financial allocations). It *does not* track internal transactions (e.g., environmental coordinator preparing a permit). These internal transactions are activity-based costs that will be discussed in more detail below. All cost data obtained from the general ledger is quite accurate and does not involve estimates of any kind.

A second cost category is associated with the cost of the resources that become non-product outputs or process losses. For example, when a part is spray painted, some of the paint does not end up on the part. This overspray is probably captured on a paint filter in the ventilation system. If 60% of the paint is incorporated on the part (i.e., interim product in throughput), 40% of the paint is lost from the work step (i.e., non-product loss). The cost of this lost paint should be added to the general ledger cost associated with this loss along with the cost of the paint filters (i.e., the intent of purchasing the filters was only to dispose of them after they captured droplets of paint, preventing these drops from getting into the air handling/treatment system). The plastic bags in the wastebaskets in your office represent a similar case. Your building management firm purchased those plastic bags intending to throw them away, thereby making the custodian's job easier. The cost of all the bags that are purchased must be added to the cost of your solid waste disposal bill along with the estimated cost of everything else that you purchased and threw away in that wastebasket.

To obtain the cost of the losses, it is often necessary to confer with the purchasing department. Some of these costs are estimated since they may be split between product and loss, such as in the paint example. Sometimes you throw away a container included in the cost of the product inside the container. Of course, because estimates are less accurate than the general ledger costs, you may want to estimate conservatively to maintain the credibility of your analysis.

A third cost category is associated with the activity-based cost of managing the loss. If the loss is regulated (e.g., hazardous air pollutant, hazardous waste, or wastewater priority pollutant), there are a number of activities that may be required by the regulations. You first must determine all the activities that must be performed for the non-product losses from each work step at the lowest level in the process map. Then you must estimate the cost associated with each of these activities. The total activity-based cost associated with each loss is added to the total cost of the loss associated with the general ledger cost and the cost of the lost resources.

Often the cost of a non-product loss will triple when adding the cost of the lost resource (i.e., the second cost category above). If the loss is regulated, the activity-based cost of managing the loss may increase this composite cost to five times the original general ledger cost. Obviously, there are large variations in the true cost of the non-product losses. However, capturing *all* the cost components is necessary because if the loss can be prevented, all of this money is saved, not just the general ledger cost of the loss.

Selecting P2 Opportunities

Information gathered in the process-mapping phase of the P2 program can be used to select P2 opportunities on which to focus for problem solving and decision-making. This is generally more useful than relying solely on a walk-through or other P2 assessment. However, walk-throughs using process maps are essential to the proper verification of the information in the maps. Some P2 programs target opportunities by trying to eliminate costly compliance issues associated with the use or loss of regulated materials. Other P2 programs seek to address targets that have been pre-selected by management or environmental personnel. Each organization has its own means for selecting P2 opportunities. However, there is a tool that can be used to help the P2 team through this process.

If all the P2 opportunities identified in the process maps were arranged in order of their true cost to the organization, you would find that 20% of the P2 opportunities provide approximately 80% of the cost benefits. Conversely, the remaining 80% of the P2 opportunities provide 20% of the true cost benefits. In most cases, you will find the 80/20 rule (also called the *Pareto Principle*) to be a great guide for selecting P2 opportunities (Figure 4-4). Most organizations use Pareto analysis in
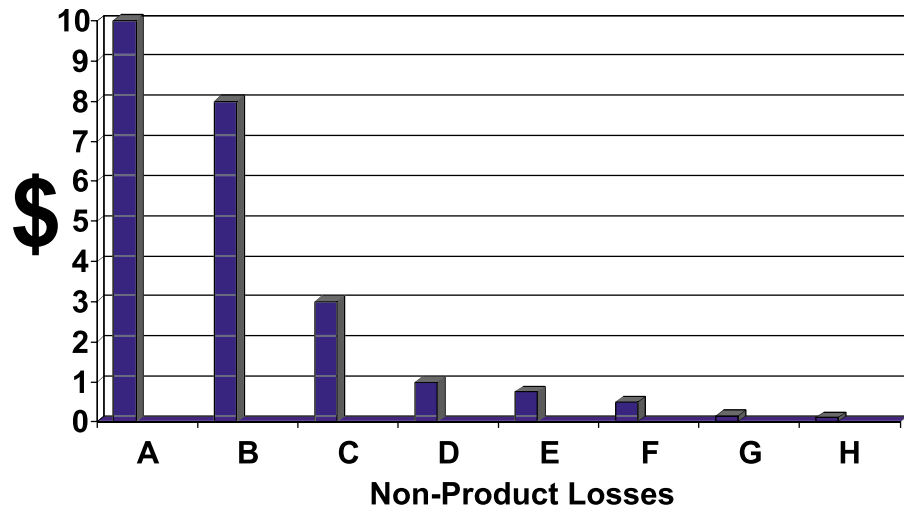
Figure 4-4. Pareto Diagram Showing True Cost Versus Waste Type.

some aspect of their work (Reference 4-4) to help focus their efforts. This tool dates back to 1897 and has the greatest staying power of any of the tools presented in this *Guide.*

Quality improvement experts advise concentration on the "vital few" sources of problems and avoiding distraction by those of lesser importance. The term for this process is called *rank ordering.* Pareto analysis is a rank-ordering tool. However, the fact that you have rank ordered your P2 opportunities does not mean you shouldn't address the easier opportunities early on. Early in a P2 program, projects must be carefully selected to ensure the greatest chance of success. P2 teams may be tempted to immediately tackle projects that are too large or too diffuse for them to handle. Too often, these projects may seem necessary to gain and maintain management approval for the P2 program. The resulting frustration only dampens enthusiasm for the prevention effort. Avoid bogging down in P2 opportunities that offer minimal cost benefits. Instead, focus your long-term efforts on the 20% where the true cost savings may be found. This approach maximizes the value of the P2 program to the organization. Pareto analysis helps identify the most obvious opportunities for improvement in present operations.

Pareto analysis helps identify the most obvious opportunities for improvement in present operations.

It is interesting to note that focusing on wastes by volume or weight may cause the P2 team to overlook some important wastes. In some cases, small volume wastes may be responsible for the highest costs. An example of this involves laptop computers that become contaminated when used in radiologically controlled areas. Contaminated laptops represented only a very small volume of the mixed radioactive waste

from a National Laboratory in the United States. However, the cost of disposal was the highest of all the items considered in the analysis. Other examples of the use of Pareto analysis are presented on the CD-ROM that accompanies this *Guide.*
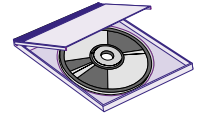
Analyzing Root Causes

"Root cause" is the basic reason that a resource is being used or a process loss is occurring. If this cause can be eliminated, the resource use or loss would be prevented. This approach is the very basis of P2.

Root cause analysis refers to the process of identifying causal factors. Most people involved in P2 are ardent problem solvers, but in their haste to get to a solution, some may skip over this very important problem-solving activity. P2 teams which skip this important step may simply take the most obvious action, rather than the one that would best solve the problem.

Root cause analysis teaches organizations to look at all potential causes: materials, technology, work practices, and people.

For example, when faced with environmental problems caused by a toxic chemical, P2 "problem solvers" might initially assume that the best way to address the issue is to find a "safe" substitute. In fact, the problem may be caused by *how* the company is using the chemical, rather than by the chemical itself. Changing work procedures or equipment or training employees more effectively might offer a better and/or less costly solution. Root cause analysis teaches organizations to look at all potential causes: materials, technology, work practices, and people.

Root cause analysis can be an effective management tool for determining the true or actual cause of resource use or loss in a process, facilitating effective corrective action, and preventing recurrence of the problem. It also provides obvious opportunities for improvement since it identifies both the underlying reasons for problems and the obstacles to correcting them.

The cause and effect diagram (also known as a fishbone diagram) provides an effective tool for conducting root cause analysis (Reference 4-5). Studies have found that this tool is the most widely used problem-solving tool in the world. However, it takes a little training and experience to use this important tool effectively. This tool is to be used by the P2 team, not by individuals. It provides a useful graphic to explain to management and other interested parties exactly what may be causing a problem. Once the diagram has been completed, the P2 team can count the number of causes found. The 80/20 rule can be used to help focus on the most probable causes by drawing circles around the 20% of the causes that may account for 80% of the problem. The P2 team will be more effective if it has this understanding and focus before attempting to generate P2 alternatives. An example of a cause and effect diagram can be found in Figure 4-5. Other cause and effect diagrams are included on the CD-ROM that accompanies this *Guide*.

The cause and effect diagram (also known as a fishbone diagram) provides an effective tool for conducting root cause analysis.

Figure 4-5. An Example of a Cause and Effect Diagram.

MATERIALS

TRANSPORT DAMAGE
HAIRLINE CRACKS
OIL DRIPS
SIZE
PAINT
TOO WIDE
GLASS
LIGHT COLOR CRACKS
COMPOSITION VARIES

MACHINES

SECTIONS AT DIF SPDS
CONVEYOR ROLLERS
BUILD-UP ON ROLLERS
SPEED
ACCEL ROUGH
DECEL ROUGH
CURTAIN COATER
BAD O-RINGS
DIRTY BELTS
CONVEYOR
PINCH ROLLERS STUCK
FINAL WASH
FLAT DESIGN
ADJUSTED TOO LOW
AIR KNIVES
CUP BRUSHES
CAUSES SCRATCHES
PCS IMBED IN ROLLERS
HARD TO ADJUST
CYLINDRICAL BRUSHES
BROKEN GLASS CAUGHT
PRECLEAN
PUSH GLASS
NOT LEVEL
LOOSE SET SCREWS
COND. OF SPIDER GEARS
OVEN
PINCH ROLLERS
TOO HOT

TOO MANY BROKEN/ DEFECTIVE SHEETS

LACK OF TRAINING
LACK OF AWARENESS
APATHY
TECHNIQUE
PLACE ON LBUCK ROUGHLY
RUSHING
OPER. TRAINING
NOT PAYING ATTENTION
TRAINING
MATERIAL HANDLING
UNLOADING
POOR COMMUNICATION
IMPROPER TRAINING
WRONG SIZE L-BUCKS
UNCLEAR DEFINITION OF 1ST QUAL. VS. DEFECTS
VENDOR VARIATIONS
SLIDE MIRRORS AGAINST EACH OTHER
ONLINE STACKING
EXPERIENCE

OVERZEALOUS MTRL HANDLER
TECHNIQUE
BUMP WHEN MAKING UP GAP
STAGING
IMPROPER TRAINING
HIT GLASS TOGETHER
MTRL HANDLER NOT USING TOOLS PROPERLY
LOADING

PEOPLE

METHODS

LOADING BROKEN SHEETS

Generating Alternative Solutions

Every P2 approach has some method of deriving alternatives for solving the P2 problem. Some P2 practitioners restrict themselves to only a small number of P2 alternatives for a given problem because they have not performed root cause analysis (and thus may lack key information) or because the P2 team members are not adequately involved in the process of deriving alternatives. P2 literature (i.e., case studies and success stories) provides only some ways to address each problem. An expert may offer limited tried-and-true solutions. Your organization's P2 team should feel confident that it may develop equally effective alternative ways to address the situation.

The Systems Approach operates on the theory that "the only way to find a good P2 alternative is to have many P2 alternatives." A good method for generating alternatives is "brainwriting," a technique similar to brainstorming, but tends to be less restrictive (Reference 4-6). Brainwriting is a written form of brainstorming that uses forms like that shown in Figure 4-6. It takes advantage of the fact that many people are much more likely to write down their ideas than say them. This brainwriting technique allows resource people (i.e., those not on the P2 team, vendors, or technical assistance personnel) to lend their expertise in generating alternatives. Brainstorming is a very widely used tool for generating alternatives. Some organizations use a tool known as an affinity diagram. No matter what your preference, the quantity of alternatives is what counts. Experience has shown that brainwriting is often

The Systems Approach operates on the theory that "the only way to find a good P2 alternative is to have many P2 alternatives."

1	2
3	4
5	6
7	8
9	10

Figure 4-6. Form Used for Brainwriting Exercise.

able to help the P2 team generate as many as 18–40+ alternatives in a short period of time.

To help encourage P2 team members to "think outside the box," it is important to get each team member to express the "most outrageous alternative that just might work." This gets everyone involved in using a bit of creativity to address the P2 problem at hand. Even "wild" concepts may trigger a search for alternatives that are a bit unusual but could work in the case under consideration. This technique is called "provocation." Employing worker knowledge and a little creativity has led to many successful P2 projects.

Employing worker knowledge and a little creativity has led to many successful P2 projects.
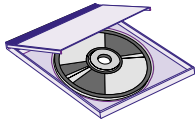
See Figure 4-7 for a listing of brainwriting alternatives for a common problem. Other examples of brainwriting alternatives can be found on the CD-ROM that accompanies this *Guide.*

Install a closed-loop (fully recycling) system.
Fully automate the system to control drive speed.
Use water-saving nozzles.
Wash less frequently.
Put dehumidifier in room to collect water vapor.
Use high-pressure jet spray (rinse/clean in one step).
Redesign water application.
Hand wash.
Reduce evaporation by lowering room temperature.
Try to collect evaporated water.
Use multistage washing process.
Only use undercarriage spray in winter.
Only wash vehicle once a week.
Dip vehicles in a tub-like device.
Lower temperature of water to decrease evaporation.
Use drying apparatus so vehicles do not drip dry.
Use a switch to activate/deactivate each step.
Close garage door before starting washing process.
Spit shine.
Use a squeegee to scrape off excess water.
Change soap application method.
Use alternative to city water source.
Use fewer absorbent sponges (less water trapped).
Use rental cars (rental agency will wash).
Redesign collection of water.
Drive through faster.

Figure 4-7. Brainwriting Alternatives for an Automated Vehicle Cleaner.

Selecting an Alternative for Implementation

The bubble-up/bubble-down tool is an excellent means for prioritizing and selecting an alternative to implement from a long list of possibilities.

Selecting a P2 alternative for implementation is facilitated with decision-making tools such as a *criteria matrix* (also known as a *selection grid*) or *bubble-up/ bubble-down* (also known as *forced pair analysis*). These are prioritization tools. The bubble-up/bubble-down tool in particular is an excellent means for prioritizing and selecting an alternative to implement from a long list of possibilities (Reference 4-7). When using this tool, the P2 team is allowed to examine only two alternatives at a time. They must ask which is best and use general criteria

such as the effectiveness of the alternative, the ability to implement the technique, and the cost associated with that implementation. This method of discussing the various alternatives is very interactive. Other tools do not allow for a lot of verbal communication among P2 team members. This communication leads to more information that will ultimately help facilitate implementation of the selected alternative.

Alternatives that "bubble up" to the top are typically easy to implement and have a relatively low cost. These alternatives may be characterized as the *low hanging fruit* or *quick wins.* Little or no capital is required to implement these alternatives and work can begin right away in most cases. If good cost data is collected, these "quick wins" can generate savings that can be reinvested by the organization to create more prevention and value. Alternatives that currently fall below the grouping of quick wins are generally more effective at preventing resource use and process losses. However, they may require more study and capital investments. Since it will take time to test and study these alternatives in an engineering feasibility study (See *Waste Minimization Opportunity Assessment Manual*, EPA/625/7-88/003 and *Facility Pollution Prevention Guide*, EPA/600/R-92/088 on the CD-ROM for more information on conducting a feasibility study), the P2 team can be working on the problem with the higher ranked, albeit less effective, alternatives. The results of the feasibility study will be useful for preparing a capital justification request to use the more effective alternative at a later time. Continual improvement can be maintained in a P2 program in this way.
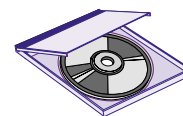
The alternatives, in order of priority, are as follows:

1. Simply reduce the soap input in the car wash
2. Use high-pressure water instead of soap
3. Alter the soap application step
4. Use degradable soap
5. Install a closed-loop system
6. Use alternative cleaning materials
7. Use a local, off-base car wash
8. Use rental cars instead of owning/maintaining
9. Locally treat the water before discharge to sewer
10. Drive less, walk more, use bicycles
11. Reuse dirty/soapy water
12. Install a new/improved car wash
13. Use a softening agent to take the soap out of the water
14. Handwash the cars
15. Use ultrafiltration to filter the water
16. Dry-clean the cars
17. Ultrasonic cleaning
18. Ablative paint for cars
19. Use dirt-colored cars
20. Paint the cars with slippery paint
21. Do not clean the cars at all
22. Buy new cars constantly

Figure 4-8. Bubble-up/Bubble-down Example.

Many P2 practitioners currently use prioritization tools. One limitation, however, is that they begin with a finite set of potential solutions to choose from because they have not used a method such as brainwriting to generate sufficient alternatives. An example of the prioritization of the alternatives generated in the previous step may be found in Figure 4-8. You may note that alternatives can be grouped in different combinations during the bubble-up/bubble-down procedure. Other examples of the use of bubble-up/bubble-down can be found on the CD-ROM.
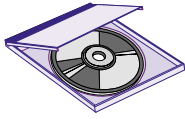
Action Planning

A formal action plan should be prepared for every P2 activity that is planned for each year of a P2 program.

Finally, a formal action plan should be prepared for every P2 activity that is planned for each year of a P2 program (Reference 4-8). In the rush to implement, P2 practitioners should not overlook the need to formalize their action plans. Each action plan should list the P2 alternative that will be implemented and show the sequence of steps necessary to implement the alternative. The person responsible for ensuring that each step is completed should be indicated in the action plan. Performance of that step must have some recognizable goal that must be reached. A metric should be devised to measure the progress toward meeting that goal and to provide a time frame for reaching the goal or completing that step. Finally, an indication of the resources required to reach the goal should be included in the formal action plan.
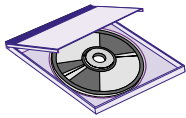
A sample form for use as an action plan is shown in Figure 4-7. Some action plan examples can be found on the CD-ROM that accompanies this *Guide.*

When P2 programs are audited on an annual basis, the auditor can select action plans and confirm that the work indicated actually has taken place. Periodic assessments of P2 program status depend on information like this to serve as the basis for measuring progress.

ALTERNATIVE SELECTED:				Date:	
Action	Responsible Person	Performance	Monitoring Technique	Completion Deadline	Resources Needed
1					
2					
3					
4					

Figure 4-9. Example of an Action Plan.

CHECKLISTS

Checklists are often necessary tools for P2 programs. A checklist helps guide an organization's activities and progress. Checklists provide important steps and method information for measuring operational performance and effectiveness and help the organization collect and organize data for assessing its current status and how well it is operating. It is useful to make lists of questions and answers for anything related to each of the problem-solving and decision-making tools presented in this *Guide.* Such lists form an outline of the entire problem situation and are important entries in any record of the process.

Checklists also help the P2 facilitator and P2 teams by providing guidance for further action and indicate things to do, process components to visit, people to see, and questions to ask. By devising a series of checklists, the P2 team provides itself with a means to review the entire resource use or loss problem.

Checklists are a handy way to jot down ideas as they arise for possible use at a later date. As the checklists increase in size and number, they can be reorganized and combined to simplify dealing with the problem as a whole and to clarify its parts. Checklists help the team organize the tasks and provide an overall view of the situation, its requirements, attributes, alternatives, and consequences.

Here are some simple steps for deriving checklists for a P2 program.

> ❑ Determine the purpose and intended use of the checklist.
> ❑ Perform research to ensure that the checklist covers all requirements and asks for specific data to be recorded.
> ❑ Provide space for checking off completed steps, ideas, or data items.
> ❑ Ask the subject matter expert to review the final draft of a checklist to ensure that nothing of importance has been overlooked or omitted.
> ❑ Perform revision and pilot-test the checklist before placing it into use.

P2 teams should compose checklists that complement the process they use in their P2 program. The various components of a typical P2 effort using the Systems Approach tool are listed so that a P2 team may use checklists to achieve better results in these areas:

> ❑ Keep track of the process characterization effort, including all ancillary and intermittent operations.
> ❑ Assure proper resource accounting for uses and losses at the work-step level.

Checklists also help the P2 facilitator and P2 teams by providing guidance for further action and indicate things to do, process components to visit, people to see, and questions to ask. By devising a series of checklists, the P2 team provides itself with a means to review the entire resource use or loss problem.

- ❑ Gather the true costs for each work step in the process characterization effort.
- ❑ Gather information for rank ordering of P2 opportunities.
- ❑ Select a P2 opportunity to analyze.
- ❑ Make sure that all causes in each cause category are considered in the root cause analysis for the selected opportunity.
- ❑ Document the search for potential solutions and alternatives.
- ❑ Gather information on each alternative to be used in the prioritization effort.
- ❑ Document the selection of the best alternative for implementation.
- ❑ Test the completion of the action plan.
- ❑ Track the implementation of the solution and evaluate progress.
- ❑ Test the use of each of the P2 program elements in this process.
- ❑ Test the overall P2 program effectiveness.

The periodic use of checklists generates a consistent means of assessing progress.
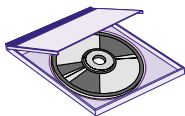
The periodic use of checklists generates a consistent means of assessing progress. Checklists should be designed to provide managers and P2 team members with a tool for assessing the significant characteristics of each step in the Systems Approach, checking the vital "how to" of each step, and analyzing in greater detail how well the tools are being used.

A number of checklists can be found in the CD-ROM that accompanies this *Guide.* You should be able to use and customize these electronic documents to fit the needs of your organization.

LESSONS LEARNED

Tools take time to master, but they help foster skills that the P2 team needs to characterize the process, solve problems, and make decisions.

Tools take time to master, but they help foster skills that the P2 team needs to characterize the process, solve problems, and make decisions. The repeated use of the tools makes P2 team meetings more productive. Many people avoid the use of tools because they believe that it takes too long and the benefits are not worth the effort. The tools lead to increased focus and questioning. P2 teams that use the root cause analysis tool usually derive a minimum of 20 P2 alternatives for future consideration. In contrast, teams that do not use the tool typically limit themselves to three or four alternatives.

The more methods and tools that you have time to use, the better the P2 program will be in the long run. Limiting tool selection can impair the development of the P2 program.

Continual improvement is important to focus the organization on P2 success. Organizations strive to improve, but few understand the difficulty in trying for continual improvement. Frequently, organizations initially set percentage improvement goals beyond their reach with too little information. P2 is based on achieving many successes over time. Many of the problems of organizations have evolved over many years and cannot all be solved at one time. The organization can use Systems Approach tools to generate the information effectively and use it to set goals during the development of the action plans. Although it is important to focus improvement efforts on critical issues (Pareto diagrams), improvements can be made little by little until these major issues are resolved.

Organizations strive to improve, but few understand the difficulty in trying for continual improvement.

Incremental improvements can lead to breakthrough improvements. This is accomplished by learning from the improvements and seeking to make larger improvements. Incremental improvements also allow for "quick wins." These little victories, when accompanied by cost data, help maintain management approval for the P2 effort. Continued funding of P2 projects also provides the time for breakthrough improvements to materialize.

Checklists are useful tools for gathering information and data and tracking progress of the problem-solving and decision-making method. However, they are relatively ineffective at communicating that information to management and other interested parties. Each of the Systems Approach tools has a visual output that is much more effective in this regard.

Making P2 a way of life in order to achieve success takes more than words; it requires action. Action plans provide documentation for these actions and a means of tracking P2 progress over time.

REFERENCES

4-1.   Nothing to Waste Manual
       http://www.nmenv.state.nm.us/ (see Special Projects)

4-2.   "Understanding a process by using process mapping." Pojasek, R.B. (1997). *Pollution Prevention Review* 7(3): 91-101.

4-3.   "Materials accounting and P2." Pojasek, R.B. (1997). *Pollution Prevention Review* 7(4): 95-103.

4-4.   "Selecting P2 opportunities." Pojasek, R.B. (1998). *Pollution Prevention Review* 8(2): 103-110.

4-5.   "Using cause and effect diagrams in your P2 program." Pojasek, R.B. (1996). *Pollution Prevention Review* 6(3): 99-105.

4-6.   "Identifying P2 alternatives with brainstorming and brainwriting." Pojasek, R.B. (1996). *Pollution Prevention Review* 6(4): 93-97.

4-7.   "Prioritizing P2 alternatives." Pojasek, R.B. (1997). *Pollution Prevention Review* 7(1): 105-112.

4-8.   "Implementing your P2 alternatives." Pojasek, R.B. (1997). *Pollution Prevention Review* 7(2): 83-88.

CHAPTER 5
Traditional Approach to P2 Implementation

INTRODUCTION

A number of models are available for implementing your P2 program. This chapter will focus on a "traditional" model based on the previous editions of this EPA Guide (*Waste Minimization Opportunity Assessment Manual*, EPA/625/7-88/003 and *Facility Pollution Prevention Guide*, EPA/600/R-92/088). Chapter 6 will examine an implementation model that utilizes a formal environmental management system (EMS). Chapter 7 will evaluate the use of a quality model for P2 implementation. This *Guide* will not prescribe or recommend any one of these P2 implementation models. Instead, you can mix and match components to derive a P2 program implementation model that works best in your organization. If you do this, your organization's P2 program is far more likely to be implemented and maintained. This concept will be presented in Chapter 8.

At the top level (Figure 5-1), the traditional P2 model offers a logical path for implementing P2. First you establish the P2 program using the information provided. Then, you prepare a written P2 plan to describe how the program will be implemented. Next, you execute the program implementation. Finally, you must maintain the P2 program over time.

Includes:
☐ Introduction
☐ Establishing a P2 Program
☐ Writing the P2 Program Plan
☐ P2 Program Implementation
☐ Maintaining the P2 Program
☐ Combining the Traditional Approach with the Systems Approach
☐ Approaches for Very Small Organizations
☐ Other P2 Implementation Approaches
☐ Reference

You can mix and match components to derive a P2 program implementation model that works best in your organization. If you do this, your organization's P2 program is far more likely to be implemented and maintained.

```
┌─────────────────────┐        ┌─────────────────────┐
│  ESTABLISH P2        │        │  WRITE P2 PROGRAM    │
│  PROGRAM             │───────▶│  PLAN                │───────▶
│                 1    │        │                 2    │
└─────────────────────┘        └─────────────────────┘

┌─────────────────────┐        ┌─────────────────────┐
│  P2 PROGRAM          │        │  MAINTAIN P2         │
──▶│  IMPLEMENTATION   │───────▶│  PROGRAM             │
│                 3    │        │                 4    │
└─────────────────────┘        └─────────────────────┘
```

Figure 5-1. Top-level Depiction of the Traditional Approach to Pollution Prevention Implementation.

ESTABLISH P2 PROGRAM		ORGANIZE P2 PROGRAM		CONDUCT PRELIMINARY P2 ASSESSMENT
	1.1		1.2	1.3

Figure 5-2. Establishing a P2 Program.

Let's look at the details in each of these steps to see how the information in this *Guide* can ease the implementation using the traditional approach to P2.

ESTABLISHING A P2 PROGRAM

The traditional approach has a "top-down" focus.

The traditional approach has a "top-down" focus. This approach, as presented in the earlier EPA publications (Figure 5-2), begins with getting management approval and setting program goals *before* P2 information is collected. The first step is to obtain an executive-level decision to establish the P2 program. This decision is communicated to the workforce using a policy statement. Consensus-building efforts will promote acceptance of this policy statement.

To organize the P2 program, management names a P2 task force and states goals before any formal information is gathered. Goals that are established upfront for a P2 program challenge the effort.

The traditional approach views the preliminary assessment as a "walk-through" activity to be performed by a team of employees or by an outside service provider or process expert.

Under the traditional approach, the task force next conducts a preliminary P2 assessment to collect some P2 data, reviews sites for future P2 studies, and establishes the priorities for the P2 program. A preliminary assessment is necessary to gather information for the written P2 plan (Figure 5-2, work step 1.3). Some organizations may consider conducting this preliminary assessment prior to work steps 1.1 and 1.2 (see Figure 5-2). The traditional approach views the preliminary assessment as a "walk-through" activity to be performed by a team of employees or by an outside service provider or process expert.

The Systems Approach described in Chapter 4 of this Guide *allows for some "bottom-up" efforts before the endorsement of senior management.*

These ideas show how you can organize this part of the P2 program using the tools presented in this Guide.

The Systems Approach described in Chapter 4 of this *Guide* allows for some "bottom-up" efforts before the endorsement of senior management. Using the process-mapping tool described in Chapter 4 of this *Guide* gives the team a more complete understanding of the processes (including the ancillary and intermittent processes). This leads to a more complete listing of opportunities for P2. Pareto analysis can be used to rank order the opportunities for P2. The organizational management can then propose goals based on a more complete assessment of the P2 opportunities and establish clear priorities for the program. Goals could be stated in the action plans for each year instead of as program goals. These ideas show how you can organize this part of the P2 program using the tools presented in this *Guide*.

WRITING THE P2 PROGRAM PLAN

The traditional approach next addresses writing the P2 program plan (Figure 5-3). A good planning effort makes careful note of what the stakeholders want in the program. These are the interested parties or external groups described in the quality-based implementation model (see Chapter 7). Stakeholders may include the following: customers, suppliers, employees, regulators, environmental interest groups, community organizations, stockholders, and anyone else with a stake in the outcome of the P2 program.

The P2 plan should state clear objectives for the P2 program. It should anticipate obstacles to program implementation and plan means to overcome them. A good planning effort addresses these obstacles during the preparation of the plan. Finally, the P2 plan requires a firm schedule. It can be a challenge to set a schedule based solely on the information gathered to this point, but a schedule is essential for management to track the plan's progress during the course of the year.

Stakeholders may include the following: customers, suppliers, employees, regulators, environmental interest groups, community organizations, stockholders, and anyone else with a stake in the outcome of the P2 program.

The P2 plan should state clear objectives for the P2 program.

A schedule is essential for management to track the plan's progress during the course of the year.

```
          ┌─────────────────────────────┐
          │   WRITE P2 PROGRAM PLAN      │
  ───────▶│                             │────────▶
          │                           2 │
          └─────────────────────────────┘
                Consider External Groups
                Define Objectives
                Identify Potential Obstacles
                Develop Schedule
```

Figure 5-3. Writing the P2 Program Plan.

Earlier in this *Guide* (Chapter 4), action plans were described. The action plan is a tool that can be used to address all the concerns that can arise when writing a P2 program plan. Each organization should have an action plan for each P2 project conducted in the P2 program. The collection of these action plans (many organizations implement 8 to 11 P2 action plans in a typical year) constitutes the major portion of the P2 plan. The other part of the P2 plan outlines the management structure within which these plans will be used and reviewed during the course of the year. The objectives of the program should reflect the vision and mission statements for the P2 efforts.

Each organization should have an action plan for each P2 project conducted in the P2 program.

P2 PROGRAM IMPLEMENTATION

In the traditional approach the detailed P2 assessment is the starting point of the program implementation phase (Figure 5-4). An assessment team is assembled for this task. It is not defined as a worker team but rather as a higher-level, multidisciplinary team which may

In the traditional approach the detailed P2 assessment is the starting point of the program implementation phase.

Figure 5-4. P2 Program Implementation.

The purpose of the detailed assessment is to help the team derive alternatives.

Based on the detailed assessment, the assessment team proposes a number of P2 alternatives and screens them to help focus on the implementation that will follow.

Once the P2 projects have been selected, the traditional approach has the P2 team obtain funding and initiate work on the alternative.

include some employees. Checklists and worksheets are provided to help the team collect data and information. This assessment team will review the data and visit the sites where the P2 activity is planned to occur.

The purpose of the detailed assessment is to help the team derive alternatives (called "options" in the previous publications) for P2. The team uses brainstorming as a tool to find potential alternatives. The traditional approach does not formally include root cause analysis before deriving alternatives.

Based on the detailed assessment, the assessment team proposes a number of P2 alternatives and screens them to help focus on the implementation that will follow. Most of the P2 industry-specific manuals provided a limited number of alternatives, so the screening was fairly straightforward. The traditional approach model uses criteria matrices for screening. Once screening is complete, it is time for a feasibility analysis of the priority alternatives. Of course, not all P2 alternatives require such formal analysis. Quick wins or "low-hanging fruit" P2 alternatives can proceed more expediently. They do not compete for capital funding. When an alternative requires some capital funding to implement, it is frequently subjected to a technical feasibility study, a determination of its environmental feasibility, and finally a determination of the economic feasibility. At this point, the traditional approach requires the preparation of a formal, written P2 assessment report. This report details the analysis of the P2 assessment team and allows that information to be presented to management in a formal manner after a review by the P2 task force. Once the P2 projects have been

selected, the traditional approach has the P2 team obtain funding and initiate work on the alternative. The work is reviewed and adjusted during execution to make sure it meets the objectives. There is no requirement in the traditional approach to prepare a formal action plan. The P2 implementation team reviews its progress on an informal basis and makes necessary adjustments to enhance the P2 effort.

The final step in the traditional P2 program implementation is to measure P2 progress. Data is acquired from the implementation phase and analyzed. The traditional approach recommends the measurement of economic results.

MAINTAINING THE P2 PROGRAM

At this stage, the traditional approach shifts to the maintenance of the P2 program (see Figure 5-5). Five activities are detailed in this program component.

At this stage, the traditional approach shifts to the maintenance of the P2 program.

This program maintenance begins with the integration of the P2 program into other formal corporate P2 initiatives. These programs could include safety, quality, preventive maintenance, lean manufacturing, and so on. Accountability for wastes are assigned to the generating process. All wastes are carefully tracked and formally reported in the organization. The program results are evaluated annually.

Program maintenance begins with the integration of the P2 program into other formal corporate P2 initiatives.

Educational training for those who participate in the P2 program needs to be specified. No tools are taught in the traditional approach; however, the participants do become familiar with the process. Training is provided to new employees to orient them to P2. Advanced training is provided to those most involved with the P2 program. Each year, every employee needs to be updated on knowledge of P2.

Educational training for those who participate in the P2 program needs to be specified.
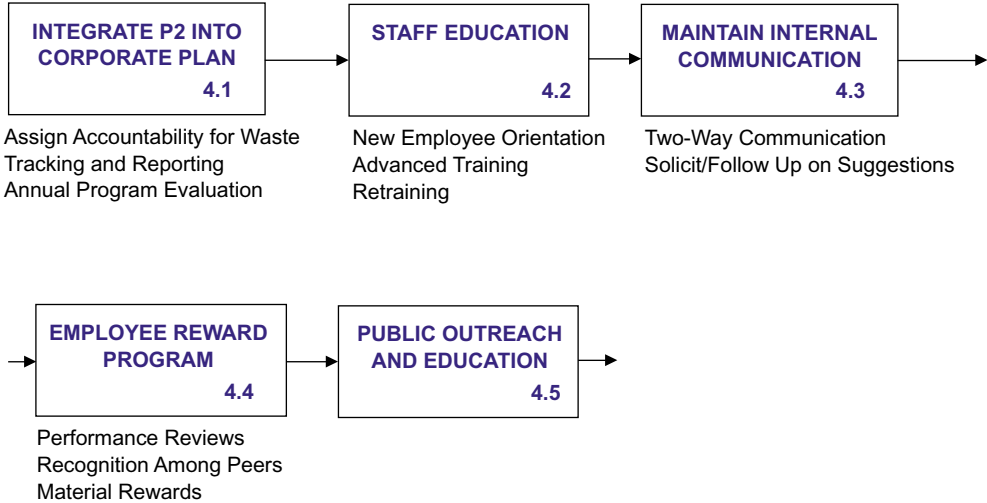
Figure 5-5. Maintaining the P2 Program.

Communication is important to any program. The traditional approach looks at all routine communications and finds ways to encourage them. It also promotes the solicitation and follow-up of employee suggestions.

As an incentive for participation in the P2 program, the traditional approach includes an employee reward program. It features performance reviews, recognition among peers, and material rewards. Finally the traditional approach recommends a public outreach and educational program.

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More information on the traditional approach, including copies of the previous EPA publications, can be found on the CD-ROM that accompanies this *Guide*. All the checklists and worksheets from the traditional approach are provided on that CD-ROM.

COMBINING THE TRADITIONAL APPROACH WITH THE SYSTEMS APPROACH

Many of the readers of this *Guide* have been using the traditional approach for years. The process maps provided here and in Chapter 1 should help you use this approach more effectively. You may have begun to consider changes you might make to the approach that will work well for you. It is instructive to prepare a process map of your approach to P2 so everyone in your program can understand it clearly.

The Systems Approach tools presented in this Guide *can be used to enhance the effectiveness of the traditional approach.*

The Systems Approach tools presented in this *Guide* can be used to enhance the effectiveness of the traditional approach. One area where improvement can be made is in the process characterization. It is easier for management and team members to "*see*" the process maps. Having piles of information and checklists to review can be far more daunting. The process maps also enable the team to focus on certain areas that offer the best opportunities for P2.

Process mapping can be conducted by those interested in promoting P2 before going to management for commitment to the program. It may be a wise decision to let them understand what opportunities await them if they approve this program. Process maps will typically find more opportunities for P2 than a walk-through or preliminary assessment.

Another potential improvement is in the use of root cause analysis to examine why a selected P2 opportunity has a problem associated with the use of a regulated material or a regulated loss.

Another potential improvement is in the use of root cause analysis to examine why a selected P2 opportunity has a problem associated with the use of a regulated material or a regulated loss. Experiments have been conducted with P2 teams to test the theory that root cause analysis will lead to better alternative generation. A team that does not use root cause analysis and goes directly from the selection of the P2 opportunity to the generation of alternatives typically is capable of specifying two to four alternatives. In contrast, a team that uses root cause analysis first and then tries to generate alternatives will come up with

18 to 40+ alternatives. Many of the alternatives derived in the former case may not finish in the top-10 listing after the longer list of alternatives is prioritized. The cause-and-effect diagram is the most widely used problem-solving tool in the world. It deserves consideration in the implementation of your P2 program.

The issue of goal setting is very important in P2. The traditional approach sets goals up front. Many state-mandated P2 programs also set statewide goals at the start of the program. In the Systems Approach, the organization sets performance goals in the action plans after the information on P2 has been gathered and evaluated. They are set year-by-year and project-by-project. The sum of all the action plan performance goals is the overall performance goal of the year. Some quality experts believe that goal setting is rarely done properly. They argue that one should measure continual improvement and always increase the amount of P2 accomplished, no matter how small they may be. There should also be no backsliding in areas in which improvements have already been made. This sort of seemingly incremental improvement can yield large breakthroughs as P2 program participants learn how to master change.

The basics of the traditional approach can be integrated with the lessons of the Systems Approach. They work well together and allow the organization to make continual improvement in the conduct of the traditional P2 program.

APPROACHES FOR VERY SMALL ORGANIZATIONS

One argument for retaining the traditional approach exclusively was that it worked well for very small organizations. The tools of the Systems Approach were sometimes thought to take too long to use and to be too difficult for very small organizations to master. Some observers thought that these organizations would have to rely on outside P2 technical assistance providers to help them with P2 alternatives.

The following case study illustrates how the Systems Approach could be used by small organizations to complement the use of the traditional approach. Use of this Systems Approach does not rule out the traditional approach, but illustrates how the tools that are presented in this *Guide* might increase the effectiveness of the traditional approach.

EPA funded the development of a publication called *Nothing to Waste* (Reference 5-1) for its Environmental Justice program. This publication uses the Systems Approach for dealing with very small businesses. A model for helping very small organizations succeed was developed by a team lead by a not-for-profit group, Working Capital. They formed groups of leaders of very small organizations who met on a regular basis outside of working hours. A facilitator helped them work through some modules that taught them how to write a business plan and how to apply for a loan. Banks provided the groups with money to

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loan. When the group determined that a member was qualified for a loan, the group had the power to grant that loan. The bank stipulated that if the person missed any payments, everyone in the group was dunned and could not get a loan for a specified period of time. This stipulation made the members of the group work together better so that everyone paid back loans. Banks were very happy with the results. Previously, typical loan defaults for this segment were as high as 60%. Using this model, loan defaults dropped to less than 10%.

It became obvious that these small organizations could not afford any waste. Their initial loan could only be $500. If an individual borrower wasted any of this money, the entire group would be less successful. For example, a small furniture maker needed to know that finish overspray led to the loss of some of the valuable finish that was purchased. The furniture maker had to find out how more of that finish could be placed on the furniture to reduce the waste.

In the *Nothing to Waste* program, leaders from very small organizations still meet regularly in off-work hours in teams of five to seven companies. They use the Systems Approach tools under the guidance of a group facilitator trained in the use of the tools. They map each other's processes, apply the tools to identify opportunities for P2, and derive and select alternatives for dealing with the losses. The group facilitator also helps provide the group members with P2 information and resources that may be needed to implement the selected P2 alternative. States that have adopted this model (e.g., New Mexico, Maine, and Massachusetts) have been able to make better use of their technical assistance providers by having them "visit" with many small organizations at once instead of making many trips to separate operations.

Very small organizations may not have the technical capability to follow the formal traditional approach on their own. However, they can master the problem-solving and decision-making tools quickly and use them to communicate effectively with one another, even though they do not actually work together. They can learn how to communicate better with their customers, suppliers, and lending institutions as a result of learning how to use these tools. Action plans allow the group to track each other's progress. These plans are reviewed at each meeting.

Nothing to Waste has been formally adopted for use in the Green Zia Program in New Mexico (Reference 5-1). This publication is available on the Internet and can be found on the CD-ROM. It can be used by P2 teams in larger companies to help worker teams get an understanding of the use of the tools in the Systems Approach without an expensive training program.

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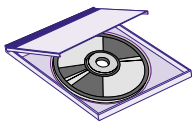
OTHER IMPLEMENTATION APPROACHES

Chapter 6 will examine how an organization can use the environmental management system (EMS) to help implement a P2 program. This is an important implementation model since many organizations are now considering this type of EMS (i.e., ISO 14001, EMAS, etc.). Chapter 7 will examine how an organization can use a quality-based program like the Baldrige approach to implement a P2 program. A prevention-based approach is built into the criteria that allow an organization to compare itself to organizations which have achieved environmental excellence. An organization that scores well in the rating system should have a significant amount of P2 in its operations.

Process maps have been prepared in each of these chapters so you can compare them to the process maps in this chapter. By using this tool, you will be able to select the approach that is most effective for you and compare it to the implementation approaches provided in this *Guide*. Chapter 8 will provide some tips on how to mix and match these implementation approaches.

REFERENCE

5-1.   Nothing to Waste Manual
        http://www.pojasek-associates.com/Reprints/Nothing-to-Waste.pdf

CHAPTER 6

EMS Approach to P2 Implementation

INTRODUCTION

The new international voluntary standard for environmental management systems (EMSs) known as ISO 14001 is proving to be an effective tool for improving organizational environmental performance and implementing P2 opportunities. The intent of the standard is to establish and maintain a systematic management plan designed to continually identify and reduce the environmental impacts resulting from an organization's activities, products, and services. Currently, no government mandate requires organizations to have a comprehensive EMS, but several states are exploring the effectiveness of having organizations use an EMS in implementing and complying with P2 planning requirements.

Government policymakers are interested in EMSs as a possible way to supplement the so-called "command-and-control" environmental regulations. The EPA recognizes that an EMS can help organizations integrate environmental considerations into day-to-day decisions and practices (References 6-1 and 6-2). EMSs will not replace existing regulatory systems in the United States but will work best when they complement the existing regulatory programs including formal enforcement actions. Other EMSs are emerging, but the focus of this chapter will be on the ISO 14001 standard's elements.

For several years, the EPA has been engaged in a number of important activities designed both to promote and evaluate the effectiveness of EMSs in a variety of settings. These activities vary widely and include (1) a major EMS research program conducted in partnership with states through the Multi-State Working Group (MSWG), (2) programs to promote and demonstrate the value of EMSs in various sectors such as local government and metal finishing, and (3) the use of EMSs as components of voluntary leadership programs. The EPA has also used EMSs as important components in enforcement settlement agreements. The MSWG has adopted a consensus policy document to help guide states and others in designing EMSs, evaluating EMS credibility, and participating in EMS processes (Reference 6-3). The principles are as follow:

- EMSs should improve compliance with environmental laws, enable organizations to achieve performance "beyond compliance" with legal requirements, and reduce environmental impacts from both regulated and unregulated activities.

Includes:
- ☐ Introduction
- ☐ Getting Started
- ☐ Environmental Policy, Management Commitment, and Scope
- ☐ EMS Planning
- ☐ EMS Implementation
- ☐ Monitoring and Measurement
- ☐ Lessons Learned
- ☐ References
- ☐ Supplemental Reading

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The EPA recognizes that an EMS can help organizations integrate environmental considerations into day-to-day decisions and practices.

The MSWG has adopted a consensus policy document to help guide states and others in designing EMSs, evaluating EMS credibility, and participating in EMS processes.

- An EMS can serve as a supplementary tool that enables regulatory agencies and others to jointly achieve greater environmental protection.
- The quality of an EMS is linked to environmental performance achieved.
- EMS metrics can document improved environmental performance, which may enable regulatory agencies to achieve policy objectives more efficiently and improve communications with the public.
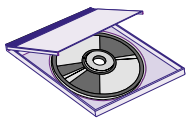
A growing number of organizations have pioneered new strategies for integrating environmental management into their overall business strategy. Although regulatory compliance remains an important driver of environmental performance and of the adoption of advanced practices, business factors such as cost savings and improved business performance are just as important. EMSs are motivating organizations all over the world to reconsider their environmental performance and effectiveness and determine how P2 strategies can help them reduce wastes, risks, and costs. These organizations should establish and maintain a systematic management plan that promotes P2 and is designed to continually identify and reduce the environmental harm (impacts) created by the organization's activities, products, and services. The EMS fosters innovative strategies and a framework for improving environmental performance by encouraging all the employees of the organization to look for ways to reduce environmental impacts by first using P2 techniques. Supporting information on EMSs can be found on the CD-ROM that accompanies this *Guide*.

GETTING STARTED

Like other management systems, an EMS is a formal approach for articulating goals, making choices, gathering information, measuring progress, and improving performance. An EMS promotes important planning and improvement elements needed in the design of multimedia source reduction and recycling programs for all forms of pollution. Several elements of an EMS provide positive reinforcement for P2 assessment and planning efforts and add an element for continual review by management that is needed for implementation and improvement. Figure 6-1 is a top-level process map for implementing P2 using an EMS program.

The goal of the standard is to establish a common approach to EMSs that is internationally recognized, leads to improved environmental performance, and provides an opportunity for gaining international recognition and market share. ISO 14001 is a management system standard, not a performance standard. Given that ISO 14001 is a system built for industry by industry, it uses a language that management un-

An EMS promotes important planning and improvement elements needed in the design of multimedia source reduction and recycling programs for all forms of pollution.

The goal of the standard is to establish a common approach to EMSs that is internationally recognized, leads to improved environmental performance, and provides an opportunity for gaining international recognition and market share.

Figure 6-1. Implementing P2 Using an EMS Program (Top-level Process Map).

derstands, and it will keep top management's attention through involvement. The EMS provides a systematic approach for integrating environmental protection into all business functions and management strategies.

The EMS provides a systematic approach for integrating environmental protection into all business functions and management strategies.

One important way the EMS standard promotes integration of environmental and organizational management is by requiring top management to define the environmental policy. However, the EMS approach to P2 encourages several initial activities prior to setting up the policy:

- Identifying current environmental compliance procedures and management techniques
- Reviewing the policies in place and environmental concerns for the future
- Ensuring that all relevant information is up to date
- Generating an environmental plan for continual involvement and improvement for the future

Figure 6-2 is a process map that shows these initial steps in the EMS approach to P2.

As an initial step in developing a comprehensive EMS, most organizations find it helpful to complete an objective gap analysis of their existing environmental system. This enables the organization to discover its current status regarding environmental performance and compliance and highlight areas that require attention under an EMS. The results of a "gap" analysis will provide a benchmark for the organization's alignment and conformance to the ISO 14001 standard. Many organizations are developing useful gap audit tools, including facilities, consultants, and technical assistance providers. The scope of the gap analysis audit should include all areas of the organization related to environmental systems as well as the interfaces between a specific facility and its corporate environmental department.

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| IDENTIFY ENVIRONMENTAL COMPLIANCE PROCEDURES AND MANAGEMENT TECHNIQUES 1.1 | REVIEW POLICIES IN PLACE AND ENVIRONMENTAL CONCERNS FOR THE FUTURE 1.2 | ENSURE ALL ENVIRONMENTAL INFORMATION IS UP TO DATE 1.3 |

GENERATE AN ENVIRONMENTAL PLAN FOR EMPLOYEE INVOLVEMENT AND CONTINUAL ENVIRONMENTAL IMPROVEMENT 1.4
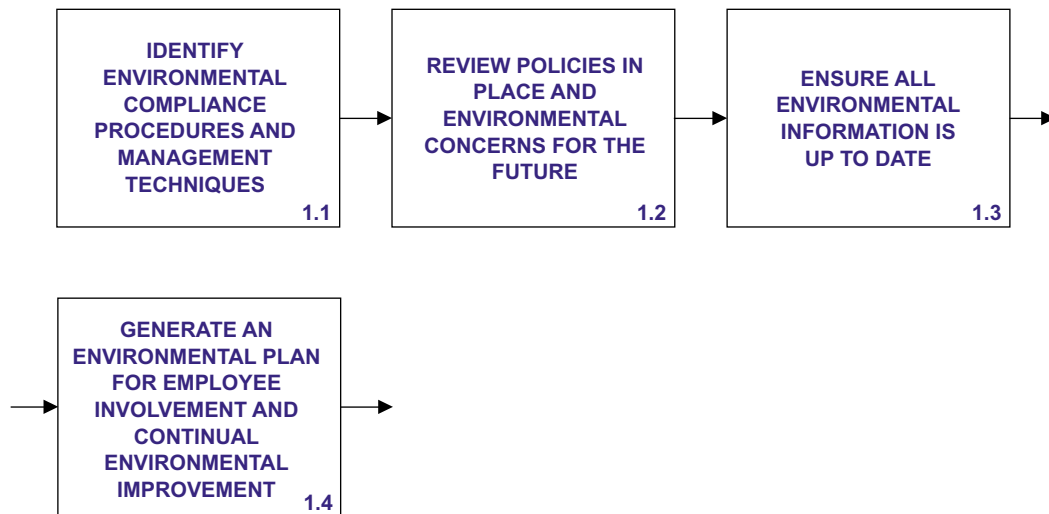
Figure 6-2. Getting Started—Recognized Need.

It is likely that top-level management will view an EMS as a competitiveness issue rather than as a cost center for environmental compliance.

EMSs require that organizations have a "commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes." An organization's current practices for tracking compliance are a good place to start, and they should be compared to what an EMS entails. An EMS aligned to ISO 14001 requirements offers the potential for delivering substantial gains in production and environmental efficiency and reduced costs in environmental compliance. It is likely that top-level management will view an EMS as a competitiveness issue rather than as a cost center for environmental compliance. Involvement of top management in defining policy, reviewing the current plan, and maintaining EMS awareness is seen as a positive outcome by many since management has sometimes been a tough audience to reach on environmental issues.

Command and control standards give organizations no incentive to exceed what is necessary for compliance.

An organization has to prove that its EMS has been implemented effectively and leads to compliance over time. The organization must have a procedure to identify and have access to legal and other requirements to which it subscribes. Periodic compliance and EMS system audits are required to assess procedural improvements and identify needed system improvements through corrective actions. Such a mechanism for improvement is completely absent in command-and-control regulations such as BAT (best available technology) standards and emission standards. Standards such as these give organizations no incentive to exceed what is necessary for compliance. In some cases, they may encourage the use of control technologies over other approaches that would result in better environmental performance. Command and control standards give organizations no incentive to exceed what is necessary for compliance.

Another regulatory advantage of an EMS is the requirement to consider legal and other requirements when establishing objectives and

targets for the significant aspects. The potential for exchange between an EMS and state P2 facility planning requirements is generating interest among environmental regulators in several states. As part of the MSWG initiative, the state of Washington studied organizations using ISO 14001 and concluded, "EMSs are proving to be a superior approach for implementing P2 assessments and planning activities." They allow the EMS to meet the organization's planning requirements if the waste management hierarchy is followed in setting objectives and targets. The EPA's Environmental Performance Track program has developed a matrix of several other state programs that have modified their requirements, and it can be found on their Web site (Reference 6-4).

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ENVIRONMENTAL POLICY, MANAGEMENT COMMITMENT, AND SCOPE OF THE EMS

Based on the current environmental assessment and performance, it is management's responsibility to develop a shared vision and direction for the organization's EMS policy and to commit to its implementation (Figure 6-3, work steps 2.1, 2.2, 2.3). In the policy, management defines its scope and ensures consistency with the organization's vision, core values, beliefs, and other goals. Management may use the new policy to expand the organization's environmental perspective. The environmental policy for an EMS contains the following commitments:

- Commitment to "prevention of pollution"
- Commitment to compliance with all applicable requirements and other requirements to which the organization subscribes
- Commitment to continual improvement of the system itself and not specifically continued improvement of the required environmental performance criteria.
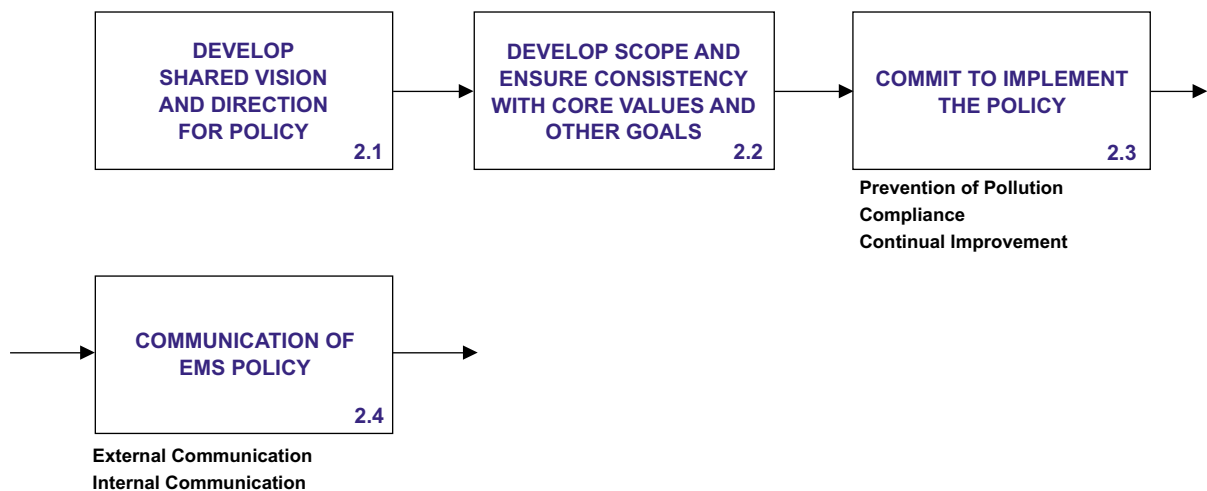
Figure 6-3. Policy and Commitment: Define Environmental Policy, Scope, and Commitment.

P2 is different from prevention of pollution as defined in the EMS standard. Prevention of pollution is defined by the standard as **"use of processes, practices, materials or products that avoid, reduce** or control **pollution, which may include recycling**, treatment, **process changes**, control mechanisms, **efficient use of resources and material substitution**." This definition does include control and treatment scenarios but the phrases indicated in bold in the definition provide a clear mandate in the policy to pursue source reduction as a goal and objective of the EMS.

The EMS policy is used as the guidance for setting and reviewing the organization's environmental objectives and targets. The EMS standard does not require specific environmental goals. Instead, it provides a general framework for organizing the tasks necessary for effective environmental management and improved performance.

Communication of the EMS Policy

Once management reaches agreement on the policy, it should be documented, kept up-to-date, and used by all employees. Most organizations already have procedures in place on how they communicate their policies internally and externally (Figure 6-3, work step 2.4). The EMS standard requires that the environmental policy of the organization be made available to the public. Many organizations already provide far more environmental information through P2 plans, annual reports, regulatory records, and participation in emergency response planning.

An EMS addresses the process for responding to external communications or requests for environmental information. The organization documents its procedure on "how to" respond to these external requests for information on the EMS, environmental aspects, and P2, if and when they occur. The basic documentation an organization should keep for external requests includes who made the contact, the date, the nature of the request, the nature of the response, and what, if any, materials were sent.

The EMS requires the organization to develop and implement procedures to ensure internal communication of the EMS policy, responsibilities, and results. The EMS and environmental "aspects" need to be communicated to all internal levels of the organization and job functions that could impact the environment. The internal communication procedure specifies whose responsibility it will be to communicate changes relating to the EMS and environmental aspects. Changes may include environmental information, such as revised objectives and targets, changes in procedures, and environmental incidents or regulatory changes. Another internal communication "how to" is a process for responding to employee requests and concerns related to the EMS and P2. Internal communication should include discussions of general and useful P2 opportunities that apply to all wastes and losses identified in the organization.
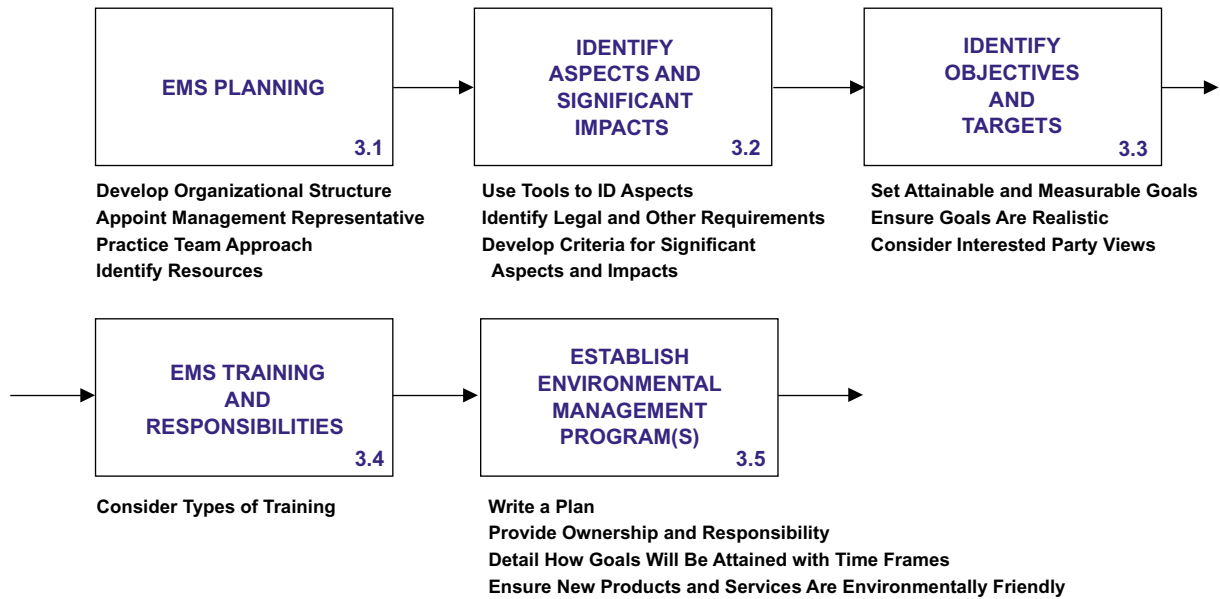
Figure 6-4. Planning in the EMS.

EMS PLANNING

As an organization grows and as product lines change, planning is necessary. Planning for P2 should go hand in hand with any business planning effort (Figure 6-4, work step 3.1). Unfocused, ill-timed, or poorly managed P2 efforts will lead to low performance and high cost. Conversely, a well-conceived and effectively implemented P2 program leads to high performance and reduced costs. Improved environmental performance is an important benefit for most organizations undertaking EMS development and implementation. Although some organizations have comprehensive EMSs that systematically track environmentally relevant activities, many do not. An EMS includes organizational structure, responsibilities, practices, procedures, processes, and resources for implementing effective environmental management.

Top management appoints a management representative or representatives to ensure the organization accomplishes its goals when establishing an EMS. The management representative monitors and evaluates the system and reports to top management on the EMS's effectiveness. The coordinator(s) works with organizational teams to generate new ideas and modify the EMS when necessary for improvement. The organization could create an environment and select a forum in which creative ideas can be heard and tried.

Most organizations choose to meet in teams to discuss production and wastes and develop questions for needed checklists. Teams are used to multiply the strength of the organization. The team approach

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The management representative monitors and evaluates the system and reports to top management on the EMS's effectiveness.

Teams are used to multiply the strength of the organization. The team approach allows for discussion and comparison of differences.

allows for discussion and comparison of differences. It may be useful to set up self-managing P2 teams chosen from all levels of the organization. The involvement of several levels of management in these discussions, normally in several groups, improves their usefulness. Clearly identifiable teams are the primary means of organizing the EMS work, as opposed to individual job functions or independent work areas. These teams can be used to identify, evaluate, and implement P2 opportunities.

Teams are authorized to take direct action, make decisions, and initiate changes that result in continual improvement of the EMS to comply with the policy and achieve the organization's objectives and targets. When the employees' roles have been formally structured to support the work team approach, members can rely on one another for cross training, problem solving, administrative duties, and mutual support. Opportunities for waste elimination, reduction, reuse, recycling, and energy and water conservation are addressed by a P2 team of the most appropriate people regardless of their reporting level in the organization.

Identification of Aspects and Significant Environmental Impacts

The EMS is driven by environmental impacts. An EMS encourages organizations to systematically address the environmental impacts of their activities, products, and services (Figure 6-4, work step 3.2). This systematic approach may prove effective in encouraging organizations to take a proactive and P2 approach to managing their environmental impacts and programs. An organization's aspects may include waste generation and pollution, resource utilization and depletion, energy generation and utilization, and other ecological impacts on the environment.

> **Aspect**—element of an organization's activities, products, or services that can interact with the environment.

The standard outlines a core set of planning activities that are used in many organizations to assess and implement P2. This planning ensures a facility will:

- Identify facility activities, operations, processes, services, and products that have environmental impacts
- Identify all legal requirements that apply to the organization's activities, products, and services
- Evaluate which environmental impacts are significant
- Set objectives and targets for reducing negative environmental impacts
- Select and implement activities through environmental management program(s) to achieve the identified targets

These teams can be used to identify, evaluate, and implement P2 opportunities.

Teams are authorized to take direct action, make decisions, and initiate changes that result in continual improvement.

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An organization's aspects may include waste generation and pollution, resource utilization and depletion, energy generation and utilization, and other ecological impacts on the environment.

Through the procedure of aspect identification and ranking, P2 should emerge as a core part of the environmental management plan(s). The P2 assessment is a systematic, periodic survey of the organization's operations designed to identify areas of potential waste reduction and conservation. A well-designed EMS can go far beyond the traditional process-driven view for characterization of wastes and losses. In evaluating all of its environmental aspects, an organization can take activities such as solid waste, energy and water use, landscaping, commuting, sound, and other impacts into consideration although they are not regulated. The organization can question suppliers about contents of materials, use and types of packaging, and methods of delivery. Aspect identification procedures include the following:

- Process mapping
- Interviews
- Questionnaires
- Checklists
- Benchmarking
- Cost/benefit, energy, and life cycle analysis
- Inspections and audits
- Review of records and emergency responses
- Material balances of inputs and outputs

Consideration of operating conditions and controls and their effect on environmental impacts is an important part of identifying the organization's significant aspects. The organization should select criteria to determine the significance of its aspects. The criteria might include regulated activities, costs to manage, and risks associated with use of raw materials. What is most important is that the criteria reflect the organization's values as stated in the policy. Several good examples of ranking potential significant aspects/impacts can be found in US EPA's *Integrated Environmental Management Systems Implementation Guide* and NSF International's *Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations* (References 6-4 and 6-5). See the CD-ROM for more information on EMSs.

Identifying operations and monitoring and measuring activities associated with significant environmental aspects leads to the development of procedures that minimize the risk of those environmental impacts. This systematic approach can help foster P2 solutions by encouraging an organization to identify opportunities for doing things in new ways, for finding new products from "waste," and for going beyond the traditional view that environmental issues are the responsibility of the environmental, health, and safety managers.

Typically, organizations separate their environmental strategies by media—land, air, and water—to address their environmental impacts

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and compliance with various environmental regulations. This leads to a single media dependence on reactive and end-of-pipe strategies that are potentially inefficient and costly. Many organizations that have instituted a thorough EMS have benefited by becoming aware of inefficiencies that were not apparent previously. Correcting these inefficiencies generates cost savings and reduced environmental liabilities. A multimedia EMS approach will ensure all significant aspects are identified that impact the environment and are costly for the organization.

The organization benefits by involving suppliers and contractors in the EMS procedures and requirements for certain significant environmental aspects they could impact. Identification of health and environmental concerns associated with the raw materials used by an organization is important in assessing the significance of environmental aspects associated with that materials' use. It may be necessary to provide training and guidance to outside organizations whose actions onsite may create an aspect or impact the organization's environment. This provides a forum for the two organizations to investigate goods and services for P2 opportunities. From improving efficiencies to changing basic processes, design has played an important role in reducing waste. Good supplier partnerships can result in designing for P2 and meeting the objectives and targets established for the EMS.

An organization may choose to modify an existing assessment tool or develop a procedure for identifying all the organization's environmental aspects and their significance. Use a team approach during this planning phase and keep the aspects' list updated. Prioritize the significant aspects to begin addressing opportunities to improve the organization's impact on the environment. Finally, remember to look beyond regulatory requirements and your organization's boundary when considering your organization's aspects and invite input from all interested parties.

EMS Objectives and Targets

The EMS sets explicit goals by establishing and maintaining objectives and targets for improvement (Figure 6-4, work step 3.3). The EMS's objectives and targets are the most important place for articulating P2 planning goals. Although an organization has discretion with regard to its objectives and targets, they must be consistent with the organization's environmental policy containing a commitment to prevention of pollution that helps reinforce source reduction goals and compliance with state P2 planning laws.

Objectives—overall environmental goals that an organization sets out to achieve.

Targets—detailed performance requirements that are set and met to achieve the environmental objectives.

Again, P2 (source reduction) practices and techniques succeed best when promoted as the number one strategy for improving environmental performance and meeting attainable and measurable goals. In setting the EMS's objectives and targets, the organization must consider (1) significant environmental aspects, (2) legal and other requirements, (3) the views of external parties and societal concerns, (4) technical options and operational feasibility, (5) financial requirements for paybacks, and (6) business requirements for marketability and profitability. All of these are usually taken into consideration when P2 opportunities are being examined for inclusion in an organization's P2 plan.

In setting the EMS's objectives and targets, the organization must consider (1) significant environmental aspects, (2) legal and other requirements, (3) the views of external parties and societal concerns, (4) technical options and operational feasibility, (5) financial requirements for paybacks, and (6) business requirements for marketability and profitability.

An EMS encourages innovative P2 solutions to waste and loss problems at all levels of the organization. Documented objectives and targets of the EMS must be provided for all relevant levels and functions of the organization that impact the environment. The objectives and targets may be different for various levels of the organization such as management, plant engineer, and line supervisors and operators. The keys are consistency with the environmental policy and the inclusion of P2. The EMS standard requires organizations to set objectives and targets for reducing their environmental impacts, select activities to achieve the identified targets, and then use a continual improvement cycle to evaluate and correct the system.

EMS Training and Responsibility

The EMS requires that all employees be made aware of their environmental responsibilities and trained to exercise care when performing duties with environmental consequences (Figure 6-4, work step 3.4). Consider what type of EMS training is needed to achieve the organization's objectives and targets and integrate this training into existing environmental, health and safety, and emergency preparedness training programs. This training requirement provides the opportunity to involve all employees in P2. If the absence of correct procedures could lead to deviations from your EMS policy, objectives, or targets, the procedure or work instruction should be documented and used in training. This is an extremely important part of a successful EMS.

The EMS requires that all employees be made aware of their environmental responsibilities and trained to exercise care when performing duties with environmental consequences.

Employees will need to be trained in the procedures relevant to their roles and responsibilities for meeting the objectives and targets and in the potential results of departure from specified operating procedures. It is important to ensure that EMS internal auditors are trained and familiar with the waste management hierarchy and P2 strategies. Training will ensure that EMS objectives and targets are assessed and are being met using source reduction methods.

It is important to ensure that EMS internal auditors are trained and familiar with the waste management hierarchy and P2 strategies.

One company created a bulletin board displaying the company's policy, significant aspects and impacts, and objectives and targets of the EMS. During morning line meetings, the line supervisors went with the line team to the bulletin board and reviewed this information all the

way up to the week of the ISO 14001 registration audit. This approach was excellent for several reasons: (1) it built on a system already in place, (2) the regular meeting established and reinforced the importance of knowing this information, and (3) the employees knew where to go when the auditors asked them questions about these areas of the EMS.

By providing environmental awareness training for all employees, an organization can count on the technical know-how of employees on the production floor to help find creative P2 strategies to reduce their environmental impacts. With respect to training competency, the EMS standard asks that the organization determine what qualifications (education, training, and/or experience) are necessary and to ensure that each employee completes these requirements for his/her job. Often, it is the employees most familiar with the organization's production processes who are in the best position to identify P2 projects for improving environmental program performance. Just as an organization uses incentives to boost employee productivity, management should provide incentives for developing useful ideas to reduce waste.

Often, it is the employees most familiar with the organization's production processes who are in the best position to identify P2 projects for improving environmental program performance.

Environmental Management Programs (EMPs)

The EMS is designed to continually improve system and environmental performance through creation of an environmental management program (EMP). The EMP is the last element of the EMS planning phase (Figure 6-4, work step 3.5). It sets up action items, assigns responsibilities at all levels of the organization for plan execution, sets specific time lines, and determines the resources needed for implementation to achieve the objectives and targets. With the goals established, the subset of activities defined, and the accountabilities in place, each person with specific responsibilities must now develop EMPs for implementation. One person or several people are assigned the accountability for meeting the goals and objectives in the planned time frame for each task in the action plan and for maintaining the current level of performance on each of these items.

The EMS is designed to continually improve system and environmental performance through creation of an environmental management program (EMP).

Although setting objectives and targets is treated as a separate function from EMPs in the planning phase, they are related. You have to have an idea of how you will accomplish an objective and target before you set it up as a program in your system. This is the process many organizations now use in their P2 planning effort to accomplish specific projects. After P2 assessment and planning, projects are initiated to implement technically and economically feasible P2 opportunities. Without the continual improvement component of the EMS, however, P2 planning and implementation may be an end point instead of the ongoing process of setting new objectives and targets for other aspects that impact the environment.

The number of EMPs that an organization sets up can vary. One company uses one EMP to address all of its objectives and targets.

Another company set up four EMPs for dealing with (1) all regulated aspects, (2) solid waste, (3) energy usage, and (4) PCB elimination. Finally, one company's EMPs were developed largely at the departmental level. The EMP(s) and objectives are reviewed by the team when changes occur in the organization's operations. When objectives and targets are not met, corrective actions are identified and taken.

As progress is made, it should be recorded against the EMPs created. Some questions and progress can be measured quantitatively. Other questions are more subjective, but progress can still be measured. The purpose is to monitor progress on currently active EMPs and watch for slippage on implemented activities. As with any implementation review, the questions to ask are the following:

- Have the milestones been achieved?
- If not, what can be done to bring this stage of implementation back on schedule?
- What issues need to be resolved to continue our progress?

The number of EMPs that an organization sets up can vary. One company uses one EMP to address all of its objectives and targets. Another company set up four EMPs for dealing with (1) all regulated aspects, (2) solid waste, (3) energy usage, and (4) PCB elimination. Finally, one company's EMPs were developed largely at the departmental level.

EMS IMPLEMENTATION

At present, there is a clear need for careful evaluation of how an EMS will influence an organization's environmental effectiveness. This evaluation will facilitate more informed decision-making about how best to incorporate an EMS approach into existing environmental regulatory programs and P2 planning. At this point, many organizations already have sophisticated EMSs in place and perceive little customer demand or regulatory advantage to seek full registration. Many are aligning with the standard, however, and are aware that third-party auditing may become necessary in the future.

Most organizations already have regulatory and P2 procedures including work instructions, batch sheets, training records, testing and monitoring results, controls to meet permit operating limits, and calibration instructions (Figure 6-5, work step 4.1). Build on your existing documentation whenever you can if it is appropriate. The working documents provide the detailed "how to" and step-by-step instructions needed to perform tasks. Document the system requirements to meet your business needs and keep it simple.

If instructions and documentation do not add value to operational control, question whether they are needed. Not every department in the organization will need the same amount or detail in documentation. Factors that can affect the need to document procedures include the risk and complexity of the activity and the frequency and degree of supervision needed to perform the activity. Organizational teams should identify gaps in the existing documentation and initiate new procedures to ensure continual improvement.

Build on your existing documentation whenever you can if it is appropriate.

If instructions and documentation do not add value to operational control, question whether they are needed.

Factors that can affect the need to document procedures include the risk and complexity of the activity and the frequency and degree of supervision needed to perform the activity.

Records document that the organization is doing what it said it would, and they include forms, labels, tags, logbooks, and correspondences. Important record system questions are the following:

- How will records be collected?
- Where will records be filed?
- How will records be filed?
- How will records be disposed (recycled)?
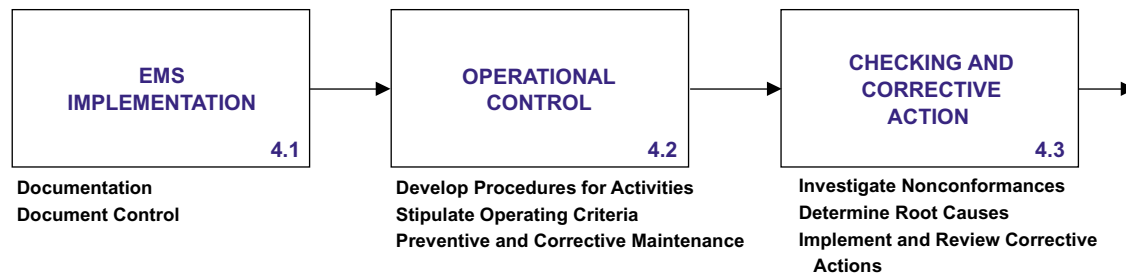
Figure 6-5. Implementation of the EMS.

Operational Control

Implementation of operational controls is the "do" part of the EMS cycle of "plan, do, check, review" (Figure 6-5, work step 4.2). Procedures are instructions used by the organization for environmental system activities such as P2. They define the details of who, what, when, where, and why in the EMS activities and include some generic "how to's." This is where most organizations expend the most effort while implementing an EMS. Because procedures are extremely important, the organization will benefit from determining which procedures to document and how to best write them for guidance and training. Written procedures are an essential element of operational control if the absence of these procedures could lead to deviations from the environmental policy, objectives, and targets.

The important step for operational control is identifying activities and employee job functions that can have a potential or actual impact on the environment. Operational controls established for significant environmental impacts help the organization determine the roles, responsibilities, and authorities needed to ensure performance. You stipulate operating criteria for employees in these improved standard procedures. Large amounts of waste may be generated through improper storage practices, inefficient production start-up or shutdown, scheduling problems, lack of preventive maintenance, or poorly calibrated devices for pollution control. Good operational control for P2 is defined as a procedure or process within an organization that reduces multimedia wastes and conserves natural resources.

Process changes can result in new operational controls that reduce waste at the source, primarily during production. Good operating procedures and improved housekeeping are the simplest P2 practices. Improved housekeeping relies on using good common sense and is often the most effective first step toward waste reduction. By properly labeling materials and wastes, an organization can reduce the risk of misuse or disposal of the wrong substance. By properly separating wastes, an organization can assess the potential for reuse, recycling, or exchange of the materials. Inventory control and handling materials properly, including storage, will reduce loss of input materials and reduce expired shelf life of time-sensitive materials.

Good operating procedures and improved housekeeping are the simplest P2 practices.

Substituting less toxic raw materials may be difficult in certain situations, but it can be an efficient part of P2 operational control to reduce multimedia wastes. Changes may include equipment, layout, piping changes, use of automation, waste concentration or volume reduction, and energy conservation. Operational control ensures that equipment is working properly and avoids faulty valves or pipes leaking materials that become contaminated and a waste. Preventive maintenance procedures are designed to reduce incidents of equipment breakdowns, inefficiency, or process fluid leakage. Another important operational control is corrective maintenance, such as resetting control valves or adjusting process temperatures to increase efficiency and prevent raw material loss and waste generation.

Substituting less toxic raw materials may be difficult in certain situations, but it can be an efficient part of P2 operational control to reduce multimedia wastes.

The basic steps to success in P2 through operational control include building on existing systems, establishing procedures, assigning responsibility, determining access, communicating and training, and auditing procedures and records. These procedures are the core of a P2 program's operational phase and are often the "low-hanging fruit" that are within easy reach. Without a Systems Approach, much of the P2 "low-hanging fruit" will be lying on the ground.

Checking and Corrective Action

The checking and corrective action element in the EMS is the main focus for continual improvement (Figure 6-5, work step 4.3). Management involvement and commitment to reducing waste needs to deal successfully with checking and corrective action. P2 may benefit from closer supervision to improve production efficiency and reduce inadvertent waste generation through early detection of mistakes. EMSs ensure that nonconformances to procedures are investigated, that root causes of the nonconformity are identified, and that corrective and preventive actions are implemented, documented, and reviewed. This type of analysis leads to increased efficiency of the EMS and P2 through improved performance.

The checking and corrective action element in the EMS is the main focus for continual improvement.

As systems are put in place, it makes sense to establish measuring processes on how well the system is working, identify actual or

potential problems, and act to eliminate them. This element of the EMS establishes measures of environmental performance and identifies where corrective actions are needed, if any. Organizations that have implemented an EMS have realized internal efficiency gains. Internal efficiency gains may be realized by the identification of root causes of waste and by easier access to environmental reporting information, records, and permits.

EMS MONITORING AND MEASUREMENT

The EMS standard requires procedures to monitor and measure your environmental performance, to record information that allows performance tracking of operational controls and conformance with the objectives and targets, and to evaluate compliance with environmental regulations.

Determining what to monitor and measure and what information to record is critical.

The EMS standard requires procedures to monitor and measure your environmental performance, to record information that allows performance tracking of operational controls and conformance with the objectives and targets, and to evaluate compliance with environmental regulations (Figure 6-6, work step 5.1). This element leads to success in determining real measurements that can be communicated internally or externally.

Determining what to monitor and measure and what information to record is critical. The objectives and especially the targets of the EMS are quantifiable and measurable so that progress toward achieving them can be tracked. EMS measures are used as environmental performance indicators. Legal and other requirements were considered in setting objectives and targets so monitoring of effluents and air emissions are measured and tracked. Key operational characteristics and parameters associated with significant environmental aspects are tracked and can serve as measures. Choose the number of indicators carefully—too many create information overload and an ineffective system, but too few mean you won't have enough information to make good business decisions. To ensure good measurement, the key questions to answer are the following:

MONITORING AND MEASUREMENT WITH CORRECTIVE AND PREVENTIVE ACTIONS 5.1	PERIODIC REVIEW BY MANAGEMENT OF IMPLEMENTATION AND EFFECTIVENESS 5.2	IMPROVE EMERGENCY PREPAREDNESS AND SPILL PREVENTION 5.3
Measure Environmental Performance Track Operational Controls Track Conformance with Objectives and Targets Evaluate Compliance with Environmental Regulations	Detect Overall EMS Trends Review Corrective Actions for Continual Improvement Provide Commitment and Support	Review and Update Procedures and Training After Accidents

Figure 6-6. Evaluation and Management Review.

- Who is responsible for tracking, analyzing, compiling, and reporting data?
- What is the frequency of measurement for data?
- How will data be analyzed/compiled?
- How will data be reported?

Although the organization may be monitoring data on a hourly or daily basis for compliance purposes, the data will be used more strategically for the EMS. Monitoring will be used to detect overall trends and the possible need for corrective and preventive action. In this way, the organization may identify gradually declining performance and will be able to reverse it before a nonconformance, noncompliance, or other incident occurs.

Many companies are already evaluating their compliance in at least one of two ways: through compliance audits or through monitoring of regulatory permits. An environmental compliance audit compares an organization's performance with a set of environmental requirements relying largely on following a paper trail of permits, sampling data, and reports. Auditing the EMS's actual performance is different because it focuses on employees from various levels and job functions within the organization and their actions. A compliance audit compares an organization's performance to environmental requirements while an EMS audit focuses on employees and their actions.

A compliance audit compares an organization's performance to environmental requirements while an EMS audit focuses on employees and their actions.

There are two types of environmental solutions: short term to fix the immediate problem and long term to prevent the problem from recurring. The focus of the EMS and P2 is on the long-term solutions that eliminate or reduce the organization's environmental aspects and impacts. The first step to implementing a long-term solution is to develop plans that assign responsibility, determine progress dates, and designate needed resources to complete the corrective actions. If at some point the initial solution does not work, it may mean the true root cause was not correctly identified. At this point, generate new solutions and record the reason for the change.

The focus of the EMS and P2 is on the long-term solutions that eliminate or reduce the organization's environmental aspects and impacts.

Management Review and Continual Improvement

An EMS encourages a systematic approach to improving environmental procedures and performance through continual improvement. Top management periodically reviews EMS implementation and effectiveness (Figure 6-6, work step 5.2). Experience has shown that the effectiveness of management directly affects the chances of a successful EMS. EMSs are business systems that allow organizations to manage their environmental issues in a systematic, organized fashion based on continual improvement—just like any other area of business such as quality, purchasing and inventory control, accounting and payroll, and cash flow. Like these other areas, EMSs focus on top management support and commitment, accountability, employee involvement, responsibility and training, documentation, operational controls,

An EMS encourages a systematic approach to improving environmental procedures and performance through continual improvement.

preventive actions, and periodic checking and review with corrective action.

If a nonconformance has occurred, the responsible employees determine how to correct it and prevent it from recurring. Management review provides a broader, strategic look at the EMS and may be a source of direction on preventing nonconformance. There are many tools for developing solutions that have been discussed previously. The next step is to prioritize the solutions for possible implementation. Use of traditional business tools for prioritizing solutions can be used, such as cost-benefit analysis.

Emergency Preparedness and Spill Prevention

Accidents and emergency situations can create environmental impacts. Large amounts of waste may be generated through spills and lack of emergency response procedures. The EMS must include preventive actions and how to mitigate environmental impacts. Improving emergency preparedness procedures reduces accidental and material losses while maintaining or increasing productivity (Figure 6-6, work step 5.3).

Studies to implement preventive and corrective maintenance, emergency response, spill prevention, and P2 programs should be undertaken and their findings incorporated into the operational control procedures. Improved procedures can range from a change in management approach to a change in waste handling practices and must be a part of the overall emergency plan for the organization.

Preventive procedures should be reviewed and updated when necessary after accidents and emergency situations. When it comes to developing solutions, the EMS stipulates that the corrective and preventive actions be appropriate to the magnitude of the problem and commensurate with the environmental impact encountered. P2 can be implemented by changing existing procedures to reduce waste resulting from the cleanup of spills or leaks. Emergency plans already developed can be referenced in the overall emergency preparedness and response procedure of the EMS.

LESSONS LEARNED

The EMS is based on a documented and clearly communicated policy that includes three distinct guiding principles: compliance with applicable environmental requirements, prevention of pollution, and a commitment to continual improvement in environmental performance. In some cases, organizations' environmental policies, especially corporate policies, may have become too long and broad to be understood easily by employees and the public. An organization's EMS policy needs only to focus on the three guiding principles and to drive the accomplishment of the EMS's objectives and targets through training and involvement.

An EMS identifies, translates, and communicates applicable environmental and voluntary requirements to affected employees, suppliers, and contractors. Voluntary requirements may include those addressing P2, company or corporate initiatives, health, process safety management (PSM), and sustainable development. Health and PSM tend to be mandatory requirements of the Occupational Safety and Health Administration (OSHA). EPA's Green Lights, Climate Wise, Project XL, Design for the Environment (DfE), Environmentally Preferable Purchasing Program (Reference 6-9), and the American Chemistry Council's (ACC) Responsible Care® are examples of voluntary initiatives. Refer to the CD-ROM for more information on these programs. Standard operating procedures ensure that the employees, suppliers, and contractors can meet the EMS's requirements.

Compliance with Environmental Regulation

The EMS specifies procedures for how compliance will be achieved and maintained organizationally. For example, it defines the compliance roles and responsibilities of environmental managers, establishes how they and management will be held accountable for achieving and maintaining compliance, and describes how environmental performance and compliance information will be communicated to relevant employees, suppliers, and contractors. The EMS establishes a mechanism for receiving and addressing environmental and compliance concerns raised by individuals, organizations, or other interested parties.

The EMS includes procedures for identifying changes to applicable environmental requirements—including new ones that may apply as a result of process or material changes—and addressing these changes through the EMS process. For those organizations that are already performing environmentally, the EMS should establish objectives and targets that promote leadership and ensure continued achievement of compliance.

Prevention of Pollution

Identifying all aspects and determining their significance is usually the largest gap in most organizations' current environmental systems. The EMS establishes and maintains a procedure to identify all of the environmental aspects of the organization's activities, products, and services that it controls and influences. Current procedures to identify existing process waste streams and review new customer work requests can be used as starting points for identifying all aspects. Also, a procedure to identify which of these aspects have significant impact on the environment is needed, and significant impacts must be considered in setting objectives.

Many organizations focus almost exclusively on negative environmental impacts. Positive environmental impacts are also important. These might include company-sponsored community recycling pro-

An organization's EMS policy needs only to focus on the three guiding principles and to drive the accomplishment of the EMS's objectives and targets through training and involvement.
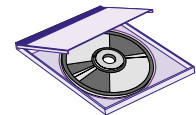
Standard operating procedures ensure that the employees, suppliers, and contractors can meet the EMS's requirements.

The EMS establishes a mechanism for receiving and addressing environmental and compliance concerns raised by individuals, organizations, or other interested parties.

The EMS should establish objectives and targets that promote a leadership and ensure continued achievement of compliance.

grams and household hazardous waste collection days. An EMS can develop approaches to procurement, processing, and delivery that reduce or minimize significant environmental impacts for organizations, customers, and interested parties.

An EMS establishes specific objectives, targets, and time frames for implementing P2 initiatives, improving environmental performance, and maintaining compliance.

An EMS establishes specific objectives, targets, and time frames for implementing P2 initiatives, improving environmental performance, and maintaining compliance. These should be documented and updated. An EMS ensures that the organization has skilled employees and financial and technical resources to achieve its objectives and targets and maintain compliance. In setting objectives and targets for each relevant job within the organization, it is important to consider pollution prevention goals; any additional significant impacts; legal and other requirements; technological options; financial, operational, and business requirements; and views of interested parties. These considerations are important in EMS planning and are used for capital improvement decisions, product and process design, training programs, and maintenance activities.

EMP requirements specifically include designation of responsibility for actions and the means and time frame by which the objectives are to be achieved.

The organization establishes environmental management programs (EMPs) to achieve its EMS objectives and targets. EMP requirements specifically include designation of responsibility for actions and the means and time frame by which the objectives are to be achieved. The EMP must review new activities, products, equipment, or services and address environmental changes through the EMS. For measuring performance-based improvement, targets must be quantifiable and use metrics that are related to the organization's overall goals. Most organizations have set some quantitative goals for various process waste streams, for example, reducing sludge production 10% by 2002 based on amount of wastewater treated. The EMP establishes the frequency at which the objectives and targets will be reviewed.

Continual Improvement

The EMS identifies and provides for the planning and management of all the organization's operations and activities, including facility maintenance, in order to achieve operational control and maintain compliance.

In many organizations, operational controls have been implemented for achieving waste reduction goals, although responsibility for achieving these goals has not always been designated. The EMS identifies and provides for the planning and management of all the organization's operations and activities, including facility maintenance, in order to achieve operational control and maintain compliance.

The EMS also establishes documented procedures for mitigating any adverse impacts on the environment that may be associated with accidents or emergencies.

The EMS establishes documented procedures for preventing, detecting, investigating, promptly correcting, and reporting (both internally and externally) actual and potential accidents, emergency situations, and environmental violations. The EMS includes procedures for tracking any preventive and corrective actions that are taken. If an environmental violation or accident resulted from a weakness in the system, the EMS is updated and refined, ensuring that similar situations are avoided. The EMS also establishes documented procedures for mitigating any adverse impacts on the environment that may be associ-

ated with accidents or emergencies. An EMS provides for the testing of emergency procedures when it is practicable.

EMS training programs ensure that all employees, suppliers, and contractors whose job roles may impact objectives, targets, and compliance are trained and capable of carrying out their responsibilities. The organization should evaluate competency for employees whose work may create significant environmental impacts. The organization must date and retain training records, training materials, and documents demonstrating evaluation of employee awareness and competency.

EMS documentation describes how all of the system elements will be integrated into the organization's overall decision-making and business planning process and provide direction to all relevant environmental procedures. An EMS document control system includes procedures for maintaining and protecting documents and other records as objective evidence of compliance and effectiveness. The EMS specifies retention times for environmental records in accordance with relevant laws.

An EMS document control system includes procedures for maintaining and protecting documents and other records as objective evidence of compliance and effectiveness.

Management must appoint a representative to ensure implementation and review of the EMS. The EMS requires periodic and objective auditing and review of the organization's environmental system effectiveness and compliance. Without top management review, visible involvement, and support, the EMS will not generate significant environmental improvement or better results over the current management system. This is the most important element of the EMS because management becomes a source of direction and oversees development of action items for sustainable improvement and long-term value creation. Management review promotes organizational leadership by demonstrating a commitment to environmental responsibility. The scope and frequency of the review will depend on the size and complexity of the organization's environmental impacts.

Management review promotes organizational leadership by demonstrating a commitment to environmental responsibility.

Organizations are discovering that their investments in EMSs are leading to improved environmental performance and compliance with benefits for the environment and community. An EMS provides a good method for establishing and implementing a P2 program. To achieve maximum environmental benefits, the EMS should embody the "plan, do, check, and act" model for continual improvement. This model ensures that environmental impacts are systematically identified, controlled, and monitored. The EMS helps ensure more consistency by organizations in achieving and maintaining compliance, promoting results-oriented efforts, and attaining more reliable data on environmental performance. Effective use of an EMS can be viewed as a demonstration of environmental responsibility and leadership by organizations. An EMS provides the basis for collaborating with regulatory agencies to enhance suitability and effectiveness and promote a leadership, performance-based system.

An EMS provides a good method for establishing and implementing a P2 program. To achieve maximum environmental benefits, the EMS should embody the "plan, do, check, and act" model for continual improvement.

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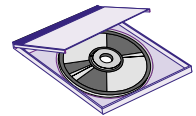
CHAPTER 7
Using a Quality Model to Implement P2

INTRODUCTION

This chapter presents an approach to preparing a P2 plan that is business-oriented, while still meeting any state or local P2 requirements. P2 has sometimes suffered from its reputation as something that the environmental personnel do or direct others to do. A more effective approach is integrating P2 into your organization's core business practices. This approach allows you to communicate the value of P2 to both senior management and workers. Your P2 plan also can be maintained and improved on an annual basis. This chapter presents a proven quality model that is based on the highly successful Baldrige Quality Program.

The Malcolm Baldrige National Quality Award is bestowed each year by the President of the United States on organizations that have demonstrated proficiency in the use of this quality model. The award was established by the U.S. Congress in 1987 to raise awareness about the importance of quality and performance excellence. When this award was established, the organizers believed that quality was no longer optional for American companies but was instead a necessity for doing business in an ever-expanding and more competitive world market. Nearly 50 countries now offer awards based on the Baldrige quality model, and 43 of the 50 states in the United States offer awards based on this model.

The Malcolm Baldrige National Quality Award was established by the U.S. Congress in 1987 to raise awareness about the importance of quality and performance excellence.

In 1998, the State of New Mexico began the Green Zia program, which adopted this quality model to measure environmental excellence. *Environmental excellence* is a term that describes the ultimate goal sought by using a quality program for environment, health, and safety (EHS) management. An environmental excellence program sets a "stretch goal" of attaining "best-in-class" status in those areas that best support a prevention-oriented approach to EHS management. No longer are short-term goals with percent reduction targets accepted by upper management and other interested parties. Results from these goal-driven activities are only "outcomes" of EHS performance and not a measure of the performance itself. Also, results by themselves offer little diagnostic value (i.e., were "good" results well below those of your competitors?). Green Zia shows an organization how to use a 15-item list of performance characteristics that can be modified to enable fast-paced EHS program improvement and thus contribute to the results. By focusing on performance, the organization can both help encourage P2 program development and provide a metric to show how effectively that P2 program is working.

In 1998, the State of New Mexico began the Green Zia program, which adopted this quality model to measure environmental excellence. Environmental excellence is a term that describes the ultimate goal sought by using a quality program for environment, health, and safety (EHS) management.

Using this quality model, the stretch goal can be set at **zero**—zero defects, zero inventory, zero equipment breakdowns, and zero waste. Many organizations are now extending the zero concept to EHS programs—zero incidents, zero accidents, zero wastes, zero emissions, and zero drain on world resources (sustainability). P2 is a major driving force in the quest for zero waste and zero emissions.

The Green Zia model has all the essential ingredients that make a zero waste vision possible.

The Green Zia model has all the essential ingredients that make a zero waste vision possible. First, it has criteria that define "best in class" so each organization can measure progress towards excellence. Second, it has a set of guiding principles (or core values) that must be present in order to integrate the criteria throughout the program. Third, it has a rigorous scoring system that is used by trained examiners to provide a score that represents the current state of the environmental excellence program on a 1000-point scale. Fourth, the examiners issue a feedback report detailing the strengths and weaknesses of an organization's excellence program against the criteria and guiding principles. The scoring system and the feedback reports are important tools for organizations to use in their environmental excellence programs. Organizations seek excellence, in their own way, using this model by selecting the performance elements for improvement and determining how to leverage these efforts in the organization. The P2 plan is often used to drive the program.

This chapter will first look at the criteria contained in this quality model. Next, the quality model's guiding principles will be discussed. Finally, a five-step process will be presented to show how this quality information can be integrated with the Systems Approach presented in the first four chapters of this *Guide*. You can find more readings on this topic in the reference section at the end of the chapter and on the CD-ROM that accompanies this *Guide*.

SEVEN QUALITY MODEL CRITERIA

When implementing a P2 program, it is important to keep your eye on what is important. Based on years of quality management experience, this boils down to seven criteria:

1. Leadership
2. Strategic planning
3. Interested-party involvement
4. Employee involvement
5. Process management
6. Information analysis
7. Results

These criteria form the basis for the Green Zia program and will be used in the quality model presented in this chapter. Within each of these criteria, you will need to address **how** you are working to integrate P2

into your organization. In the past, you have probably focused on **what** you were doing. This may still be important. The "how" approach will lead you to the level of P2 integration that you seek. The first six criteria show you how to drive performance that will then lead to results, something that is covered in the seventh criterion. Let's take a look at the types of "how" questions that should be asked in each of these criteria.

Leadership. A strong top-down direction for P2 or an EMS will enhance the chances of success in the program and help integrate it into the organization as a whole. P2 will be seen as important if the top leaders support it. Two sets of issues must be dealt with in the leadership criterion:

- How do senior leaders **communicate** their commitment to continual P2 program improvement to the employees and other interested parties?
- How do senior leaders **demonstrate** that commitment?

The time you take to keep the leaders informed and involved (i.e., "walking the talk") will help you provide answers to these important questions.

Strategic planning. Leadership most often uses some form of strategic planning to guide the organization's course. Sometimes this involves a formal strategic planning program. In other cases, the strategic planning may be much less formal. There are four basic questions that you need to address in the strategic planning criterion to attain continual P2 program improvement:

- How do you **identify** long-term and related short-term goals and objectives?
- How do you **develop** these goals and objectives?
- How do you **implement** these goals and objectives?
- How do these goals and objectives relate to your organization's overall business objective?

To be ideally situated, the P2 program must be important in the eyes of the senior leaders and be represented in the strategic planning process. There is a strong link between strategic planning and leadership.

Interested-party involvement. No organization operates in isolation. There are many other organizations that can have an impact on your P2 or EMS programs. Interested parties include a wide variety of different stakeholders in your P2 program such as customers, suppliers, contractors, regulatory agencies, non-government organizations (NGOs), environmental groups, community groups, and the public at

large. The questions that need to be considered for this criterion include the following:

- How does your organization involve interested parties in the development and implementation of your P2 program?
- How is your organization involved in other organizations' P2 programs?

The employees represent a special stakeholder position that has its own criterion.

Employees are a very important part of the P2 program.

Employee involvement. This criterion looks at the bottom-up portion of the P2 program, which is every bit as important as the top-down portion covered in the leadership category. Employees are a very important part of the P2 program, so it is important not to rely exclusively on outside experts and technical assistance to find P2 alternatives. Who knows the inner workings of an organization better than the employees? Questions that need to be addressed are the following:

- How does your organization prepare and involve employees in the **development** and in the **implementation** of the P2 program approaches?
- How are the employees' value and well-being considered in the P2 program?

Both the other interested-party and employee involvement criteria deal with the involvement of people in your P2 program. Now, you should turn to the process. In the past, this may have been the sole focus of the P2 program.

Process management concerns itself with how you manage all work processes in such a way that P2 behavior is facilitated.

Process management. This is the criterion that ISO 14001 or other EMSs can help an organization with its score. Process management concerns itself with how you manage all work processes in such a way that P2 behavior is facilitated. It is important to realize that the process management criterion includes both "things people do" and other organization work processes (e.g., manufacturing). The important questions to ask here are as follows:

- How does your organization identify the primary and supporting work processes that impact the P2 program?
- How does your organization analyze those work processes to understand their impacts and underlying causes?
- How does your organization manage all work processes to gain P2 program excellence?

This criterion is closely related to the information-analysis criterion.

Information analysis. Information analysis is the fuel of the P2 program. Paying attention to this criterion is the only way that clear results can be determined. The following three questions should be asked:

- How does your organization select information to assess the effectiveness of the P2 program?
- How does your organization collect that information?
- How does your organization use that information to make decisions?

This last question implies an important link to the strategic planning and leadership criteria. An organization that performs well makes sure that valuable information finds its way into the strategic planning process and is not used solely in the environmental program.

Results. This is the criterion with the greatest number of points in the quality model. Results measure the outcomes of all the performance changes and move the P2 program beyond anecdotal information and success stories to something that will link to all the other criteria. Remember that performance (i.e., the first six criteria) drive results. The two important considerations that need to be addressed in this criterion are as follows:

- What are your organization's planned vs. actual results related to your P2 program approach?
- What are the levels and trends as they relate to impacts on environment, other interested parties, and financial indicators?

The "how" is still involved in this criterion as you need to consider the following issues:

- How do you select the results you wish to track?
- How do you plan to measure them?
- How do you use the results to drive the other criteria?
- How do you trend your results for continual improvement?
- How do you trend the results of other similar organizations to benchmark your P2 program progress?

Using the Criteria

The Green Zia program makes it clear that all the criteria are linked and interrelated with the other criteria. Whenever you address one of the criteria, you need to ask how you need to leverage this by recognizing how it interacts with another criterion. The information that can be found on the CD-ROM will show many important connections between these criteria.

Another interesting fact about the Green Zia method is that there are a number of more detailed questions that can be asked within each criterion that describe what might be the best one can do (i.e., if you can answer every question in a positive manner within an example, your organization may be considered to be doing a great job in that area). A complete list of these questions can be found on the CD-ROM.
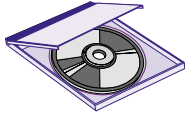
It is not important for your organization to be the best in all seven criteria areas. You will certainly do better in some than you do in others. The point is to make sure that the P2 program addresses all seven criteria in a forthright manner.

The Green Zia program assigns points to each of these criterion. These points emphasize the greater importance of results in a P2 program. By using the proper scoring methodology outlined on the CD-ROM, you will be able to see the areas that require more effort as you seek to improve the P2 program. Once you address these opportunities to improve the program using the Systems Approach tools, you can measure the amount of improvement in the overall program score. This concept will be described later in this chapter.

ELEVEN QUALITY MODEL GUIDING PRINCIPLES

Guiding principles, often referred to as *core values*, are used to set a context for all activities in an organization. They are meant to provide guidance for decision-making at all levels in the organization. You need to find a way to integrate each of the guiding principles with the proper criteria in the quality model if you wish to integrate the P2 program into the organization. Your organization may have already published a set of guiding principles. If so, consider how P2 can be addressed within each of these areas. If your organization does not have a set of guiding principles, consider how you can introduce the following principles into the culture. Keep in mind that it may take a long time (i.e., perhaps more than two years of concerted effort) to change the culture by addressing these guiding principles in the statement of the criteria. However, once this change takes place, the P2 program will be integrated within the organization. There are 11 guiding principles that can be considered in this quality model:

1. Interested-party–driven P2
2. Leadership
3. Continual improvement and learning
4. Valuing employees
5. Fast response
6. Efficient product, service, and process design
7. Long-range view of the future
8. Management by fact
9. Partnership development
10. Public responsibility and citizenship
11. Results focus

Let's take a look at what is meant by each of these guiding principles.

By using the proper scoring methodology, you will be able to see the areas that require more effort as you seek to improve the P2 program.

You need to find a way to integrate each of the guiding principles with the proper criteria in the quality model if you wish to integrate the P2 program into the organization.

Interested-party–driven P2. P2 is judged by interested parties (i.e., customers, employees, suppliers, regulators, stockholders, the public, and the community). Thus, P2 must take into account all product and service features and characteristics that contribute value to these interested parties and lead to their satisfaction, preference, and continued interest in your organization.

Interested-party–driven P2 is thus a strategic concept. It is directed toward organizational customer retention, market share gain, growth, and maintenance of all relationships with time. It demands constant sensitivity to changing and emerging interested-party and market requirements and the factors that drive interested-party satisfaction and attention. Interested-party–driven P2 also demands awareness of developments in technology and of competitor's offerings and rapid and flexible response to interested-party and market requirements.

Interested-party–driven P2 means much more than waste discharge and emission reduction, merely meeting regulatory requirements and specifications, or reducing complaints. Nevertheless, waste reduction and elimination of causes of dissatisfaction contribute to the interested party's view of P2 and are thus also important parts of interested-party–driven P2. In addition, the organization's success in recovering from EHS problems and waste management issues ("making things right for the interested party") is crucial to building interested-party relationships and to customer retention.

Leadership. An organization's senior leaders are the right team to set directions and create an interested-party orientation, clear and visible P2 values, and high expectations. These directions, P2 values, and expectations should address all interested parties. The leaders can ensure the creation of strategies, systems, and methods for achieving environmental excellence, stimulating innovation, and building knowledge and capabilities. The strategies and P2 values will help guide all P2 activities and decisions of the organization. The senior leaders who are committed to the development of the entire workforce will encourage participation, learning, innovation, and creativity by all employees.

Through their behavior and personal roles in P2 planning, communications, review of P2 performance, and employee recognition, the senior leaders serve as role models, reinforcing P2 values and expectations and building leadership and initiative throughout the organization.

Continual improvement and learning. Achieving the highest levels of P2 performance requires a well-executed approach to continual improvement and learning. The term *continual improvement* refers to both incremental and "breakthrough" improvement. The term *learning* refers to adaptation to change, leading to new goals and/or P2 approaches. Improvement and learning need to be "embedded" in the

P2 must take into account all product and service features and characteristics that contribute value to these interested parties and lead to their satisfaction, preference, and continued interest in your organization.

An organization's senior leaders are the right team to set directions and create an interested-party orientation, clear and visible P2 values, and high expectations.

The term continual improvement *refers to both incremental and "breakthrough" improvement.*

The term learning *refers to adaptation to change, leading to new goals and/or P2 approaches.*

way the organization operates. The term *embedded* means that improvement and learning:

1. Are a regular part of daily work.
2. Are practiced at individual, work unit, and organizational levels.
3. Seek to eliminate waste at its source.
4. Are driven by opportunities to innovate and do better in the P2 program.

P2 improvement and learning include:

1. Enhancing value to interested parties through new and improved products and services.
2. Developing new business opportunities from P2 successes.
3. Reducing waste, emissions, and discharges and related costs.
4. Improving responsiveness to production and quality in waste (nonvalue added activity) reduction programs.
5. Increasing productivity and effectiveness in the use of all resources (e.g., energy, water, and materials).
6. Enhancing the organization's performance in fulfilling its public responsibilities and service as a good citizen.

Thus, improvement and learning are directed not only toward better products and services but also toward being more responsive, adaptive, and efficient—giving the organization additional marketplace and performance advantages.

An organization's P2 success depends increasingly on the knowledge, skills, innovative creativity, and motivation of its workforce.

Valuing employees. An organization's P2 success depends increasingly on the knowledge, skills, innovative creativity, and motivation of its workforce. Employee success depends increasingly on having opportunities to learn and to practice new skills. Organizations can take advantage of the workforce's potential by investing in its development through education, training, and opportunities for continuing growth. Opportunities might include enhanced P2 awareness and increased pay for demonstrated P2 awareness, knowledge, and skills. On-the-job training offers a cost-effective way to train and to better link P2 training to work processes. Education and training programs may need to utilize advanced technologies, such as computer-based learning and satellite broadcasts. Increasingly, training development needs to be tailored to a diverse workforce and to be more flexible for high performance P2 work practices.

Major challenges in the area of valuing employees include:

1. Integrating human resource practices: selection, performance, recognition, training, and career advancement.
2. Developing, cultivating, and sharing the P2 knowledge possessed by the organization's employees.
3. Aligning human resource management with strategic change processes.

Addressing these challenges requires use of employee-related data on process knowledge, skills, satisfaction, motivation, EHS knowledge, and well being. Such data can be tied to indicators of organizational or unit performance, such as interested-party satisfaction, customer retention, and productivity. Through this approach, employee contributions may be integrated and aligned with business P2 directions.

Fast response. Obtaining permits and regulatory compliance can add significant time to organizational decision-making. Success in globally competitive markets demands ever shorter cycles for introductions of new or improved products and services. Also, faster and more flexible response to interested parties is now a more important requirement. Major improvements in response time often require simplification of work units and processes together with timely incorporation of P2 into the design phase (i.e., design for the environment). To accomplish this, the P2 performance of work processes should be among the key process measures. Other important benefits can be derived from this focus on time: time improvements often drive simultaneous improvements in organizational behaviors, quality, P2, cost, and productivity. Hence, it is often beneficial to integrate response time, quality, P2, and productivity objectives.

Major improvements in response time often require simplification of work units and processes together with timely incorporation of P2 into the design phase (i.e., design for the environment).

Efficient product, service, and process design. Organizations need to emphasize P2 in the design phase—problem and waste prevention achieved through building P2 into products and services and building efficiency into production and delivery processes. P2 design includes the creation of fault-tolerant (robust) or waste-free processes and products. Costs of preventing problems at the design stage are lower than costs of correcting problems that occur "downstream." Accordingly, organizations can emphasize P2 opportunities for P2 innovation and interventions "upstream"—at early stages in processes. This approach should also take into account the organization's supply chain.

Organizations need to emphasize P2 in the design phase—problem and waste prevention achieved through building P2 into products and services and building efficiency into production and delivery processes.

The design stage is critical from the point of view of public responsibility. In manufacturing, design decisions impact the production and content of municipal and industrial wastes as well as other environmental impacts. Effective design strategies should anticipate growing environmental demands and related issues and factors.

Long-range view of the future. Pursuit of market leadership requires a strong future orientation and a willingness to make long-term com-

Major components of such a long-term P2 commitment include developing employees and suppliers as key P2 participants in the long run and fulfilling public responsibilities over this period of time.

mitments to all other interested parties. Organizations anticipate many factors in their strategic planning efforts, such as interested party expectations, new business opportunities, the increasingly global marketplace, technological developments, new customers and market segments, evolving regulatory requirements, community/societal expectations, and strategic changes by competitors. Short- and long-term P2 plans, P2 strategic objectives, and P2 resource allocations can reflect these influences. Major components of such a long-term P2 commitment include developing employees and suppliers as key P2 participants in the long run and fulfilling public responsibilities over this period of time.

Management by fact. Organizations depend on the measurement and analysis of P2 performance. Such P2 measurements are driven by the organization's strategy and provide critical data and information about key processes, outputs, and P2 results. Many types of data and information are needed for P2 performance measurement and improvement. Performance areas should include (1) interested-party and employee satisfaction, (2) product and service offerings, (3) operations, (4) market and competitive comparisons, and (5) P2 financial benefits.

P2 measurements are driven by the organization's strategy and provide critical data and information about key processes, outputs, and P2 results.

Analysis refers to extracting larger meaning from P2 data and information to support evaluation, decision-making, and operational improvement within the organization. Analysis entails using data to determine P2 trends, projections, and cause and effect—knowledge that might not be evident without analysis. Data and analysis support a variety of purposes, such as P2 planning, reviewing overall P2 performance, improving operations, and comparing P2 performance with competitors or with "best practices" benchmarks.

P2 partnership development. Organizations can better accomplish their overall goals by building internal and external P2 partnerships.

Organizations can better accomplish their overall goals by building internal and external P2 partnerships.

Internal P2 partnerships might include labor-management cooperation, such as agreements with unions. P2 agreements might entail employee development, cross-training, or new work organizations, such as worker teams. Internal P2 partnerships also might involve creating network relationships among work units to improve flexibility, responsiveness, and P2 knowledge sharing.

External P2 partnerships might be with customers, suppliers, NGOs, environmental regulatory agencies, and educational organizations for a variety of purposes, including P2 education and training. An increasingly important kind of external P2 partnership is the strategic partnership of alliance. Such P2 partnerships might offer entry into new markets or a basis for new products or services. P2 partnerships also might permit the blending of an organization's core competencies or leadership capabilities with the complementary strengths and capabilities of P2 partners, thereby enhancing overall P2 capability, including the elimination of waste from all business processes.

Internal and external P2 partners should develop longer-term waste elimination objectives, thereby creating a basis for mutual investments. P2 partners should address the key requirements for success, means of regular communication, approaches to evaluating P2 progress, and means for adapting to changing conditions.

Public responsibility and citizenship. An organization can benefit by communicating its responsibilities to the public and practicing good citizenship. These responsibilities refer to basic expectations of the organization—business ethics and protection of public health, safety, and the environment. These responsibilities apply to the organization's operations as well as the life cycles of its products and services. Organizations also can emphasize resource conservation and waste reduction at the source. P2 planning should anticipate adverse impacts from production, distribution, and transportation. The plan must provide response if problems occur and make information available and provide the support needed to maintain public awareness, safety, and confidence.

In addition to meeting all local, state, and federal laws and regulatory requirements, organizations should treat these and related requirements as opportunities for continual improvement "beyond mere compliance" or by attaining compliance through P2.

Practicing good citizenship refers to the following items: (1) improving education, (2) promoting health care in the community, (3) enhancing the local environment, (4) promoting resource conservation and recycling, (5) participating in community service, and (6) sharing nonproprietary P2 program information. Leadership as a corporate citizen also entails influencing other organizations, private and public, to partner for these same purposes. For example, individual organizations could lead efforts to help define the obligations of their industry to its communities.

Results focus. An organization's P2 performance measurements will benefit from a focus on key P2 results. Results should be focused on creating and balancing value for all interested parties—customers, employees, stockholders, suppliers, NGOs, P2 partners, and the community. To meet the sometimes conflicting and changing aims that balance implies, organizational strategy needs to implicitly include all interested-party requirements. This balance will help to ensure that P2 actions and P2 plans meet interested-party needs and avoid adverse impact on any stakeholders. The use of a balanced composite of performance measures offers an effective means to communicate short- and long-term P2 priorities, to monitor actual P2 performance, and to marshal support for improving results. It is important to remember that the first six criteria drive performance while the results criterion captures the measurement of this performance. Results in and of themselves are not performance.

An organization's P2 performance measurements will benefit from a focus on key P2 results.

Using the Guiding Principles

The criteria describe how best-in-class organizations handle each of the seven areas covered. The guiding principles show how to integrate P2 into any organization. You can learn more about how to com-

bine these quality model items by reading the Green Zia and Baldrige information on the CD-ROM. Let us now see how these items can be incorporated into a P2 Plan.
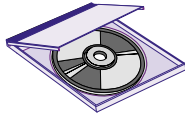
FIVE-STEP PROCESS TO IMPROVE YOUR P2 PLAN

Let's examine a simple five-step process that utilizes the quality model and the Systems Approach tools presented in the first four chapters of this guide. This process should help you integrate your P2 plan into your organization's core practices. These steps are as follows:

1. Plan and develop your P2 program.
2. Develop your organization's P2 opportunities.
3. Implement your revised P2 plan.
4. Maintain your P2 program.
5. Measure your progress toward zero waste and emissions.

This five-step process is presented as a top-level process map in Figure 7-1. Each of these steps will be described in the following sections. You can follow along with the various process maps that were prepared to illustrate the points made in the text.
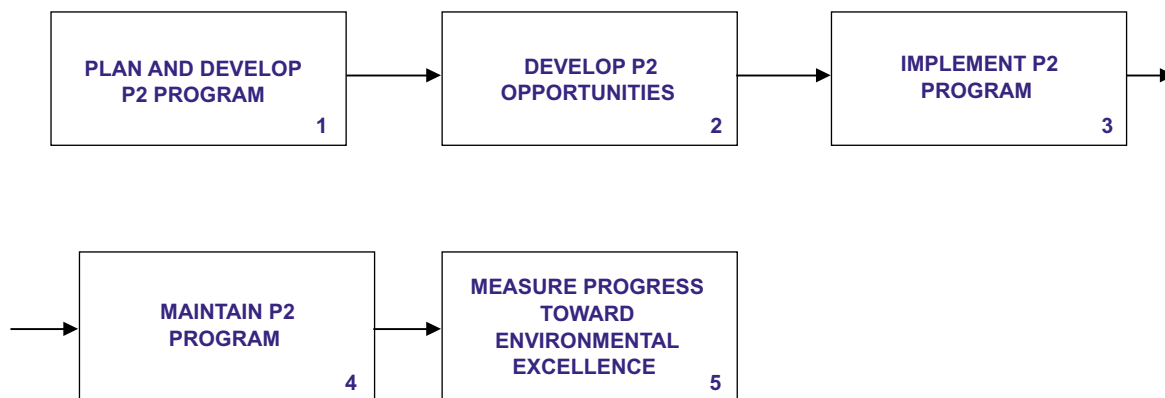
Figure 7-1. Top-level Depiction of Quality Model Approach to Pollution Prevention Implementation.

Step 1. Plan and Develop Your P2 Program

The first step in preparing a P2 program (Figure 7-2, work step 1.1) is to determine the elements of the quality model that will be addressed in the P2 planning effort. Four of the seven criteria covered in this chapter are addressed in this step: strategic planning, interested-

party focus, leadership, and employee involvement. You should determine the gap that may exist between the more detailed questions that get asked in the Green Zia program for each of these criteria and what is currently going on in your organization. The Green Zia criteria questions can be found on the CD-ROM that comes with this publication. Your gap analysis should also consider how to integrate the P2 program into your core business practice using some combination of the 11 guiding principles. This step is very similar to the first step in the traditional P2 approach discussed in Chapter 5.

The consideration of the quality model criteria should not only help you make your plan more businesslike, but it should also help you better meet the requirements of any P2 planning laws.

The leadership criterion helps you prepare the management P2 policy. This leadership examination will look at how senior leaders actually communicate and demonstrate their commitment to continual environmental improvement and P2 to employees and to other interested parties.

The leadership criterion helps you prepare the management P2 policy.

The employee involvement criterion helps you prepare the employee involvement, awareness, and training requirements. This effort looks at how the organization prepares and involves employees in the development and implementation of the P2 approaches. It also asks how the employees' value and well being are considered in these programs.

The employee involvement criterion helps you prepare the employee involvement, awareness, and training requirements.

The strategic planning criterion addresses how the organization will identify, develop, and implement long-term and short-term goals and objectives for continual environmental improvement and P2 and how these goals and objectives relate to the overall business objective.

The strategic planning criterion addresses how the organization will identify, develop, and implement long-term and short-term goals and objectives for continual environmental improvement and P2.

Finally, the interested-party focus criterion determines how your organization involves all interested parties in the development and implementation of your continual environmental improvement and P2 efforts.

The interested-party focus criterion determines how your organization involves all interested parties in the development and implementation of your continual environmental improvement and P2 efforts.

In the next step (Figure 7-2, work step 1.2), the relevant processes that occur within the organization are characterized using the process-mapping tool in the Systems Approach. These maps will be used as templates for gathering information on the process. This activity helps you identify the production units that require further analysis.

During this work step, consideration of two other criteria is important: process management and information analysis. Process management addresses how the organization will identify, analyze, and manage all the processes that have the ability to impact the environment or cause injury to workers. Information analysis determines how the organization selects, collects, and uses information to assess the effectiveness of the program and make decisions on the basis of this information.

Process management addresses how the organization will identify, analyze, and manage all the processes that have the ability to impact the environment or cause injury to workers.

PLAN P2 PROGRAM 1.1	CHARACTERIZE PROCESSES 1.2	DOCUMENT PAST SUCCESSES 1.3
Planning for Continual Environmental Improvement Interested Party Focus Leadership Employee Involvement Integrate with Guiding Principles	Process Maps of Main Process Process Maps of Supporting Processes Establish Information Templates Process Management Information Analysis	Prepare a Listing

PREPARE DRAFT P2 PLAN 1.4

Draft Plan Without Action Plans

Figure 7-2. Planning and Developing a Pollution Prevention Program.

Information analysis determines how the organization selects, collects, and uses information to assess the effectiveness of the program and make decisions on the basis of this information.

You will note that six of the seven criteria and the eleven guiding principles of the quality model are incorporated into the P2 program in the first two steps. This integration should help strengthen the P2 program and integrate it into the organization's key business operations.

The third step (Figure 7-2, work step 1.3) addresses the desirability of documenting previous P2 activities. Even at the start of a P2 program, it is important to document what has been done before. The third work step examines all P2 activities that can be documented with a time frame of two to five years. Employees and management alike will be justifiably proud of these accomplishments and can build on them in this newly constituted P2 program.

Finally, after all this effort, it is time to prepare a formal P2 plan in draft form for review both internally and by the interested parties. Once the P2 action plans are prepared, the P2 plan can be finalized and distributed.

Finally, after all this effort, it is time to prepare a formal P2 plan in draft form for review both internally and by the interested parties. Once the P2 action plans are prepared, the P2 plan can be finalized and distributed.

Step 2. Develop Your Organization's P2 Opportunities

The hierarchical process maps prepared in the previous step are now used to gather information on the production units. You are now ready to develop the P2 opportunities (Figure 7-3).

In the information and analysis step (Figure 7-3, work step 2.1), every use of a toxic material represents an opportunity to eliminate that use. Every loss of a toxic material or the generation of hazardous waste

represents an opportunity not to have that loss or waste. The facility will have many P2 opportunities visually depicted by the process maps. You must rank order these P2 opportunities to provide some focus to your P2 plan. Pareto analysis (also referred to as the 80/20 Rule) is used in the Systems Approach to separate the vital P2 opportunities from the "trivial many." You may want to consider selecting between 8 and 11 opportunities for the first planning year of the program. These opportunities should be selected with a goal of completing them within that year. The P2 program needs to have some "quick wins" to help maintain the interest of management and the other interested parties. You may want to select a couple of opportunities that will take a bit longer to complete and consider them with respect to the two-year window in the planning requirements. All the opportunities that will ulti-mately be included in the program can also be listed at this point. Next, you will collect more information on these opportunities.

The facility will have many P2 opportunities visually depicted by the process maps. You must rank order these P2 opportunities to provide some focus to your P2 plan.

The second step (Figure 7-3, work step 2.2) begins the process of production unit analysis. For each opportunity, an employee team will work with a facilitator provided by the organization to determine the root cause for the use or loss of all resources (i.e., materials, water, and energy). They will use a cause and effect diagram to look at how mate-rials, methods, machines (technology), and people contribute to the P2 opportunity that has been identified. This team will conduct the root cause analysis and then prepare a memorandum version of a defini-tive statement of the problem. The time spent by the team determining the root cause is rewarded by the generation of a higher number of

For each opportunity, an employee team will determine the root cause for the use or loss of toxic materials or hazardous waste.

The time spent by the team determining the root cause is rewarded by the generation of a higher number of alterna-tives.
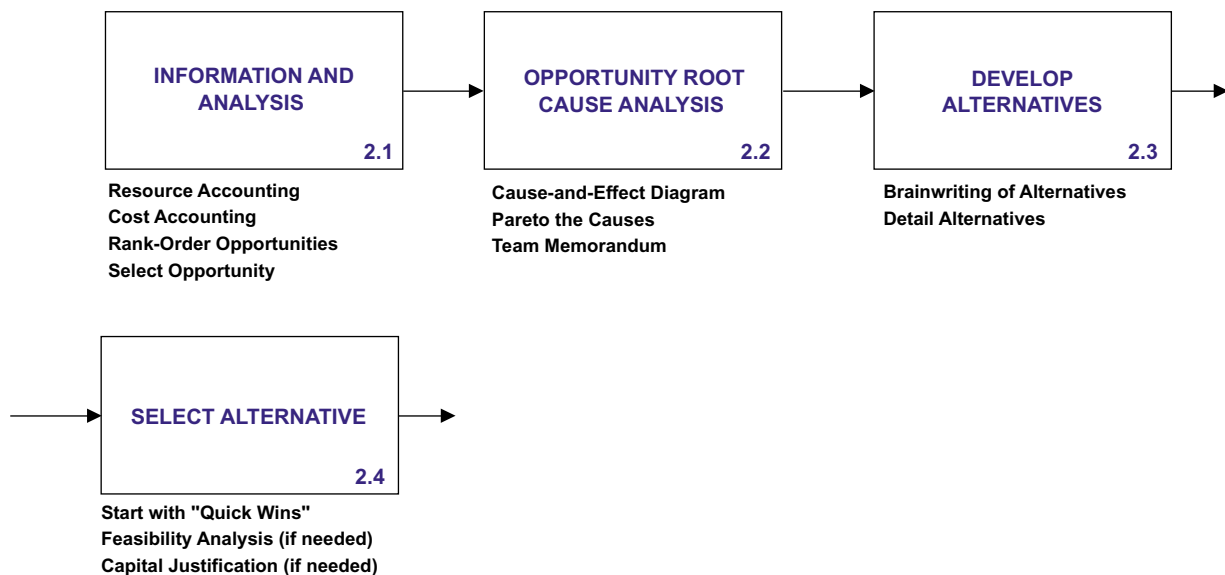
Figure 7-3. Development of Pollution Prevention Opportunities.

alternatives in the next step. Now, they are in a position to generate alternatives for realizing this opportunity by using a brainwriting tool (Figure 7-3, work step 2.3). Finally, they will select an alternative for implementation using a bubble-up/bubble-down tool (Figure 7-3, work step 2.4). These interactive problem-solving and decision-making tools will help the team gather the information needed for successful implementation and communication with management and other interested parties.

Step 3. Implement Your Revised P2 Program

The P2 program is implemented by preparing draft action plans for all the alternatives.

The P2 program is implemented (Figure 7-4) by preparing draft action plans for all the alternatives studied in the previous step. These action plans are the core of the P2 program each year and should be carefully reviewed before implementation. At this point, it is worthwhile to reconsider the relevant items in the quality model that were evaluated in the first step of the program (Figure 7-1). Recall that these criteria, as well as the guiding principles, are carefully designed to help integrate programs into core business practices. Constant effort to develop and improve on these items will keep the P2 program moving towards zero waste and emissions as a stretch goal. These criteria and guiding principles can be reinforced in the action plans and in the revisions to the P2 plan itself.

Typically, it is good to aim for 8 to 11 plans each year.

A key point, given the work done in the previous step, is employee involvement, awareness, and training. It has often been said "employees never resist their own ideas." They can become important partners in P2 when the Systems Approach is used in the program. Once all this is done, final action plans are created for implementing each P2 alternative. Typically, it is good to aim for 8 to 11 plans each year. This goal should not inhibit people from doing other P2 activities. The focus will be on the main action plans in the program. The P2 plan will provide for implementation that is subject to a P2 program oversight committee. This group should be comprised of managers and should include the organization's senior manager. The action plans should be reviewed at

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┌──────────────────────────────┐
│   IMPLEMENT P2 PROGRAM        │
│                               │
│                            3  │
└──────────────────────────────┘
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Prepare Draft Action Plans
Consider All Quality Model Criteria
Finalize Action Plans for Year (8-11 Plans)
Provide for Program Oversight
Provide for Program Auditing
Prepare Final P2 Program
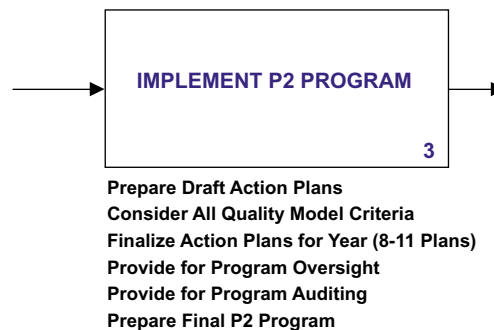
Figure 7-4. Implement the Pollution Prevention Program.

least on a quarterly basis. At the end of the year, they can be audited both internally and externally (i.e., by interested parties). The final P2 plan should now have internal plan approval and is ready for implementation.

Step 4. Maintain Your P2 Program

Once the P2 plan is implemented, it must be maintained over time (Figure 7-5). It is important to review the quality model criteria for information analysis and results. The results criterion examines your organization's real and anticipated P2 results related to your continual environmental approach to zero waste and emissions. It suggests that you consider levels and trends as they relate to impacts on the environment, worker health and safety, other interested party impacts, and key financial indicators. Managers love results and continue programs that deliver good results. Remember that "what gets measured, gets managed." P2 programs cannot survive on success stories. The information analysis criterion ensures that these results are used in running the organization and not simply sent off to the interested parties. The P2 plan must be improved with feedback received on the actual progress that is made. Each year, the sequence of preparing action plans using the Systems Approach is repeated.

Managers love results and continue programs that deliver good results. Remember that "what gets measured, gets managed." P2 programs cannot survive on success stories.

MAINTAIN P2 PROGRAM

4

Information Analysis
Results
Continual Improvement with Feedback
Reports to Interested Parties
Action Plans for Year 2
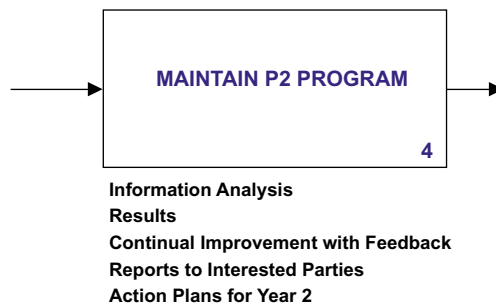
Figure 7-5. Maintain the Pollution Prevention Program.

Step 5. Measure Your Progress Toward Zero Waste and Emissions

After a few years, the P2 program can be scored in light of what it has contributed to the organization's stretch goal of zero waste and emissions (Figure 7-6). This scoring can be accomplished in a manner like the Green Zia program. It provides the ultimate scorecard for how important the P2 plan has been for the organization. Trending information helps the organization point to its accomplishments. The organization can also trend itself in comparison to other similar organizations using benchmarking techniques. This information can be used

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                    ┌─────────────────────────┐
                    │   MEASURE PROGRESS      │
        ──────────▶ │ TOWARD ZERO WASTE AND   │ ──────────▶
                    │     EMISSIONS           │
                    │                      5  │
                    └─────────────────────────┘
                    Prepare Green Zia-type Application
                    Score Application Using Trained Examiners
                    Determine How P2 Influenced Feedback Report
                    Continual Improvement of P2 Program
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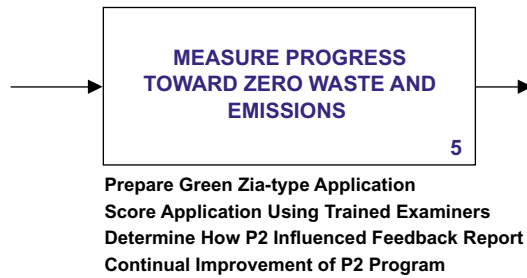
Figure 7-6. Measure Progress Toward Zero Waste and Emissions.

Not only can an organization score itself, but it can also score all of its suppliers. These scores can be compared on an "apples-to-apples" basis. In this manner, the entire life cycle of a product to a customer can be scored for environmental excellence, P2, and product stewardship.

to continuously improve the P2 plan and other initiatives aimed at attaining zero waste and emissions.

Not only can an organization score itself, but it can also score all of its suppliers. These scores can be compared on an "apples-to-apples" basis. In this manner, the entire life cycle of a product to a customer can be scored for environmental excellence, P2, and product steward-ship. Improvements can be weighed against the effect they had on the trending of these scores in time. While scoring may not be for every-one, it can be a useful tool for measuring continual improvement.

USING THE QUALITY MODEL TO IMPLEMENT P2

Your ISO 14001, Global Reporting Initiative, CERES Principles, Responsible Care Program®, balanced scorecard, six sigma, ISO 9000, and other environmental and quality initiatives will help you score points in each of the criteria. They all help contrib-ute to environmental excel-lence.

The use of the Systems Approach and the quality model provides a means of creating a sustainable P2 plan for your organization. Is it worth the effort? If your organization already has a quality program in place, the effort is not great at all. It is likely that there is already a program in place that you can build on. The quality model criteria and guiding principles simply emphasize good business practice and should be easy to implement at any rate. Your ISO 14001, Global Reporting Initiative, CERES Principles, Responsible Care Program®, balanced scorecard, six sigma, ISO 9000, and other environmental and quality initiatives will help you score points in each of the criteria. They all help contribute to environmental excellence. This program simply provides a means of integrating these approaches with environmental perfor-mance in your organization.

The P2 plan should be integrated with the core business prac-tices. "Oh, that is something that the environmental coordinator is do-ing!"—such an attitude can only limit results. By making the P2 plan more businesslike, the possibilities for P2 within the organization and across the country are significantly enhanced.

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 Gallagher, P., Kowalski, J., Pojasek, R. B., and Weinrach, J.
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*Green Zia Environmental Excellence Program: 2001 Program
 Information and Application Guidance*, New Mexico
 Department of Environment, Santa Fe, NM, 2001.

WEB SITES

Systems Approach Tools:
 http://www.Pojasek-Associates.com

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 http://www.quality.nist.gov

New Mexico Green Zia Program Information:
 http://www.nmenv.state.nm.us/ (See Special Projects)

CHAPTER 8
Finding Your Own Way to Implement P2

INTRODUCTION

This *Guide* has presented three approaches to implementing a P2 program: traditional based, EMS based, and quality based. All three approaches can be improved by using the process characterization, problem-solving, and decision-making tools that are described in Chapter 4. Your organization may already have some type of P2 program in place. It may be seeking only to improve its existing program or may not feel that there is time to implement a brand new program following any of these three approaches. This chapter will discuss some of the items that are covered in these approaches to provide you with some ideas for planning and implementing a P2 program that is specific to your organization's requirements and culture. Let's take a look at the program elements in each of these approaches to see where they have commonality. From this analysis, the elements that your organization should strive for as it implements the P2 program may be apparent.

We also will look at the various planning elements that were described in Chapter 3 of this *Guide* and the concept of *guiding principles* or *core values*. It will be important to see how these mesh with or remain separate from the implementation elements. The implementation elements that will be covered in this chapter are as follows:

- Extent of planning
- Leadership
- P2 goal setting
- Focus on results
- Information and analysis
- Process management
- Employee participation
- Focus on interested parties
- Guiding principles or core values
- P2 program elements

Each of these elements should be addressed in the P2 program.

EXTENT OF PLANNING

The three approaches run the full gamut of planning. You will need to determine the effort your organization wants to devote to planning as you seek to implement or improve the P2 program.

All three approaches can be improved by using the process characterization, problem-solving, and decision-making tools that are described in Chapter 4.

This chapter will discuss some of the items that are covered in these approaches to provide you with some ideas for planning and implementing a P2 program that is specific to your organization's requirements and culture.

You will need to determine the effort your organization wants to devote to planning as you seek to implement or improve the P2 program.

There is some upfront planning involved in the traditional P2 program. It is modeled around assessments that are conducted in the workplace. Adding process mapping to this approach will help find more opportunities for P2. This does not greatly increase the amount of planning in the process, however. When this program was prepared in the late 1980s, many people saw a need to just get in there and get started. A program *can* be developed from these initial efforts. What happened is that the initial efforts ran out of steam, since there was no program to guide continual improvement. Once the easy issues were addressed, it was difficult for the P2 efforts to continue.

In the EMS-based implementation P2 program, much of the planning is specified in the guidance set forth in ISO 14001 or other EMS guidance documents.

In the EMS-based implementation P2 program, much of the planning is specified in the guidance set forth in ISO 14001 or other EMS guidance documents. You will recall that the EMS implementation involves employees and has action plan requirements. Also, recall that the EMS implementation includes management involvement and continual improvement. In setting the EMS objectives and targets, the organization must consider the following items: (1) its significant environmental impacts, (2) legal and other requirements, (3) the views of external parties and societal concerns, (4) technical options and operational feasibility, (5) financial requirements for paybacks, and (6) business requirements for marketability and profitability. This involves planning. Planning is very important in the EMS approach to P2. While there is no requirement that the EMS program be integrated into the strategic planning of the organization, as shown in Chapter 6 the program would be much more successful if it was so integrated.

The quality-based P2 program places more emphasis on the recognition of environmental matters in the organization's strategic plan.

The quality-based P2 program involves planning in the following areas:

1. Strategy
2. Formal action
3. Integration and implementation

This approach to P2 places more emphasis on the recognition of environmental matters in the organization's strategic plan. Even if the organization does not have a formal strategic planning capability, environmental thinking must make it into the executive suite. An entire part of the evaluation is dedicated to strategic planning. Some questions to ask of the P2 planning efforts in this regard may be found in Box 8-1. These questions, which also can be used in the traditional and EMS approaches, can help align the P2 program with the strategic thrust of your organization. Any progress made in this direction will help integrate P2 into mainstream activities.

Box 8-1. Questions to Ask About the Planning Component

Consider strategic planning for environmental improvement as you ask the following questions (Reference 8-1). These questions are designed to ask "*how*" so that you can compare your organization's performance to others.

strategic planning

How does your organization:

- Use information from the environmental management system in other organizational planning initiatives?
- Consider the long-term environmental impact of the business on its quest for sustainability?
- Anticipate and mediate external environmental impacts?
- Include employees in environmental planning?
- Involve vendors, suppliers, customers, and others?

Consider formal action planning as you ask these questions:

action planning

How are:

- Formal action plans developed to support process analysis and improvement (P2) efforts?
- Employees included in the development of action plans?
- Suppliers, vendors, customers, and other interested parties included in the development of action plans?
- Action plans assessed and improved on from year to year?

To determine if your P2 program fosters integration and implementation with other organizational programs, ask these questions:

integration and implementation with other organizational programs

How are:

- Action plans implemented, tracked, modified (for continual improvement), and communicated to all interested parties?
- The action plans linked to the strategic planning process of the organization?
- Resources aligned to support improvement (P2) efforts?
- All the results from the programs disseminated to support organizational learning and improvement of the environmental management process?
- Environmental management processes formally maintained and improved?

The quality-based P2 approach and the EMS approach require written action plans. The EMS-based approach requires environmental management programs (EMPs) as written action plans. These documents are used to track progress made during the year on all scheduled P2 projects and activities. They are auditable by independent third parties. The Systems Approach tools help gather the information needed for comprehensive action plans. At the end of the year, it is possible to perform a "lessons learned" review of each of the action plans or EMPs and a decision can be reached on what to do in the following year.

The final aspect of the quality- and EMS-based P2 approaches is the actual integration and implementation of P2 activities with other organizational programs. It is important that P2 activities not be restricted to the environmental professionals in an organization. Employee teams from different departments need to be involved. The oversight committee should be composed of senior managers representing different functions within the organization. Whenever possible, it is prudent to look at their planned activities to see which ones have potential for P2 involvement. In this manner, the planned integration will be much more effective.

An emphasis on planning is important no matter which approach your organization uses. Although your organization may choose not to have planning dominate your P2 program's implementation, you should seek to improve your planning efforts each year by asking the questions provided and enhancing the program incrementally. Your organization could gradually increase the level of planning by answering those questions. In this manner, your organization will be integrating the P2 program into the core business practices.

LEADERSHIP

All the implementation models presented require a policy statement that is endorsed by the top management of the organization. Some important differences exist, however.

In the traditional approach, a "top-down" focus was encouraged. Management approval was sought before the P2 program was started. This commitment to the program was communicated to the workforce using the policy statement. Management names the P2 task force. Although management often saw P2 reports and success stories, this information loop sometimes did not provide for strong support for continual improvement.

The EMS-based Implementation Approach also seeks to have top management periodically review EMS implementation and effectiveness. Experience has shown clearly that program success is largely dependent on maintaining the involvement of senior management. The EMS is a management system that allows organizations to address the environmental issues in a systematic, organized fashion based on continual improvement—just like any other area of the organization. The EMS approach described in this *Guide* focuses on all management issues, including attainment of objectives, completion of corrective actions, effectiveness of policy, and cost-driven targets.

Leadership is encouraged in the quality-based P2 approach by recognizing the importance of both senior leadership and community lead-

It is important that P2 activities not be restricted to the environmental professionals in an organization.

All the implementation models presented require a policy statement that is endorsed by the top management of the organization.

Leadership is encouraged in the quality-based P2 approach by recognizing the importance of both senior leadership and community leadership.

ership. Senior leaders must demonstrate a commitment in this approach. Refer to the questions in Box 8-2 to see how to reach best-in-class status in this area. Striving to get positive answers to these questions will help the organization improve the management component of the P2 program.

Box 8-2. Questions to Ask About the Leadership Component

How does senior management:

- Demonstrate commitment to continual environmental improvement on par with other major organizational goals?
- Conduct proactive communication with all interested parties?
- Provide support for continual environmental improvement?
- Assure that continual environmental improvement is integrated, reviewed, and tracked?

Ask these questions about the community leadership components of the P2 program and *how* your organization accomplishes the following tasks.

How does your organization:

- Initiate and support environmental protection and sustainability efforts in the community?
- Seek to understand environmental issues specific to the community and address those issues with strategies, actions, and collaborative efforts?
- Support mentoring of other organizations in the community to promote P2 and continual improvement?
- Set affirmative procurement goals?
- Communicate your environmental performance to the community?

Many senior managers also recognize the importance of being a good corporate citizen in the local community. In the quality approach, good corporate citizenship goes beyond giving to local charities. The P2 ideals of the organization need to be promoted to all the local interested parties as a demonstration of the senior leadership's commitment to these ideals.

Senior leadership (i.e., those people to whom the environmental manager reports) must "walk the talk" to provide true leadership to the P2 program. A good "bottom-up" program with a results focus may help senior management go this extra distance. The literature on quality improvement and change management stresses the importance of having serious commitment from top management. Finding a way to gain this advantage will promote the implementation of your organization's P2 program.

SETTING P2 GOALS

In the traditional approach, the purpose of the P2 program is to meet these pre-set goals.

The EMS approach selects significant aspects and sets objectives and targets after studying the environmental impacts of the organization's activities, products, and services. Objectives are the overall environmental goals that an organization sets out to achieve.

In the quality-based P2 approach, the goals are not formally set until after the action plans are prepared.

Many believe that stretch goals of zero waste and emissions are best since it will take both continual improvement and some breakthrough thinking to get there.

In the traditional approach, senior management sets the goals for P2 *before* any formal information is gathered. This is based on the philosophy of "management by objectives." The purpose of the P2 program is to meet these pre-set goals. Much of the literature on goal setting supports this approach.

The EMS approach selects significant aspects and sets objectives and targets after studying the environmental impacts of the organization's activities, products, and services. Objectives are the overall environmental goals that an organization sets out to achieve. Action plans (EMPs) are written to meet the goals and objectives in the planned time frame.

In the quality-based P2 approach, the goals are not formally set until after the action plans are prepared. Each action plan has performance goals set for each step. The sum of the performance goals listed in the action plans are the goals for the period of time set forth in the planning sequence (i.e., typically one year). It is possible to have some action plans cover a longer time span, so that two-year goals can be set. It is important to set only continual improvement goals. Many believe that stretch goals of zero waste and emissions and continual improvement will increase the likelihood that significant strides will be made.

FOCUS ON RESULTS

Results will demonstrate whether goals have been met. Continual improvement is based on careful measurement and trending of the actual results. Maintaining top management support is based on achieving these results. A focus on results is an important part of any P2 program.

The traditional approach involves the collection of results from the various P2 activities and placing them into reports that are prepared for each effort. Sometimes the results are plotted, such as reduction in the use or emissions of certain regulated chemicals. In some cases, financial savings are given.

The EMS approach requires procedures to monitor and measure environmental performance, to record information that tracks operational controls and conformance with the objectives and targets, and to evaluate compliance with environmental regulations. Top management reviews these results on a periodic basis.

In the quality-based P2 approach, results represent the most important element. It is weighted with nearly one-third of the total evaluation points provided in the seven categories. Results are segmented into three items: environmental results; customer, supplier, employee,

and other results; and financial results. The environmental results look at current levels and trends just as the other approaches do. The second segment of the results summarizes customer, employee, community, supplier, market, and other interested-party results within the context of the continual environmental improvement approach. In other words, how is their perception of your organization's environmental excellence changing? The third segment of the results summarizes the financial performance results related to the implementation of your continual environmental improvement approach.

The organization's results need to convey levels (the current level of environmental performance reported graphically), trends (multiple data points presented graphically), and comparative data (how your organization is performing with respect to similar organizations). It may take a few years to build strong results, but it is an important means of improving your organization's P2 program. The link between environmental and financial results is very important. All environmental results can be "translated" into financial results. This is the best means available to get and maintain top management leadership in the P2 program. Make establishing this connection a priority as you plan a new P2 program or seek to improve an existing one.

The link between environmental and financial results is very important. All environmental results can be "translated" into financial results. This is the best means available to get and maintain top management leadership in the P2 program.

INFORMATION AND ANALYSIS

It is necessary to examine how your organization uses information in order to identify and evaluate environmental aspects of products, services, or production processes. It is also important to determine how this information is used to assess service, product, or process performance and to identify areas for improvement (i.e., P2 opportunities) based on environmental considerations.

It is important to determine how this information is used to assess service, product, or process performance and to identify areas for improvement (i.e., P2 opportunities) based on environmental considerations.

Most of the information in the traditional approach comes from assessments performed in the workplace. Checklists are often used to gather information for the analysis of each P2 project. Everything is usually handled on a project-by-project basis.

In the EMS approach, information is gathered on the aspects of the organization and analyzed on a general level to determine the significant environmental impacts and to set EMS objectives and targets. Further information is required for each of the environmental management programs. Documentation is maintained in the EMS to track information and make it available for analysis. This is an important element in the quest for continual environmental improvement.

In the quality-based P2 approach, information and the analysis of that information play a pivotal role in the program. The information and the results should be linked and used in the planning efforts. Management can use these items to make P2 a central issue in the day-to-day operation of the organization.

In Box 8-3, there are some questions that may help determine how information is collected and analyzed in the P2 program.

For the program to be results-driven, there will have to be an organized means for managing information and analysis in your P2 program.

For the program to be results-driven, there will have to be an organized means for managing information and analysis in your P2 program. The tools in Chapter 4 provide some order to the program and a good starting point. By selecting more items from the questions, you can drive continual improvement.

PROCESS MANAGEMENT

The traditional approach is project-based and does not place a great deal of emphasis on process. Assessments are used to locate opportunities for P2 and a project is set forth to minimize or prevent waste at that location. These assessments may not find other points at which the P2 opportunities can be leveraged. Furthermore, the assessments may not involve the institutionalization of P2 by changing the process of environmental management.

On the other hand, the EMS- and quality-based approaches emphasize process; both ask the type of questions that can be found in Box 8-4. A strong EMS is a vital component of the quality-based P2 approach and will help the organization attain a maximum number of points in this criterion.

Process mapping and resource accounting as described in Chapter 4 help measure and report the results of reducing your environmental impacts. The organization will benefit by addressing the issue of

process management when implementing the P2 Program. Using the Systems Approach tools will provide a head start in this direction.

Box 8-4. Questions to Ask About the Environmental Process Management Component

How does your organization:

- Conduct analysis of all pertinent processes to identify environmental issues (aspects)?
- Involve employees, customers, and suppliers in process analysis?
- Use its environmental management system to manage processes in day-to-day operations?
- Conduct process analysis of corrective actions or other nonoperational problem areas?
- Improve its process analysis system?
- Systematically prioritize areas for continual improvement?
- Develop action plans to improve processes?
- Involve employees, customers, and suppliers in identifying and implementing process improvements?
- Manage processes to meet or exceed environmental performance goals?
- Communicate information on improvement projects to ensure organizational learning?
- Use benchmarking as part of ongoing process improvement activities?
- Improve its process improvement system?

EMPLOYEE PARTICIPATION

All approaches include employee involvement. Both the EMS- and quality-based approaches address employee education and skill development. The quality-based approach also emphasizes employee satisfaction and well being. As more and more organizations address the issue of sustainable development and its focus on the social aspects of environmental issues, it will become more important to pay attention to the well being of the employees.

Having a P2 policy statement hanging on the wall does not ensure that the employees will be able to participate effectively in the program.

It is always informative to walk around a facility and randomly ask employees what they know about the organization's P2 program. Having a P2 policy statement hanging on the wall does not ensure that the employees will be able to participate effectively in the program. Whenever an organization undertakes a new management program, quite a bit of time is spent preparing the employees for participation in that program. It makes sense that the same would hold true for P2.

Box 8-5 lists some questions to ask about employee participation in a P2 program.

Employee involvement plays a key role in any successful P2 program, so it is important to be diligent in promoting it.

Employee involvement plays a key role in any successful P2 program, so it is important to be diligent in promoting it.

FOCUS ON INTERESTED PARTIES

The EMS- and quality-based approaches clearly recognize the importance of having ties with regulators, customers, suppliers, and a host of other interested parties. The traditional approach provides for technology transfer, but it does not seek feedback on environmental concerns of the interested parties.

By addressing the questions asked in Box 8-6, your organization can move in the direction of involving interested parties in the P2 program. Some organizations have already begun to extend their EMS program to the supply chain. It is logical to extend this involvement to the P2 program as well. Customers need to see decisions regarding the products and services in light of what the environment, health, and safety implications may be throughout the life cycle. Other interested parties need to see how their actions affect the organization's ability to effectively implement and integrate P2 into its core business practices.

Some organizations have already begun to extend their EMS program to the supply chain. It is logical to extend this involvement to the P2 program as well.

Box 8-6. Questions to Ask About the Other Interested-Party Component

How does your organization:

- Communicate with customers to assess their needs and satisfaction regarding the environmental impact of products and services?
- Solicit and use customer feedback for environmental improvements?
- Work with customers to encourage effective product and environmental stewardship?
- Support the P2 and continual environmental improvement efforts of customers?
- Market "green" products, services, and processes?
- Develop markets for new and/or "greener" products and services?
- Involve suppliers, contractors, and vendors in the development and improvement of products, services, and processes as part of the continual environmental improvement program?
- Evaluate suppliers, contractors, and vendors for their environmental performance?
- Support the P2 or environmental improvement efforts of suppliers, consultants, contractors, and vendors?
- Work with oversight agencies to manage compliance in a mutually beneficial fashion?
- Communicate continual environmental improvement goals and action plans to interested parties to gain feedback, support, and buy-in?
- Develop systematic processes for timely reporting of reportable events/activities to appropriate interested parties?
- Work with oversight agencies to develop regulations and compliance approaches that encourage P2?
- Provide a regular, independent evaluation of successes made in the program?
- Communicate results to interested parties?

P2 cannot be thought of as a strictly internal matter. It is becoming much more important to consider other interested parties when conducting a P2 program.

GUIDING PRINCIPLES

Unlike the traditional approach, the EMS- and quality-based approaches seek to align the P2 program with the organization's guiding principles or core values. Many experts feel that guiding principles are essential to the successful integration of P2 into core business practices. The guiding principles that are presented in Chapters 6 and 7 are as follows:

1. Interested-party–driven P2
2. Leadership
3. Continual improvement and learning

P2 cannot be thought of as a strictly internal matter. It is becoming much more important to consider other interested parties when conducting a P2 program.

4. Valuing employees
5. Fast response
6. Efficient product, service, and process design
7. Long-range view of the future
8. Management by fact
9. Partnership development
10. Public responsibility and citizenship
11. Results focus
12. Prevention of pollution
13. Compliance with legal requirements

The guiding principles are used to drive the P2 program's objectives and targets.

P2 PROGRAM ELEMENTS

The six program elements for a P2 program using any of the approaches have a number of now-familiar items:

- Provide for top management support
- Characterize the process
- Perform periodic assessments
- Conduct program evaluations

Each of these items is covered in the implementation chapters (Chapters 5-8).

Two crucial program elements require consideration as you develop or seek to improve the P2 program. These are:

1. Maintaining a cost allocation system
2. Encouraging technology transfer

The importance of communicating with top management in financial terms is quite clear. It is important to determine the real cost of all resource use and loss in the process (including all ancillary and intermittent processes). It is important to translate environmental performance measured in volume and weight into financial terms. Some basic information on this topic can be found in Chapter 4. Additional material on this and on EPA's Environmental Accounting Project is available on the CD-ROM. The quality-based P2 approach scores the ability to evaluate costs effectively. In most cases, this evaluation is required to get and maintain top management approval for the program.
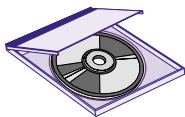
Technology transfer is very important to the propagation of P2. The Baldrige program requires winners of the award to go out and speak about what it takes to be successful with this program. Many winners give more than 100 speeches the year after they win. The EMS approach encourages organizations to mentor suppliers and contractors. Both approaches willingly share their successes so others can follow.

NOW IT'S YOUR TURN

This *Guide* has presented a number of useful P2 implementation approaches. It is up to your organization to use them and get started with a program that will work in your organization. The CD-ROM will provide you with the information needed to move forward.
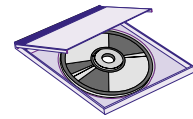
This *Guide* was *not* written to provide a "one-size-fits-all" formula for starting or improving a P2 program. Its intention is to spark some ideas and provide tools that you can use to successfully complete your organization's mission.

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