NOT MEASUREMENT SENSITIVE

DOE G 450.1-5
05-27-05

Implementation Guide for Integrating Pollution Prevention into Environmental Management Systems

[This Guide describes suggested nonmandatory approaches for meeting requirements. Guides are not requirements documents and are not construed as requirements in any audit or appraisal for compliance with the parent Policy, Order, Notice, or Manual.]

U.S. Department of Energy
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PREFACE

DOE G 450.1-5, *Implementation Guide for Integrating Pollution Prevention into Environmental Management Systems*, is one in a series of Guides that suggest approaches to meeting requirements of DOE O 450.1 (Change 1, 1-24-2005), *Environmental Protection Program*, dated 4-15-03, which requires all Department of Energy (DOE) elements to ensure that Integrated Safety Management Systems include Environmental Management Systems that provide for the systematic planning, integrated execution, and evaluation of pollution prevention (P2) actions.

DOE G 450.1-1, *Implementation Guide for use with DOE O 450.1, Environmental Protection Program*, dated 2-18-04, and DOE G 450.1-2, *Implementation Guide for Integrating Environmental Management Systems into Integrated Safety Management Systems*, dated 8-20-04, provide an overview and a detailed guide to Integrated Safety Management System (ISMS) and Environmental Management System (EMS) integration, respectively. This Guide provides guidance on integrating P2 into ISMS/EMS.

INTRODUCTION

Purpose

This document provides discretionary guidance for implementing the P2 requirements of DOE O 450.1, which requires implementation of sound stewardship practices that are protective of the air, water, land, and other natural resources impacted by DOE operations. This objective is to be accomplished by implementing EMSs as part of existing ISMSs. As part of that integration, DOE O 450.1 requires DOE elements, and contractors whose contracts include the CRD, to provide for the systematic planning, integrated execution, and evaluation of P2 and reduce or eliminate waste, pollutants, and Class I ozone-depleting substances (ODS) at DOE facilities through source reduction, reuse, segregation, and recycling and by procuring recycled-content materials and environmentally preferable products and services. This Guide suggests approaches to integrating P2 into ISMS/EMS.

Applicability and Scope

This Guide is for use by all DOE elements, including the National Nuclear Security Administration (NNSA) and contractors required to implement DOE O 450.1. It can also be used by DOE elements and contractors not subject to DOE O 450.1 as they prepare the EMS required under Executive Order 13148, *Greening the Government Through Leadership in Environmental Management*, or as they comply with Acquisition Letter AL-2002-05, *Greening the Government Requirements in Contracting.*

Use of Guidance

DOE Guides are not requirements documents and should not be construed as requirements in any audit or assessment of compliance with the associated Policy, Order, Notice, or Manual. This Guide suggests acceptable methods for integrating P2 into site operations. Other methods that are equally effective in meeting these requirements may be used.

Background

The Resource Conservation and Recovery Act (RCRA), amended by the 1984 Hazardous and Solid Waste Amendments, made the elimination or reduction of hazardous waste generation a national policy. Waste generators are required to develop and implement waste minimization programs and Federal procuring agencies to develop affirmative procurement programs to ensure that products composed of recovered materials will be purchased to the maximum extent practicable and consistent with applicable provisions of Federal procurement law.

The Pollution Prevention Act of 1990 declared as national policy that

> "…pollution should be prevented or reduced at the source whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible; pollution that cannot be prevented or recycled should

> be treated in an environmentally safe manner whenever feasible; and disposal or other release into the environment should be employed only as a last resort…."

P2 is also promoted through a series of Executive Orders (E.O.) imposing requirements on the activities of Federal agencies as follows:

- E.O. 13101, *Greening the Government through Waste Prevention, Recycling and Federal Acquisition*;
- E.O. 13123, *Greening the Government through Efficient Energy Management*;
- E.O. 13221, *Energy-Efficient Standby Power Devices*;
- E.O. 13148, *Greening the Government through Leadership in Environmental Management*;
- E.O. 13149, *Greening the Government Through Federal Fleet and Transportation Efficiency;* and
- E.O. 13327, *Federal Real Property Asset Management.*

DOE Acquisition Letter (AL) 002-05 describes the roles and responsibilities of the DOE procurement community as they partner with other DOE personnel to implement the Federal government's Greening the Government initiatives. The Acquisition Letter cites Federal Acquisition Regulation [(FAR) Title 48 Code of Federal Regulations (CFR), 23.705, which requires that contracts for operation of government facilities contain the Waste Reduction Program clause (48 CFR 52.223-10)]. That clause requires contractors to establish a program to promote cost-effective waste reduction in all operations and facilities covered by the contract.

The Acquisition Letter also indicates that contracts for operation of a DOE facility should contain the clause at Department of Energy Acquisition Regulations (DEAR) 48 CFR 970.5233-2 if the purpose of the contract includes the procurement of any such items designated in the EPA Comprehensive Guidelines. That DEAR clause provides for the contractor's participation in the DOE Affirmative Procurement Program, now generally referred to as environmentally preferable purchasing.

An additional DEAR regulation at 48 CFR 970.5223-1, Integration of Environment, Safety, and Health into Work Planning and Execution, states that contractors "shall ensure that management of environment, safety and health (ES&H) functions and activities becomes an integral but visible part of the contractor's work planning and execution processes." The regulation clarifies that safety includes P2 and waste minimization.

Many P2 opportunities at DOE sites have already been exploited through past efforts. Identifying new, less-obvious opportunities may involve analysis, evaluation, and specialized technical know-how to procure, design, or engineer products or processes that advance P2. The EMS provides the framework that allows DOE elements to identify, implement, and evaluate those opportunities.

Overview

This Guide is a companion piece to DOE G 450.1-2, *Implementation Guide for Integrating Environmental Management Systems into Integrated Safety Management Systems*, to which users should refer for information on integrating the EMS with the ISMS. This Guide is organized around the four phases of establishing an EMS:

- Phase I, Planning and Aspects Identification
- Phase II, Implementation and Operation
- Phase III, Checking and Corrective Action
- Phase IV, Management Review and System Maintenance

In Chapters 2-5, this Guide employs the four-phase, ten-step format from DOE G 450.1-2 but does not attempt to replicate its material. The Guide points out where and how P2 and related activities such as environmentally preferable purchasing (EPP) and sustainable design can fit into an ISMS/EMS.

CHAPTER 1. POLLUTION PREVENTION IN THE ISMS/EMS

DOE G 450.1-1, *Implementation Guide for Use with DOE O 450.1*, dated 2-18-04, describes the ISMS and the EMS as similar because both systems strive for continual improvement through a cycle of **plan —> do —> check —> act**.

Plans are made for programs and procedures to carry out the systems' scope and purpose and then emphasis is placed on **doing** them. During and after implementation, plans are **checked** to assess their effectiveness, and any needed corrections are **acted** upon. Because of this similar cycle, the two systems can be easily integrated into an ISMS/EMS.

1.1 P2 in the ISMS/EMS

P2 is inherent in an integrated ISMS/EMS because it is based on a similar cycle of continuous improvement. DOE O 450.1 requires that the ISMS/EMS provide for P2 systematic **planning**, integrated execution (**doing**), and evaluation and corrective action (**checking** and **acting**). P2 elements integrate with the ISMS/EMS elements as demonstrated in Figure 1.

A primary objective of DOE O 450.1 is implementation of sound stewardship practices that are protective of the environment. The most effective way to implement those practices is to integrate P2 policies, practices, and technologies into the ISMS/EMS continuous cycle of planning, implementing, evaluating, and improving the organization's environmental performance. Through this integration, P2 is an ongoing process that is the responsibility of all workers and is routinely considered at the front-end of the work-planning process for site operations and activities.

A commitment to P2 can further the EMS goals of addressing the environmental aspects of site operations in a consistent and reliable manner through planned and implemented procedures and programs. Reducing and/or eliminating an environmental risk is more efficient and effective than mitigating or managing its consequences. Environmental risks can be eliminated or reduced most easily by evaluating P2 opportunities for each existing or new activity before automatically resorting to the more traditional alternatives of pollution management, treatment, control, and disposition.

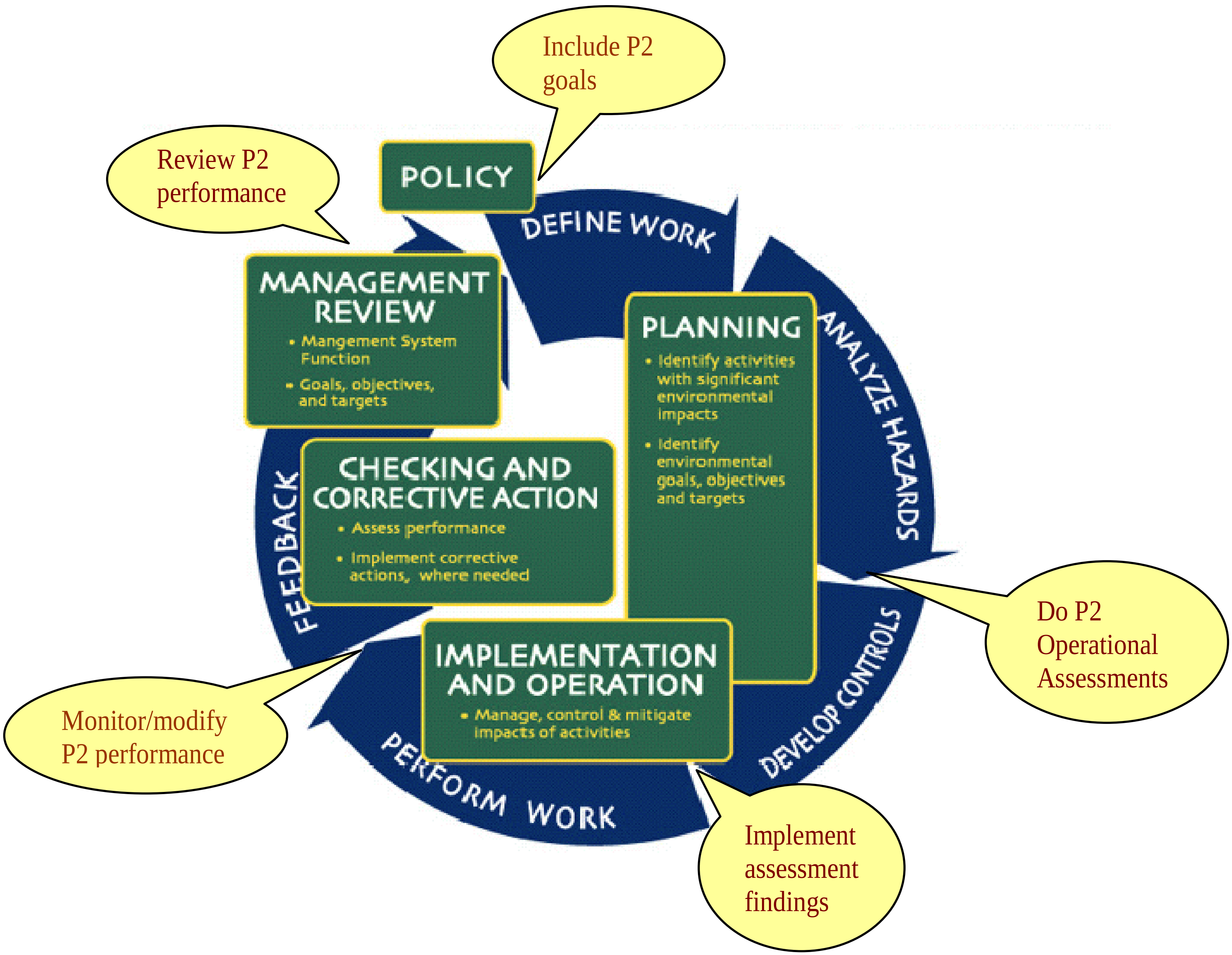
1.2 P2 as Site Policy

As shown in Figure 1, the policy statement sets the stage for the ISMS/EMS cycle. Incorporating P2 in the ISMS/EMS policy statement demonstrates site management's commitment to achieving the DOE O 450.1 requirement for the systematic planning, integrated execution and evaluation of P2.

The P2 component of the ISMS/EMS policy statement does not have to be lengthy. DOE sites have established commitments to P2 in their policy statements by including concepts such as the following:

- including pollution prevention concepts in site research, operations, and community activities,

Figure 1: Integration of P2/ISMS/EMS.



- applying national and DOE goals and policies that will make pollution prevention an integral part of site operating philosophy, and

- an environmental stewardship policy that is committed to integrating pollution prevention and waste minimization, resource conservation, and compliance into site planning and decision-making and to seeking cost-effective means to minimize environmental impacts.

1.3 Putting P2 to Work

P2 works effectively when EPP and P2 operational assessments are imbedded in the ISMS/EMS. Integrating P2 with the ISMS/EMS will be easier if the ISMS/EMS team includes people with experience in areas such as EPP, sustainable design, waste reduction, ODS use, chemical procurement, and recycling.

Team members' training, knowledge, and experience will be helpful in identifying environmental aspects and opportunities for cost-effective P2 operational assessments and solutions.

P2 operational assessments can lead to solutions when new or existing operations and activities are approached as assessment opportunities for possible pollution prevention. Paragraph 5d(6) of DOE O 450.1 and paragraph 9 of the CRD require conducting operational assessments to find source reduction, material segregation, and recycle/reuse opportunities.

P2 operational assessments will vary in scope and scale but all share the same goal:

> To identify methods, services, or products that prevent pollution at the source, or, if that is not feasible or cost-effective, minimize the amount of wastes generated, and recycle those that are created.

As part of the life-cycle analysis of existing, new or changing operations, P2 operational assessments can range from routinely scanning lists of required chemical purchases and identifying and recommending less toxic substitutes, to implementing site protocols requiring incorporation of sustainable design principles in new buildings, to formally structured pollution prevention opportunity assessments (PPOAs).

A PPOA is a systematic assessment of a process or activity to identify opportunities to

- eliminate or reduce wastes,

- conserve natural resources,

- reduce toxic chemical or hazardous material use, and

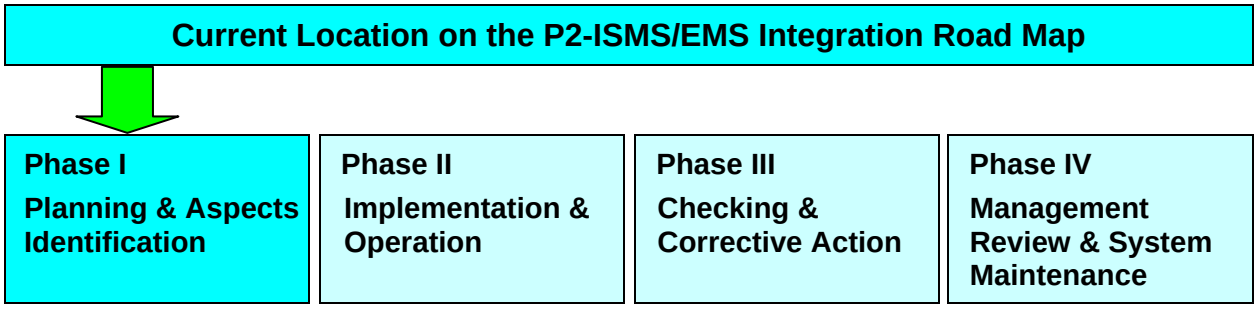
- reuse and/or recycle materials.

It involves

- understanding the process being reviewed,
- identifying environmental aspects and their impacts,
- developing alternative processes or materials,
- evaluating the cost and technical feasibility of the alternatives,
- choosing the best alternative, and
- documenting the findings.

The conduct of a PPOA should include the people who plan and actually operate the process under review, and people with experience in areas such as EPP, sustainable design, waste reduction, recycling, and environmental compliance. A PPOA sample worksheet is included in Appendix A. Some commonly used P2 terms and concepts related to P2 operational assessments may be found in the glossary.

CHAPTER 2. P2 IN PHASE I—PLANNING AND ASPECTS IDENTIFICATION



Step 1—Identify Environmental Aspects

Sites identify and list their activities, products, and services and how they interact with the environment to identify environmental aspects and identify the impact of each environmental aspect.

Environmental aspects can be identified through records review, walk-throughs, interviews, and activity reviews. Walk-throughs and employee interviews enhance the record review, reveal additional activities that have environmental aspects, and sensitize employees to the environmental impact of their activities.

Helpful records that should be readily available include chemical and materials procurement information, toxic release inventory (TRI) reports, material safety data sheets (MSDSs), waste management and disposal cost information, and regulatory permits.

Methods can be organized to be more productive by using an interview or walk-through checklist or questionnaire that could ask for the following information.

- Are new processes or construction projects planned? Do the plans for these processes or projects address energy and water efficiency and consider the substitution of environmentally preferable materials or processes?
- Are facility renovations planned which could promote pollution prevention and energy or water efficiency through improved lighting, more efficient heating/cooling, or environmentally preferable products or processes?
- Are projects slated for termination or facilities slated for demolition?
- What is the process for project planning and how are life-cycle costs and impacts considered?
- What chemicals, radiological sources, or hazardous substances are used and in what amounts?

- What wastes are produced and in what amounts?
- How are wastes managed and disposed?
- What emissions are produced?
- What are the water or energy demands involved? Do the plans for these demands address the potential for energy and water efficiency?
- Are pesticides and herbicides used?

These methods are valuable for identifying *existing potential environmental aspects*. Table 1 gives examples of identifying environmental aspects and the impacts they have on the environment.

Table 1: Identify Environmental Aspects (Example)

Aspect	Activity	Impact
Air Emissions	Fire extinguishers using Class-I ozone-depleting substances (ODS)	Degrading effect on air quality
Hazardous Waste Generation	Use of formamide in genetic sequencing	Degrading effect on air, soil, and water; hazardous waste storage and disposal

Activity planning forms and process diagrams are valuable tools for identifying any *new potential environmental aspects*. Some sites use activity planning forms (e.g., operations plans, project approval forms, work permits) as a routine practice.

For example, the experiment safety review form (Appendix B) used at one of the Department's laboratories requires applicants to provide information on the chemicals, controlled substances, gases, cryogens, radioactive materials, and biological materials that will be used; the types and amounts of wastes that will be generated; and the expected waste disposal method. Applicants also are asked to describe how they plan to minimize waste generation and to identify pollution prevention opportunities. They are asked to order or use the smallest amount of materials possible, use recycled materials, and substitute non-hazardous materials.

A work permit form (Appendix C) requires applicants to identify safety and environmental concerns such as whether chemicals or toxic materials will be used. Applicants also must indicate if a PPOA has been done or is not needed.

Process flow diagrams are often used to identify environmental aspects of existing and new activities. The advantage of a process flow diagram is that it graphically demonstrates materials used, resources needed, wastes and emissions created, and the disposal path for the wastes. Appendix D illustrates a process flow for an electrical discharge machine.

Step 2—Determine Significant Aspects

Step 2 involves identifying all the environmental aspects that are regulated or have regulatory implications in addition to determining which aspects have significance based on environmental or organizational considerations.

Paragraph 2.1.1 of DOE G 450.1-2 recommends that all environmental aspects subject to regulation should be managed through the ISMS/EMS. The Guide defines these regulatory authorities as Federal, host nation, State, or local government agency statutes, laws, or regulations or Executive Orders and DOE regulations or directives that include requirements. Because of the potential impact of a violation of any regulated environmental aspect, the Guide suggests that all regulated aspects be automatically considered significant. Table 2 provides examples of determining significant environmental aspects.

Table 2: Determine Significant Aspects (Example)

Aspect	Activity	Impact	Significance
Air Emissions	Fire extinguishers using Class-I ozone-depleting substances (ODS)	Degrading effect on air quality	**Significant: based on regulatory score (CAA, E.O. 13148 and O 450.1 provisions)**
Hazardous Waste Generation	Use of formamide in genetic sequencing	Degrading effect on air, soil, and water; hazardous waste storage and disposal	**Significant: based on regulatory and overall score**

Walk-throughs, interviews, and activity reviews can lead to identifying significant aspects resulting from the on-going or proposed activity. Environmental aspects that do not carry a regulatory implication may still be significant and warrant being addressed. Environmental aspects could be significant because of the potential harm that could result from high water or power needs, an accident, expensive product or waste management costs, or high volume of generated waste. Environmental aspects could also be significant for programs that are crucial to fulfillment of a site's mission. Again, the presence of experienced P2 personnel on the ISMS/EMS team can aid in identifying and ranking significant environmental aspects.

Including these experienced personnel on the ISMS/EMS teams, implementation review teams, and in line management is advantageous because they will be able to see the opportunity for P2 operational assessments at the earliest part of work planning. The possibility of including a PPOA or P2 solution is at its greatest in the earliest stage of activity planning because it will be perceived as a benefit to site operations and mission accomplishment from the start rather than a possibly expensive add-on after activity planning has progressed and important decisions have been made.

Step 3—Set Objectives and Targets

In this step, objectives and targets are established to address significant environmental factors. Objectives are environmental performance goals and targets are specific, measurable steps to achieve objectives. The environmental objectives and targets must be formalized, which means management must agree with the findings and associated resource needs.

Objectives and targets will flow from the P2 solutions identified through assessments of existing and new projects or activities or will be based on DOE Orders and DOE's pollution prevention goals (Appendix E), and Executive Orders. For example, DOE O 450.1 requires sites to develop and implement programs and procedures to maximize the use of safe alternatives to ODS. (NOTE: Class I ODS for all nonexcepted uses will no longer be procured after December 31, 2010.)

An objective could be to comply with the Order's requirement and targets could include phasing out Halon portable fire extinguishers by 2005 and replacing all nonexempt chillers by 2008. Gaining management approval of the objectives and targets will probably be easier when they are based on the Department's P2 goals and DOE O 450.1. Table 3 provides examples of setting objectives and targets.

Table 3: Set Objectives and Targets (Example)

Aspect	Activity	Impact	Significance	Objective/Target
Air Emissions	Fire extinguishers using Class-I ozone-depleting substances (ODSs)	Degrading effect on air quality	Significant: based on regulatory score (CAA, E.O. 13148 and O 450.1 provisions)	**Objective: discontinue procurement of Class I ODS for all but non-excepted uses by 12-31-10.** **Target 1: inspect all fire extinguishers for Class I ODS use in 1st quarter of FY05** **Target 2: develop prioritized list of fire extinguishers using Class I ODS for replacement by end of 3rd quarter of FY05** **Target 3: using list, replace all fire extinguishers using Class I ODS by end of FY10**
Hazardous Waste Generation	Use of formamide in genetic sequencing	Degrading effect on air, soil, and water; hazardous waste storage and disposal	Significant: based on regulatory and overall score	**Objective: identify possible alternatives to formamide** **Target 1: form P2 opportunity assessment team in 1st quarter of FY05** **Target 2: complete P2 opportunity assessment by end of 3rd quarter of FY05**

ISMS/EMS objectives and targets should be developed and described specifically to ensure that they can and will be implemented and that progress and outcomes can be measured as required in the checking and corrective action phase of the ISMS/EMS (see step 8 in chapter 4). Specificity

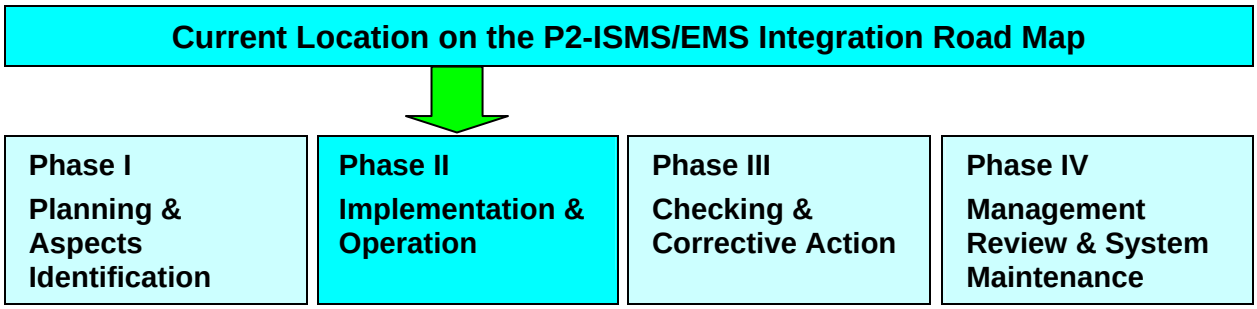
also makes it easier to develop the processes, plans, resources, training needs, and timelines necessary to ensure that the targets, and ultimately, the objectives are achieved.

Even though environmental aspects subject to regulation are normally evaluated as significant, P2 opportunities should still be considered. If the operational controls built into the ISMS/EMS are geared solely to compliance, opportunities to eliminate or reduce a waste stream and its associated cost advantage could be lost. A PPOA might reveal that use of an environmentally preferred product could result in regulatory compliance through a reduction in waste generation thereby contributing to the site's progress in achieving its P2-related ISMS/EMS objectives and targets and moving beyond compliance.

A PPOA could lead to removing an activity from regulatory control. Los Alamos National Laboratory found that using a mixture of absorbents and microbes that digest oil-contaminated soil resulted in soil that no longer had to be specially managed and disposed of as a New Mexico special waste and could be used as base fill for the construction or renovation of vehicle parking lots and equipment storage areas.

Conducting PPOAs can be ISMS/EMS objectives and targets. An objective could be the completion of a PPOA on an operation and/or process with significant waste stream generation. Or, the objective could be to reduce the generation of a hazardous waste stream by 25 percent over a 2-year period, with the first target being the completion of a PPOA of the operation and/or process creating that waste stream.

CHAPTER 3. P2 IN PHASE II—IMPLEMENTATION AND OPERATION



Step 4—Document the ISMS/EMS

In this step, team members ensure that the EMS requirements in DOE O 450.1 are documented and fully incorporated into the existing ISMS.

DOE O 450.1 lists several P2 requirements for inclusion in the ISMS/EMS, some of which will fit into the site's policy statement, objectives and targets, or operational controls and environmental management programs. P2 requirements that should be addressed in the ISMS/EMS by DOE elements are as follows (DOE O 450.1 paragraph references are shown in brackets):

- Provide for the systematic planning, integrated execution, and evaluation of P2 [4a(1)];
- Reduce or eliminate the generation of waste, the release of pollutants to the environment, and the use of Class I ozone-depleting substances (ODS) through source reduction, re-use, segregation, and recycling and by procuring recycled-content materials and environmentally preferable products and services [4b(3)];
- Obtain, as appropriate, local community advice relative to requirements of Executive Orders 13101, 13221, 13123, 13148, and 13149 [5d(3)];
- Incorporate, where appropriate, environmentally and economically beneficial landscape practices into all new landscaping programs, policies, and practices [5d(4)];
- Ensure, where appropriate, implementation of centralized procurement and distribution programs (e.g., pharmacy) for purchasing, tracking, distributing, and managing materials with toxic or hazardous content [5d(5)];
- Conduct operational assessments, such as PPOAs, of site operations to identify opportunities for source reduction, material segregation, recycle/reuse, or other P2 projects and implement cost-effective P2 projects, using life-cycle assessment concepts and practices in determining return-on-investment (5d(6)];
- Ensure site annual budgetary processes include the funding and resources necessary to implement P2 program implementation and monitoring [5d(7)];

- Monitor progress toward meeting the P2 requirements spelled out in paragraph 4b(3) (see second item in this list) and make the information available on an annual basis [5d(9)];

- Develop and implement a program and procedures to maximize the use of safe alternatives to ODS whereby procurement of Class I ODS for all nonexcepted uses is discontinued by December 31, 2010 and ODS removal or reclamation is coordinated with the Department of Defense (DoD) [5d(10)];

- Consider P2 in the specification and acquisition of departmental supplies to cost effectively maximize procurement of environmentally preferable products [5d(11)];

- Coordinate all acquisitions with DOE's "Green Acquisition Advocates" established pursuant to Acquisition Letter, AL-2000-03, superseded by AL-2002-05 dated 07/10/02, as appropriate [5d(12)]; and

- Comply with the requirements of the Emergency Planning and Community Right-to-Know Act (EPCRA or Title III of Superfund Amendments and Reauthorization Act of 1986) and the Pollution Prevention Act of 1990 [5d(13)] .

The DOE O 450.1 CRD lists the P2 requirements for contractors whose contracts contain it. Those requirements are listed below with the paragraph reference shown in brackets:

- Provide for the systematic planning, integrated execution, and evaluation of P2 [1(a)];

- Reduce or eliminate the generation of waste, the release of pollutants to the environment, and the use of Class I ozone-depleting substances (ODS) through source reduction, re-use, segregation, and recycling and by procuring recycled-content materials and environmentally preferable products and services [2(c)];

- Assist DOE in its efforts to obtain, as appropriate, local community advice relative to requirements of Executive Orders 13101, 13221, 13123, 13148, and 13149 [4];

- Assist DOE in meeting its requirements under EO 13148 by ensuring, where appropriate, implementation of centralized procurement and distribution programs (e.g., pharmacy) for purchasing, tracking, distributing, and managing materials with toxic or hazardous content [5];

- Incorporate, where appropriate, environmentally and economically beneficial landscape practices into all new landscaping programs, policies, and practices [6];

- Monitor progress toward meeting the P2 requirements spelled out in paragraph 2(c) (see second item in this list) and make the information available on an annual basis [7];

- Consider P2 in the specification and acquisition of departmental supplies to cost effectively maximize procurement of environmentally preferable products and coordinate, as appropriate, all acquisitions with DOE's "Green Acquisition Advocates" established pursuant to

Acquisition Letter, AL-2000-03, superseded by AL-2002-05 dated 07/10/02, as appropriate [8];

- Conduct operational assessments, such as PPOAs, of site operations to identify opportunities for source reduction, material segregation, recycle/reuse, or other P2 projects and implement cost-effective P2 projects, using life-cycle assessment concepts and practices in determining return-on-investment [9];

- Develop and implement a program and procedures to maximize the use of safe alternatives to ODS whereby procurement of Class I ODS for all nonexcepted uses is discontinued by December 31, 2010 and ODS removal or reclamation is coordinated with the Department of Defense (DoD) [12]; and

- Assist DOE with the requirements of the Emergency Planning and Community Right-to-Know Act (EPCRA or Title III of Superfund Amendments and Reauthorization Act of 1986) and the Pollution Prevention Act of 1990 [13] .

Step 5—Develop Environmental Management Programs

An Environmental Management Program (EMP) is created to achieve goals, objectives, and targets set for significant environmental aspects. The EMP records the significant aspect being addressed, explains why it is significant, and describes the objectives and targets established to address the aspect. The EMP will also describe required organizational resources, timeframes, and performance indicators to track progress, operational controls, roles and responsibilities, and training that might be required. The scope of the EMP will depend on the site's preference. An EMP could be developed for each significant aspect or several related aspects could be addressed by a single EMP. Alternatively, an EMP could be facility- or process-specific.

The EMP should contain all the elements necessary to implement the P2 opportunities discovered through the PPOA or to undertake the suggested PPOA. Just as the ISMS/EMS objectives and targets should be described with specificity, the elements necessary to achieve them should also be described clearly and thoroughly in the EMP.

Step 6—Develop Operational Controls

Operational controls are either engineering controls or administrative controls put in place through the EMS to address objectives and targets. Engineering controls are mechanical interventions (e.g., replace hose fittings with a more durable fitting to reduce air emissions) whereas administrative controls rely on procedural approaches (e.g., procurement specifies purchase of particular fittings.) Operational controls spell out what will be done to achieve the objectives and targets.

The operational controls required to achieve the P2 objectives and targets should be developed by a team consisting of the people who will carry out the control as well as experienced EPP, sustainable design, waste reduction, and recycling personnel. These individuals may be able to see P2 opportunities in the way the controls are developed and carried out. Table 4 provides examples of operational controls.

Table 4: Develop Operational Controls (Example)

Aspect	Activity	Impact	Significance	Objective/Target	Operational Controls
Air Emissions	Fire extinguishers using Class-I ozone-depleting substances (ODS)	Degrading effect on air quality	Significant: based on regulatory score (CAA, E.O. 13148 and O 450.1 provisions)	Objective: discontinue procurement of Class I ODS for all but non-excepted uses by 12-31-10. Target 1: inspect all fire extinguishers for Class I ODS use in 1st quarter of FY05 Target 2: develop prioritized list of fire extinguishers using Class I ODS for replacement by end of 3rd quarter of FY05 Target 3: using list, replace all fire extinguishers using Class I ODS by end of FY10	Operational Control 1: replace all fire extinguishers using Class I ODS Operational Control 2: develop procurement process to ensure use of approved fire extinguishers only
Hazardous Waste Generation	Use of formamide in genetic sequencing	Degrading effect on air, soil, and water; hazardous waste storage and disposal	Significant: based on regulatory and overall score	Objective: identify possible alternatives to formamide Target 1: form P2 opportunity assessment team in 1st quarter of FY05 Target 2: complete P2 opportunity assessment by end of 3rd quarter of FY05	Modify standard operating procedure for genetic sequencing to replace formamide with a non-toxic chemical

Step 7—Integrate P2 into ISMS/EMS Procedures

Standard operating procedures that are related to the ISMS/EMS need to be developed or existing procedures should be modified as needed to support the ISMS/EMS.

Paragraph 4a(1) of DOE O 450.1 and paragraph 1(a) of the CRD require integrated execution of P2. Operational controls and standard operating procedures are the methods that can satisfy this Order requirement. Standard operating procedures describe what will be done, and how and when it will be done, and can serve two P2 purposes. First, new standard operating procedures should be written, or existing ones should be modified, to ensure that the operational controls developed to execute the PPOA or P2 solution are actually implemented.

Second, new standard operating procedures can ensure incorporation of P2 into ongoing site operations. For example, in furtherance of DOE O 450.1 paragraph 5d(6) and paragraph 9 of the CRD, a site standard operating procedure should require P2 operational assessments of site operations that create waste and/or releases to the environment to identify opportunities for source reduction, material segregation, recycle/reuse or other P2 projects. The use of environmentally preferable products and sustainable building design principles should also become a site standard operating procedure. Sandia National Laboratories/NM and Los Alamos

National Laboratory modified their standard operating procedures to include sustainable design principles and energy efficiency criteria in their construction specifications, engineering standards, and operations and maintenance manual.

Other potential standard operating procedures, in addition to the requirement for operational assessments, include the following from DOE O 450.1. The paragraph citations are to the DOE element requirement and the CRD respectively:

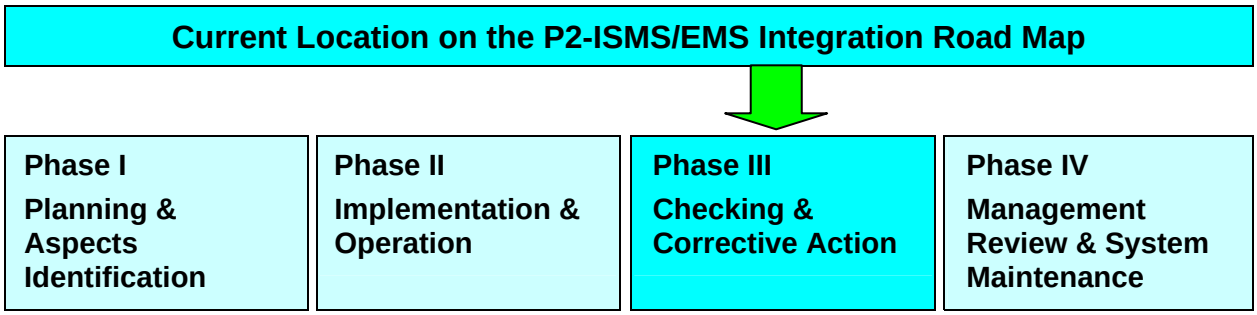
- Incorporate environmentally and economically beneficial landscape practices into all new landscaping programs and policies [5d(4); 6];

- Ensure implementation of centralized procurement and distribution programs (e.g., pharmacy) for purchasing, tracking, distributing, and managing materials with toxic or hazardous content to reduce chemical use, waste and cost [5d(5); 5];

- Develop and implement a program and procedures to maximize the use of safe alternatives to ODS (in preparation for December 31, 2010, when procurement of Class I ODS for all non-excepted is to be discontinued), and ODS removal or reclamation is to be coordinated with DoD [5d(10); 12]; and

- Consider P2 in the specification and acquisition of Departmental supplies to cost effectively maximize procurement of environmentally preferable products and services [5d(11); 8].

CHAPTER 4. P2 IN PHASE III—CHECKING AND CORRECTIVE ACTION



Step 8—Establish the ISMS/EMS Assessment Program

*The assessment step is the third part of the **plan-do-check-act** ISMS/EMS cycle. Performance assessment provides the necessary feedback to determine the effectiveness of the **plan** and **do** phases and **act** on any necessary changes.*

For DOE elements, DOE O 450.1 requires

- that site ISMS/EMS include the systematic planning, integrated execution and evaluation of programs for P2 [4a(1)]; policies and procedures to assess performance and implement corrective actions, where needed [4a(2)]; and annual review and updating, when appropriate, of measurable environmental goals, objectives and targets [4a(3)];

- monitoring and reporting on site progress toward meeting requirements to reduce or eliminate waste, the release of pollutants to the environment, and the use of Class I ozone-depleting substances [5d(9)]; and

- that operations/field/site office managers ensure that contractor ES&H self assessment programs are established within the framework of DOE P 450.5 and continue to be effective [5d(16)].

The CRD for DOE O 450.1 requires contractors to

- ensure that the ISMS/EMS provides for the systematic planning, integrated execution and evaluation of programs for P2; assessment of corrective actions to manage, control, and mitigate the effects of activities with significant environmental impacts; and annual review and updating of measurable environmental goals, objectives, and targets [1]; and

- monitor and report on site progress toward meeting requirements to reduce or eliminate waste, the release of pollutants to the environment, and the use of Class I ozone-depleting substances [7].

Progress assessments are easier when objectives are articulated clearly and targets are measurable. The degree of specificity will vary depending upon the information needed to assess performance and point to necessary modifications. Targets and objectives can include

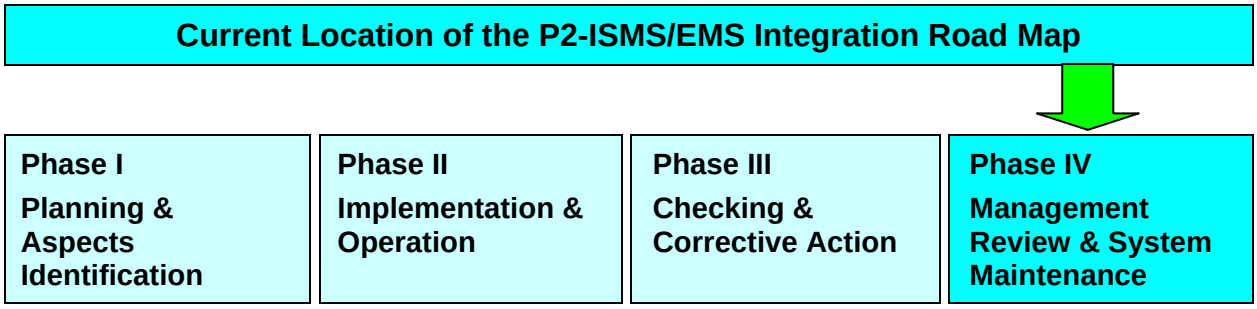
- PPOAs conducted;
- P2 opportunities identified, funded, and implemented;
- purchases of environmentally preferable products;
- continued promotion of environmentally preferable procurement;
- amounts of emissions or wastes generation reduced;
- cost savings;
- operational efficiency;
- corrective actions implemented and assessed for adequacy;
- centralized procurement and distribution of chemicals;
- elimination or reduction of purchase of ozone depleting substances;
- enhanced security performance; or
- reduced worker exposure or mission vulnerability

An assessment of how well P2 is integrated into site activities will, by necessity, involve evaluating the adequacy of EMPs, operational controls, and standard operating procedures in place to achieve the P2 objectives and targets. Table 5 provides examples of metrics that can be used in the assessment process.

Table 5: Checking and Corrective Action (Example)

Aspect	Activity	Impact	Significance	Objective/Target	Operational Controls	Checking/Corrective Action
Air Emissions	Fire extinguishers using Class-I ozone-depleting substances (ODS)	Degrading effect on air quality	Significant: based on regulatory score (CAA, E.O. 13148 and O 450.1 provisions)	Objective: discontinue procurement of Class I ODS for all but non-excepted uses by 12-31-10. Target 1: inspect all fire extinguishers for Class I ODS use in 1st quarter of FY05 Target 2: develop prioritized list of fire extinguishers using Class I ODS for replacement by end of 3rd quarter of FY05 Target 3: using list, replace all fire extinguishers using Class I ODS by end of FY10	Operational Control 1: replace all fire extinguishers using Class I ODS Operational Control 2: develop procurement process to ensure use of approved fire extinguishers only	**Target 1: percentage of fire extinguishers inspected** **Target 2: percentage of fire extinguishers replaced** **Operational Control 2: implementation of procurement process**
Hazardous Waste Generation	Use of formamide in genetic sequencing	Degrading effect on air, soil, and water; hazardous waste storage and disposal	Significant: based on regulatory and overall score	Objective: identify possible alternatives to formamide Target 1: form P2 opportunity assessment team in 1st quarter of FY05 Target 2: complete P2 opportunity assessment by end of 3rd quarter of FY05	Modify standard operating procedure for genetic sequencing to replace formamide with a non-toxic chemical	**Target 1 and 2: team formed and opportunity assessment completed on time** **Operational control:** **standard operating procedure for genetic sequencing modified and in use**

CHAPTER 5. P2 IN PHASE IV—MANAGEMENT REVIEW AND SYSTEM MAINTENANCE



Step 9—Develop the Management Review Process

Management review is the periodic review of the ISMS/EMS by senior management (i.e., managers who have the authority to make decisions for the site or facility.) The goal of this review is to ensure that the ISMS/EMS continues to be suitable, adequate, and effective for its intended purposes: that is, the ISMS/EMS is appropriate, adequately supported, and contributing to achieving site targets and objectives.

Paragraph 5d(16) of DOE O 450.1 requires that DOE operations/field/site office managers ensure that contractor ES&H self-assessment programs are established within the framework of DOE P 450.5, *Line Environment, Safety and Health Oversight*, dated 6-26-97, and continue to be effective.

Paragraph 5d(17) requires that the annual ISMS review process assess contractor ES&H performance objectives, performance measures, and commitments based on environmental risks, impacts of site activities, and established P2 goals.

Management review should bring management attention to P2 successes, resource needs, and additional opportunities; should assess the adequacy of site P2 processes and activities; and should result in recommendations for necessary changes (e.g., new or modified objectives, measurable targets, or assessment criteria.)

Step 10 Develop a Plan to Keep the ISMS/EMS Updated

The ISMS/EMS should be modified as site operations and missions change and new requirements are generated by laws, Executive Orders, or DOE directives.

Regulatory or mission or program changes will require site re-evaluation of environmental aspects and their significance, which could lead to modification of objectives, targets, and corresponding EMS operational controls. Successful completion of P2 objectives and targets also will trigger a revision of the P2 elements in the ISMS/EMS

RESOURCES

The following is a brief listing of the types of available P2 resources. More resources are available at http://epic.er.doe.gov/epic/ and http://www.eh.doe.gov/p2/

Affirmative Procurement Program for Recycled Content and Biobased Products—Guidance for Compliance with Section 6002 of the Resource Conservation and Recovery Act and Executive Order 13101 (http://twilight.saic.com/ap/APPG_2001.htm).

Buying Green Training (http://www.eh.doe.gov/p2/p2train.asp).

DOE Pollution Prevention Program Plan (http://www.eh.doe.gov/p2/p2integratedhomepage/p2plan.asp).

DOE Sustainable Design Program (http://www.pnl.gov/doesustainabledesign/).

Green Landscaping (www.epa.gov/greenacres/).

Leadership in Energy and Environmental Design (http://www.usgbc.org/LEED/LEED_main.asp).

P2 in the Environmental Restoration Program (http://www.eh.doe.gov/p2/p2iner/).

Pollution Prevention and Energy Efficiency Leadership (P2/EE) Goals (http://www.eh.doe.gov/p2/wastemin/P2goals.PDF).

Pollution Prevention Opportunity Assessment training http://mis.doe.gov/ess/training_catalog_detail.cfm?course_num=000723&skey=none

Responsibilities of DOE site recycling coordinators http://tis.eh.doe.gov/p2/ap/RCduties.doc

Strategic Plan to Implement Executive Order 13101 Greening the Department of Energy through Waste Prevention, Recycling, and Federal Acquisition (http://www.eh.doe.gov/p2/ap/StraPlan.pdf).

U.S. Green Building Council (http://www.usgbc.org/).

GLOSSARY

Bio-based Products—commercial or industrial products (other than food or feed) that use biological products or renewable domestic, agricultural, or forestry materials. (Source: E.O. 13101)

Environmental Aspect—elements of an organization's activities, products, or services that can interact with the environment. (Source: ISO-14001)

Environmental Impact—a change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products, or services. (Source: ISO-14001)

Environmental Objective—an overall environmental goal, arising from the environmental policy that an organization sets itself to achieve, and which is quantified where practicable. (Source: ISO-14001)

Environmentally Preferable—products or services that have a lesser or reduced effect on human health or the environment when compared with competing products or services that serve the same purpose. The product or service comparison may consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, or disposal. (Source: E.O. 13101)

Environmentally Preferable Purchasing—Procuring products or services that have a lesser or reduced effect on human health or the environment when compared with competing products or services that serve the same purpose. (Source: E.O. 13101)

Environmental Target—a detailed performance requirement, quantified where practicable, and applicable to the organization or parts thereof, which arises from the environmental objectives and needs to be set and met to achieve those objectives. (Source: ISO-14001)

Life-cycle Assessment—comprehensive examination of a product's environmental and economic aspects and potential impacts throughout its lifetime, including raw material extraction, transportation, manufacturing, use and disposal. (Source: E.O. 13101)

Pollution Prevention—reducing or eliminating the generation of waste, the release of pollutants to the environment, and the use of Class I ozone-depleting substances (ODS) through source reduction, reuse, segregation, and recycling and by procuring recycled-content materials and environmentally preferable products and services. [Source: DOE O 450.1, paragraph 4b(3)]

Recycling—process by which recovered materials are transformed into new products. [Source: Title 40, Code of Federal Regulations (CFR), section 246.101]

Significant Environmental Aspect—an environmental aspect that has or could have a significant impact on the environment, the organization, or to the organization's mission. (Source: ISO-14001)

Source Reduction—any practice that reduces—

- the amount of any hazardous substance, pollutant, or contaminant entering waste streams or otherwise released into the environment (including fugitive emissions) before recycling, treatment, or disposal and

- the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants. (Source: Pollution Prevention Act of 1990)

Sustainable Design—encompasses the materials used to build and maintain a facility, the energy and water needed in its operation, and the ability to provide a healthy and productive environment for facility users. (Source: Los Alamos National Laboratory Sustainable Design Guide)

Waste Prevention—any change in the design, manufacturing, purchase, or use of materials or products (including packaging) to reduce their amount or toxicity before they are discarded; the reuse of products or materials. (Source: E.O. 13101)

Waste Reduction—preventing or decreasing the amount of waste being generated using waste prevention, recycling or purchasing recycled and environmentally preferable products. (Source: E.O. 13101)

APPENDIX A. POLLUTION PREVENTION OPPORTUNITY ASSESSMENT FORMS

Pollution Prevention Opportunity Assessment
Worksheet 1

Team and Activity Description

Date _____ **P2OA ID Code** _____ **Facility** _____

Activity _____

Team Members (*Leader)	**Telephone**	**MSIN**

Description of Activity to be examined in this P2OA

Pollution Prevention Opportunity Assessment
Worksheet 2

Activity Flow Diagram

Date _____ **P2OA ID Code** _____ **Facility** _____

Activity _____

Chemical and Radioactive Inputs	
Name	**Qty.**

Material Inputs	
Name	**Qty.**

Energy Inputs	
Name	**Qty.**

Activity	
Activity	Time Period

Product or Result Output	
Name	**Qty.**

Hazardous Waste Output	
Name	**Qty.**

Non-Hazardous Waste Output	
Name	**Qty.**

Radioactive Waste Output	
Name	**Qty.**

Mixed Waste Output	
Name	**Qty.**

Other	
Name	**Qty.**

Pollution Prevention Opportunity Assessment
Worksheet 3

Pollution Prevention Opportunity Description

Date _____ **P2OA ID Code** _____ **Facility** _____

Activity _____

P2O No. 1 **P2O Title** _____

Current Practice

Proposed Action

Calculation of Waste Reduction and/or Energy Savings

Calculation of Annual Cost Savings

Current Practice *Costs*

Waste Disposal Costs _____

Purchasing Costs _____

Labor Costs _____

Subtotal of Current Practice Costs = Waste Costs + Purchasing Costs + Labor Costs = _____

Proposed Action *Costs*

Waste Disposal Costs _____

Purchasing Costs _____

Labor Costs _____

Subtotal of Current Practice Costs = Waste Costs + Purchasing Costs + Labor Costs = _____

Annual Cost Savings = Current Practice—Proposed Action = _____

Calculation of Implementation Cost and Payback

Vendor/Contact Information

Pollution Prevention Opportunity Assessment
Worksheet 3

Pollution Prevention Opportunity Description

Date _____ **P2OA ID Code** _____ **Facility** _____

Activity _____

P2O No. 2 **P2O Title** _____

Current Practice

Proposed Action

Calculation of Waste Reduction and/or Energy Savings

Calculation of Annual Cost Savings

Current Practice *Costs*

Waste Disposal Costs _____

Purchasing Costs _____

Labor Costs _____

Subtotal of Current Practice Costs = Waste Costs + Purchasing Costs + Labor Costs = _____

Proposed Action *Costs*

Waste Disposal Costs _____

Purchasing Costs _____

Labor Costs _____

Subtotal of Current Practice Costs = Waste Costs + Purchasing Costs + Labor Costs = _____

Annual Cost Savings = Current Practice—Proposed Action = _____

Calculation of Implementation Cost and Payback

Vendor/Contact Information

Pollution Prevention Opportunity Assessment
Worksheet 3

Pollution Prevention Opportunity Description

Date _____ **P2OA ID Code** _____ **Facility** _____

Activity _____

P2O No. 3 **P2O Title** _____

Current Practice

Proposed Action

Calculation of Waste Reduction and/or Energy Savings

Calculation of Annual Cost Savings

Current Practice *Costs*

Waste Disposal Costs _____

Purchasing Costs _____

Labor Costs _____

Subtotal of Current Practice Costs = Waste Costs + Purchasing Costs + Labor Costs = _____

Proposed Action *Costs*

Waste Disposal Costs _____

Purchasing Costs _____

Labor Costs _____

Subtotal of Current Practice Costs = Waste Costs + Purchasing Costs + Labor Costs = _____

Annual Cost Savings = Current Practice—Proposed Action = _____

Calculation of Implementation Cost and Payback

Vendor/Contact Information

Pollution Prevention Opportunity Assessment
Worksheet 4

Pollution Prevention Opportunities Summary

Date _____P2OA ID Code _____Facility _____

Activity _____

P2O No.	P2O Title	Waste Class Reduced	Annual Waste Reduction or Energy Savings	Estimated Annual Savings	Estimated Implementation Cost	Payback
1			0	$	$	years
2			0	$	$	years
3			0	$	$	years

Other Brainstorming Opportunities

Pollution Prevention Opportunity Assessment
Worksheet 5

Final Summary

Date _____P2OA ID Code _____Facility _____

Activity _____

Proposed Opportunities and Discussion

Recommendations and Schedule for Implementation

APPENDIX B. EXPERIMENT SAFETY REVIEW FORM EXAMPLE

SAMPLE EXPERIMENT SAFETY REVIEW FORM

REVIEW NUMBER (supplied by ERC):

PRINCIPAL INVESTIGATOR: **DATE:**
DEPARTMENT/DIVISION/GROUP:
EXT: **E-MAIL:** **LIFE NUMBER:**

Project Title:
Location(s):
Funding Source/Account Number:
Proposed Start Date and Duration:

SIGNATURES:

Principal Investigator:	**Date:**
Experiment Review Coordinator:	**Date:**
	Date:
	Date:
	Date:
	Date:
	Date:
Approval **Department Chairperson:**	**Date:**
Review/Approval Comments:	
Walkthrough Signature:	**Date:**
Expiration Date (max 1 yr.):	
FUA Change Required? ☐ Y ☐ N	**Fire Rescue Run Card Changes Required? ☐ Y ☐ N**
Has a NEPA Review been Performed for this Project? ☐ Y ☐ N	
Project Termination Acceptance Signature:	**Date:**
Comments:	

I. DEFINE THE SCOPE OF WORK

A. Description

Describe the experiment purpose/scope. Identify all apparatus that will be used and associated requirements. List special equipment (X-ray generators, lasers, etc.) that will be used during the project. Identify measurement and test equipment, apparatus operating conditions, and required maintenance procedures as appropriate. Include calibration frequency for formal calibration requirements. Attach supporting documents such as engineering calculations, drawings, and specifications.

Indicate if modification of facility is required. Include the setup and decommissioning phases of the experiment. The Work Permit Process/Form may better address the hazards and controls of the set-up and/or tear-down phases. Indicate if a Work Permit will be used.

B. Materials Used /Waste Generated

List materials to be used and wastes generated. Refer to the site Chemical Management System for a complete listing of the chemicals in your locations. Include samples, chemicals, controlled substances, gases, cryogens, radioactive materials, and biological material. You may use generic chemical class descriptions for commonly used materials (e.g., organic solvents, acids). List disposal methods.

Denote disposal method using the codes below.

Materials Used & Wastes Generated	Disposal Method Type (Code below)	Estimated Quantity (provide units)		Estimated Annual Waste Generation
		Per Use	Total/Yr	

Note: Identify Age Sensitive materials or special handling requirements.

Disposal Method Codes:

Air Emissions	Liquid Effluents	Wastes
P=Point Source	**S**=Sanitary	**H**=Hazardous
F=Fugitive	**ST**=Storm water	**I**=Industrial (Non-hazardous waste e.g., oils)
	O=Other	**R**=Radioactive
		M=Mixed (Radioactive + Hazardous)
		RM=Radioactive Medical
		MW=Medical
		T=Trash

C. Waste Minimization/Pollution Prevention

Describe how you plan to minimize generation of the wastes described above, and identify pollution prevention opportunities. Consider ordering/using the smallest amount, using recycled materials, and substituting non-hazardous materials. The **Pollution Prevention and Waste Minimization** Subject Area describes how to plan, conduct, and close out work activities to eliminate or minimize the impact of their activities on the environment.

II. IDENTIFY AND ANALYZE HAZARDS ASSOCIATED WITH THE WORK

In this section, indicate the hazards in each class. Include the setup and decommissioning phases of the experiment.

Physical Hazards (check all that apply) ☐ None			
☐ Cryogens	☐ Oxygen deficient atmosphere	☐ Noise > 85 dBA	
☐ Fall hazards (e.g., ladders, elevated platforms, towers)			
☐ Material handling equipment (e.g., cranes, hoists, forklifts)			
☐ Machine shop or nonportable powered tools use			
☐ Electrical hazards (exposed conductors, large batteries, capacitors, etc)			
☐ Confined space	☐ Trenching/soil excavation		
☐ Extreme temperatures	☐ Remote location		
☐ Other (specify):			
Pressure or Vacuum Systems (check all that apply) ☐ None			
☐ Compressed gases (lecture bottles, cylinders, gas lines)			
☐ Pressurized vessels or systems			
☐ Vacuum chambers or systems with >1000 J stored energy			
☐ Autoclaves			
☐ Other (specify):			
Fire Hazards (check all that apply)	☐ None		
☐ Open flames	☐ Welding, Brazing, Silver Soldering		
☐ Flammable gases/liquids/solids	☐ Other spark producing activity		
☐ Other (specify):			
Chemical Hazards (check all that apply)		☐ None	
☐ Carcinogens	☐ Highly acute toxins	☐ Reproductive toxins	☐ Corrosives
☐ Flammable liquids	☐ Flammable solids	☐ Strong oxidizers	☐ Oils
☐ Explosives	☐ Peroxidizables	☐ Pyrophoric materials	☐ PCBs
☐ Asbestos	☐ Pesticides/herbicides	☐ Controlled substances	
☐ Highly reactive materials		☐ Perchlorates	
☐ Toxic metals (e.g., As, Ba, Be, Cd, Cr, Hg, Pb, Se, Ag)			
☐ Other (specify):			
Ionizing Radiation (check all that apply) ☐ None			

☐ Sealed radioactive sources	☐ Windowless radioactive sources
☐ Dispersible radioactive materials	☐ Neutron-emitting radioactive sources
☐ Non-fissionable radioactive materials	☐ Fissionable radionuclides
☐ Ionizing radiation-generating devices (x-ray sources, accelerators)	
☐ Other (specify):	
Nonionizing Radiation (check all that apply)	☐ None
☐ Class II, IIIa, or IIIb (visible <15mW) lasers	☐ Class IIIb (nonvisible >15mW) or IV lasers
☐ Dynamic magnetic fields >1G at 60 Hz or dynamic electric fields > 1kV/m at 60 Hz	
☐ Static magnetic fields < 5 G. No Exposure Form is required	
☐ Static magnetic fields > 5 G and < 600 G	☐ Static magnetic fields exposure. Attach Static Magnetic Fields Exposure Form when required.
☐ Static magnetic fields ≥ 600 G	
☐ Radio frequency (RF) or Microwave sources exceeding 10 mW radiated output	
☐ Infrared sources > 10 W	☐ Ultraviolet sources > 1 W
☐ Extremely low frequency (ELF) radio sources	
☐ Other (specify):	

Biological Hazards (check all that apply)	☐ None	
☐ Regulated etiological agent	☐ Recombinant DNA	☐ Animals
☐ Human blood/components, human tissue/body fluids		☐ Human subjects
☐ Other (specify):		

Offsite Work (check appropriate box)	☐ None
☐ Reviewed or controlled by ES&H programs at the offsite location	☐ Requires additional controls (include in the next section)

See " Identification of Significant Environmental Aspects and Impacts Subject Area" or your ECR if you need assistance completing the following table.

Significant Environmental Aspects (check all that apply) ☐ None
☐ Any amount of hazardous waste generation
☐ Any amount of radioactive waste generation
☐ Any amount of mixed waste generation (radioactive hazardous waste)
☐ Any amount of transuranic waste generation
☐ Any amount of industrial waste generation (e.g., oils, vacuum pump oil)
☐ Any amount of Regulated Medical Waste (including sharps, hypodermic needles, or syringes)
☐ Any atmospheric discharges that require engineering controls to reduce hazardous air pollutants or radioactive emissions, or are identified as a Title V emission unit, or require monitoring under NESHAP
☐ Any liquid discharges that require engineering controls to limit the quantity or concentration of the pollutant, or include radionuclides detectable at the point of discharge from the facility, or contain any of the chemicals listed on the site's SPDES permit

☐ Storage or use of any chemicals or radioactive materials that require engineering controls – see "Storage and Transfer of Hazardous and Nonhazardous Materials Subject Area"
☐ On-site or off-site transportation of chemicals or dispersible radioactive materials
☐ Any use of once-through cooling water with a flow of 4 gpm—24 hrs/day (10 gpm—8 hrs/day, daily use of >15 gpm for >60 days) and discharging to the sanitary sewer
☐ Soil contamination or activation
☐ Any underground pipes/ductwork that contain chemical or radioactive material/contamination
☐ Other environmental aspects related to your work (specify):
☐ Process Assessment Form required (determined by ECR or other qualified person)

III. DEVELOP AND IMPLEMENT HAZARD CONTROLS

For each hazard identified in the previous section, describe how that hazard is controlled. Identify the **Engineering Controls (e.g., interlocks, shielding), Administrative Controls (e.g., procedures, RWPs), or Personal Protective Equipment (e.g., respirators, gloves; see the Personal Protective Equipment Subject Area**) that will be employed to reduce hazards to acceptable levels. .

The Experiment Review Coordinator, along with the **Principal Investigator** (PI) and Building Manager, as appropriate, will evaluate this experiment for impacts that will require an update to the Facility Use Agreement (FUA), and or Fire/Rescue Run Cards.

The **PI** develops and implements hazard controls in consultation with, and using feedback from, the personnel who will be performing the work.

A. Physical Hazards/Controls

Hazard	**Controls (Administrative, Engineered, Protective Equipment)**

Note: Include maintenance, inspection and testing, and formal calibration, including frequency as appropriate.

B. Chemical Hazards/Controls

Hazard	**Controls (Administrative, Engineered, Protective Equipment)**

Note: Refer to the "Working with Chemicals Subject Area" for requirements regarding particularly hazardous chemicals such as carcinogens, reproductive toxins, and highly acute toxins, including postings, decontamination plan, and address above.

C. Environmental Hazards/Controls

Hazard	**Controls (Administrative, Engineered, Protective Equipment)**

Note: Identify the requirements from applicable waste management subject area (hazardous, radioactive, mixed, regulated medical). List all applicable environmental permits (Suffolk County Art. XII, Title V Emission Source, etc.) and the relevant controls required by those permits.

D. Radiation Hazards/Controls

Hazard	**Controls (Administrative, Engineered, Protective Equipment)**

Note: List sources/materials. Attach or refer to Radiation Work Permits.

E. Biological Hazards/Controls

Hazard	**Controls (Administrative, Engineered, Protective Equipment)**

Note: List additional approvals/permits/reviews required (e.g., Biosafety Committee approval).

F. Offsite Work Hazards/Controls

Hazard	**Controls (Administrative, Engineered, Protective Equipment)**

Note: List the location of all off-site work and identify any off-site organization whose ESH requirements will be followed (e.g., other DOE Labs). Indicate additional controls (not specified above) that are needed.

IV. PERFORM WORK WITHIN CONTROLS

All work shall be performed within the controls identified within this document. It is the PI's responsibility to ensure that this document is kept up to date. The PI should consult with the ERC as appropriate to determine if changes to this document are significant enough to require a new review/document.

If a hazard assessment may be required for this experiment, the PI should contact the ES&H Coordinator and/or the ERC for assistance. The PI should document any hazard assessments performed for this experiment in Section VI.

A. Training

List all project personnel, indicating they are authorized and competent to perform the work described. List the training required for each individual. Identify any certifications or experiment-specific training required. Indicate if any project personnel are minors (18 years of age). Contact your Training Coordinator and ES&H Coordinator as appropriate for assistance.

It is the responsibility of the PI to maintain a complete up-to-date list of personnel and their full training requirements, and to ensure that training and qualifications are maintained.

Name	**Life/Guest #**	**Required Training (Course or JTA code)**

Note: The site Training and Qualifications Web Site contains course offerings and descriptions, required training checklist, and employee training records.

B. OSHA/DOE Required Medical Surveillance

Indicate if potential exposure is in excess of trigger levels listed. Exposure evaluation and/or medical surveillance may be required. Additional training may be required for any indicated agent. See SBMS for additional information and controls on the hazards listed.

Regulated Hazard	Hazard Specific Training Trigger	Medical Surveillance Exposure Trigger
☐ Inorganic Arsenic	Any day above the OSHA action level (without regard to respirator use)	30 days/year above the action level (without regard to respirator use)
☐ Biohazards (CDC/NIH/WHO listed Agent)	None	See Subject Area for guidance
☐ Cadmium	Any day above the OSHA action level	30 or more days/year at or above the action level
☐ Lasers	Use Class IIIb or Class IV Lasers	Use Class IIIb or Class IV Lasers
☐ Lead	Any day above the OSHA action level	30 or more days/year at or above the action level
☐ Methylene Chloride	Any day above the OSHA action level	- 30 days/year at or above the action level - 10 days/year above the 8-hour TWA PEL or the STEL - Any time above the 8-hour TWA PEL or STEL for any period of time where an employee at risk from cardiac disease or other serious MC-related health condition and employee requests inclusion in the program
☐ Noise	Any day above the ACGIH TLV	Any time equal or greater then 85 dBA TWA 8-hour dose
☐ OSHA Regulated Chemicals *Acrylonitrile* *Benzene* *Benzidine* *1,3 Butadiene* *4-Dimethyl aminoazobenzene* *Ethylene oxide* *Ethyleneimine* *Formaldehyde* *Vinyl Chloride*	Any day above the OSHA PEL	- Routinely above the action level (or in the absence of an action level, the PEL) - Event such as a spill, leak or explosion results in the likelihood of a hazardous exposure
☐ Static Magnetic Fields	Worker who routinely works in magnetic field	- Any time at ≥ 0.5 mT (5 G) for Medical Electronic Device wearer - Any day at ≥ 60 mT (600 G) to whole body [8 hour average] - Any day at ≥ 600 mT (6000 G) to limbs [8 hour average] - Any Time at ≥ 2 mT (20 G) to whole body [ceiling] - Any time at ≥ 5 mT (50 G) to limbs [ceiling]

C. Emergency Procedures

Identify any emergency actions, procedures, or equipment that must be in place to insure personnel safety and environmental protection. Include the Building Local Emergency Plan, location of emergency shutoffs, and spill control materials.

D. Transportation

Identify materials, hazards, and controls for any on-site and off-site transportation of hazardous and/or radioactive materials. See relevant SBMS Subject Areas.

E. Notifications

The PI or designee should notify building occupants of any activities that might impact them or their work, and document this here. List external personnel/organizations that require notification related to experimental activities and/or to be notified of changes (e.g., a Site Committee for review/approval, Occupational Medicine Clinic, or Fire/Rescue).

F. Termination/Decontamination

Describe any decommissioning plan, including decontamination of the area at termination of the experiment. Identify any hazards and controls, special precautions, or procedures. Include chemical and waste reconciliation. Indicate if a walk-down or an ERE will be scheduled to ensure the area is suitable for future projects. Indicate if Work Permit Form/Procedure will be used.

G. Community Involvement Issues

Identify issues that may require community involvement (see the Community Involvement in Laboratory Decision-making Subject Area) and describe the plan that addresses these issues. Attach the Community Involvement Checklist.

V. PROVIDE FEEDBACK ON ADEQUACY OF CONTROLS AND CONTINUE TO IMPROVE SAFETY MANAGEMENT

Provide comments on the review process, including the review form and communication. Identify any lessons learned or worker feedback contributing to modifications/improvements to the controls or process.

VI. ATTACHMENTS

Use this section to include any hyperlinks and/or additional documents, hazard assessments, figures, and tables that could not be entered into the previous sections of the form.

Attachment 1. Sample Signature Sheet

The PI is responsible for communicating the requirements in this Experiment Safety Review (ESR) to the project workers. One way to accomplish this is to have each worker read the ESR and sign an agreement form, such as the one below. This sheet is **not** submitted as part of the review process.

> *I have read this Experimental Safety Review document and understand the hazards associated with my work activities and the controls in place to mitigate those hazards. I understand the environmental aspects of my work activities and will continually work to minimize waste generated and look for areas of improvement. I am aware of the training requirements and will maintain my qualifications.*

_____
Signature

Print Name	BNL #	Signature	Date

APPENDIX C. WORK PERMIT APPROVAL FORM EXAMPLE

Work Permit #____
Work Order #____
Job# ____ Activity# ____

1. Work requester fills out this section.

Requester:	Date:	Ext.:	Dept/Div/Group:
Other Contact person (if different from requester):			Ext.:
Work Control Coordinator:		Start Date:	Est. End Date:
Brief Description of Work:			
Building:	Room:	Equipment:	Service Provider :

2. WCC, Requester/Designee, Service Provider, and ES&H (as necessary) fill out this section or attach analysis

ES&H ANALYSIS					
Radiation Concerns	☐ None	☐ Activation	☐ Airborne	☐ Contamination	☐ Radiation	☐ Other
☐ Special nuclear materials involved, notify Isotope Special Materials Group			☐ Fissionable materials involved, notify Laboratory Criticality Officer		
Safety Concerns	☐ None	☐ Ergonomics	☐ Transport of Haz/Rad Material		
☐ Adding/Removing Walls or Roofs	☐ Confined Space*	☐ Explosives	☐ Lead*	☐ Penetrating Fire Walls	
	☐ Corrosive	☐ Flammable	☐ Magnetic Field*	☐ Pressurized Systems	
☐ Asbestos*	☐ Cryogenic	☐ Fumes/Mist/Dust*	☐ Material Handling	☐ Rigging/Critical Lift	
☐ Beryllium*	☐ Electrical	☐ Heat/Cold Stress	☐ Noise*	☐ Toxic Materials*	
☐ Biohazard*	☐ Elevated Work*	☐ Hydraulic	☐ Non-ionizing Radiation*	☐ Vacuum	
☐ Chemicals*	☐ Excavation	☐ Lasers*	☐ Oxygen Deficiency*	☐ Other	
* Does this work require medical clearance or surveillance from the Occupational Medicine Clinic? ☐ Yes ☐ No					
Environmental Concerns		☐ None	☐ Work impacts Environmental Permit No.		
☐ Atmospheric Discharges (rad/non-rad)		☐ Land Use	☐ Soil activation/contamination	☐ Waste-Mixed	
☐ Chemical or Rad Material Storage or Use		☐ Liquid Discharges	☐ Waste-Clean	☐ Waste-Radioactive	
☐ Cesspools (UIC)		☐ Oil/PCB Management	☐ Waste-Hazardous	☐ Waste-Regulated Medical	
☐ High water/power consumption		☐ Spill potential	☐ Waste-Industrial	☐ Underground Duct/Piping	
Waste disposition by:				☐ Other	
Pollution Prevention (P2)/Waste Minimization Opportunity:		☐ None ☐ Yes			
FACILITYCONCERNS	☐ None				
☐ Access/Egress Limitations	☐ Electrical Noise	☐ Potential to Cause a False Alarm		☐ Vibrations	
	☐ Impacts Facility Use Agreement		☐ Temperature Change	☐ Other	
☐ Configuration Control	☐ Maintenance Work on Ventilation Systems		☐ Utility Interruptions		
WORK CONTROLS					
Work Practices					
☐ None	☐ Exhaust Ventilation	☐ Lockout/Tagout	☐ Spill Containment	☐ Security (see Instruction Sheet)	
☐ Back-up Person/Watch	☐ HP Coverage	☐ Posting/Warning Signs	☐ Time Limitation	☐ Other	
☐ Barricades	☐ IH Survey	☐ Scaffolding-requires inspection	☐ Warning Alarm (i.e. “high level”)		
Protective Equipment					
☐ None	☐ Ear Plugs	☐ Gloves	☐ Lab Coat	☐ Safety Glasses	
☐ Coveralls	☐ Ear Muffs	☐ Goggles	☐ Respirator	☐ Safety Harness	
☐ Disposable Clothing	☐ Face Shield	☐ Hard Hat	☐ Shoe Covers	☐ Safety Shoes	☐ Other
Permits Required (Permits must be valid when job is scheduled.)					
☐ None	☐ Cutting/Welding	☐ Impair Fire Protection Systems			
☐ Concrete/Masonry Penetration	☐ Digging/Core Drilling	☐ Rad Work Permit-RWP No			
☐ Confined Space Entry	☐ Electrical Working Hot	☐ Other			
Dosimetry/Monitoring					
☐ None	☐ Heat Stress Monitor	☐ Real Time Monitor	☐ TLD		
☐ Air Effluent	☐ Noise Survey/Dosimeter	☐ Self-reading Pencil Dosimeter	☐ Waste Characterization		
☐ Ground Water	☐ O_2/Combustible Gas	☐ Self-reading Digital Dosimeter	☐ Other		
☐ Liquid Effluent	☐ Passive Vapor Monitor	☐ Sorbent Tube/Filter Pump			

Training Requirements (List below specific training requirements)							
Based on analysis above, the Walkdown Team determines the risk, complexity, and coordination ratings below:				**If using the permit when all hazard ratings are low, only the following need to sign: (Although allowed, there is no need to use back of form)**			
ES&H Risk Level:	☐ Low	☐ Moderate	☐ High	WCC:		Date:	
Complexity Level:	☐ Low	☐ Moderate	☐ High	Service Provider:		Date:	
Work Coordination:	☐ Low	☐ Moderate	☐ High	Authorization to start			Date:
				(Departmental Sup/WCC/Designee)			

3. Both work requester and service provider contribute to work plan (use attachments for detailed plans)

Work Plan (procedures, timing, equipment, and personnel availability need to be addressed):	
Special Working Conditions Required:	
Operational Limits Imposed:	
Post Work Testing Required:	
Job Safety Analysis Required: ☐ Yes ☐ No	Walkdown Required: ☐ Yes ☐ No

Reviewed by: Primary Reviewer will determine the size of the review team and the other signatures required based on hazards and job complexity. Primary Reviewer signature means that the hazards and risks that could impact ES&H have been identified and will be controlled according to site requirements.

Title	**Name (print)**	**Signature**	**Life #**	Date
Primary Reviewer				
ES&H Professional				
Other				
Other				
Work Control Coordinator				
Service Provider				
	Review Done: ☐ in series	☐ team		

4. Job site personnel fill out this section.

Note: Signature indicates personnel performing work have read and understand the hazards and permit requirements (including any attachments).			
Job Supervisor:		Contractor Supervisor:	
Workers:	Life#:	Workers :	Life#:
Workers are encouraged to provide feedback on ES&H concerns or on ideas for improved job work flow. Use feedback form or space below.			

5. Departmental Job Supervisor, Work Control Coordinator/Designee

Conditions are appropriate to start work: (Permit has been reviewed, work controls are in place and site is ready for job.)			
Name:	Signature:	Life#:	Date:

6. Departmental Job Supervisor, Work Requester/Designee determines if Post Job Review is required. ☐ Yes ☐ No

Post Job Review (Fill in names of reviewers)			
Name:	Signature:	Life#:	Date:
Name:	Signature:	Life#:	Date:

7. Worker provides feedback.

Worker Feedback (use attached sheets as necessary).
a) WCM/WCC: Is any feedback required? ☐ Yes ☐ No

b) Workers: Are there better methods or safer ways to perform this job in the future? ☐ Yes ☐ No.

8. Closeout: Work Control Coordinator (authorizing dept.) checks quality of completed permit and ensures the work site is left in an acceptable condition. (WCC can delegate clean up of work area to work supervisor)

Name:	Signature:	Life#:	Date:
Comments:			

INSTRUCTIONS FOR FILLING OUT THE WORK PERMIT

Header Information

The "Work Permit #" line shall be filled in by whatever numbering sequence a given department or group wants to use. The Work Control Coordinator maintains a logbook or spreadsheet of work permit numbers issued. The other three number lines are provided for tracking purposes and are filled in as appropriate. The "Standing Work Permit" box is checked if the permit is being used as such.

Section 1—Work Request

The work requester fills out the required information in this section. The name in the "Work Control Coordinator" line is the requester's WCC. The "Service Provider" line is the department doing the work.

Section 2—Hazard Analysis

The work requester initially fills out this section identifying the location hazards, facility concerns, work controls, and specific training needs. The requester provides the work information to the service provider and schedules a walkdown of the job site. A Walkdown Team composed of the requester, service provider, and ES&H support personnel (*as needed*) may provide further input for Section #2. The service provider predominantly identifies the task hazards and appropriate controls.

Notes:

-For each subsection, a "NONE" or a hazard or work control box must be checked.

-The "Safety Concerns" items with an asterisk indicate work activities that may require Industrial Hygiene to investigate, and may then require OMC medical surveillance. If the workers are already on the protocol list for the activity or hazard, then OMC surveillance would not be needed and the "No" box would be checked. If not sure of the worker's medical status or the particular work activity, mark "Yes" and contact Industrial Hygiene to evaluate.

-When a job involves a significant change to the amount of chemicals or radioactive materials in a facility, the Building Manager must be notified to determine if the Facility Hazard Category has been affected as per the Facility Use Agreement.

-For guidance in determining if security concerns are applicable see "Security Checklist."

-Table 1 and 2 in the screening guidelines attachment provide additional definition to the ES&H issues.

Section 2—Low, Moderate and High Hazard Determination

The bottom part of Section 2 is used by the WCC or Walkdown Team to make a final determination as to the rating levels (low, moderate, or high) **for ES&H risk, complexity,** and **work coordination**. A given task may be a skill of the worker job, but the complexity of the system or the work coordination involved can dictate a higher level of planning.

If the WCC or Walkdown Team decides that ES&H risk, complexity, and work coordination are all low, then the job is categorized as a low hazard and the work permit process can be terminated at this point. If a permit will be used for low hazard work, the Work Control Coordinator, the service provider (supervisor, craft, or technician), and an individual authorizing work must sign in the lower right hand corner of the front side.

If **any** of the ES&H risk, complexity, or work coordination rating levels are checked off as **moderate** or **high**, then the rest of the work permit form must be processed.

Section 3—Work Plan

The work plan section is filled out predominantly by the work requester with input from the service provider and ES&H personnel as needed. The job site should be visited by the Walkdown Team. A written description shall detail the job and any precautions that need to be taken. Use attachments for detailed plans (i.e., drawings) and longer narrative if needed.

If the ES&H risk level is rated high, then a Job Safety Analysis, JSA, must be written and attached to the work permit.

Section 3—Primary Reviewer

It is encouraged to review work permits in a team setting as opposed to circulating the permit for review and signoff in series. The team environment has proven to be more effective in achieving good ES&H reviews and in coordinating the required resources.

The primary reviewer is responsible for assembling ES&H and subject matter experts as needed for the review based on the ESH risks, job complexities, and overall coordination. If the Primary reviewer is a member of the Walkdown Team, then the team signoff in the "Reviewed By" section can occur following the walkdown if desired. Following review and approval, the work permit is returned to the work requester for scheduling with the work provider.

Section 4—Supervisor and Worker Signoffs

A pre-job briefing with the crew to review job hazards, permits, and coordination requirements. (Required for moderate and high hazards)

The supervisor and the workers sign the form (or an attachment) to indicate that they understand the hazards, the controls and the permit requirements.

Note: The workers must sign for themselves; it is not permissible for the supervisor to write their worker's names on the work permit.

Section 5—Conditions Appropriate to Start Work

The affected department usually authorizes the start of the job. Without this section, the workers could start any time without a final check with the department. The person signing this section verifies that the requirements designated on that permit *(work controls, etc.)* have been met, and that the job may proceed.

Section 6—Post Job Review

The job supervisor or work requester determines whether a post job review is needed. In some cases, the review team may decide that a post job analysis would be beneficial for lessons learned and will request the review. If a review is requested, print the name of the reviewer(s) on the line and check off the "Yes" block. If no review is needed, check off the "No" block.

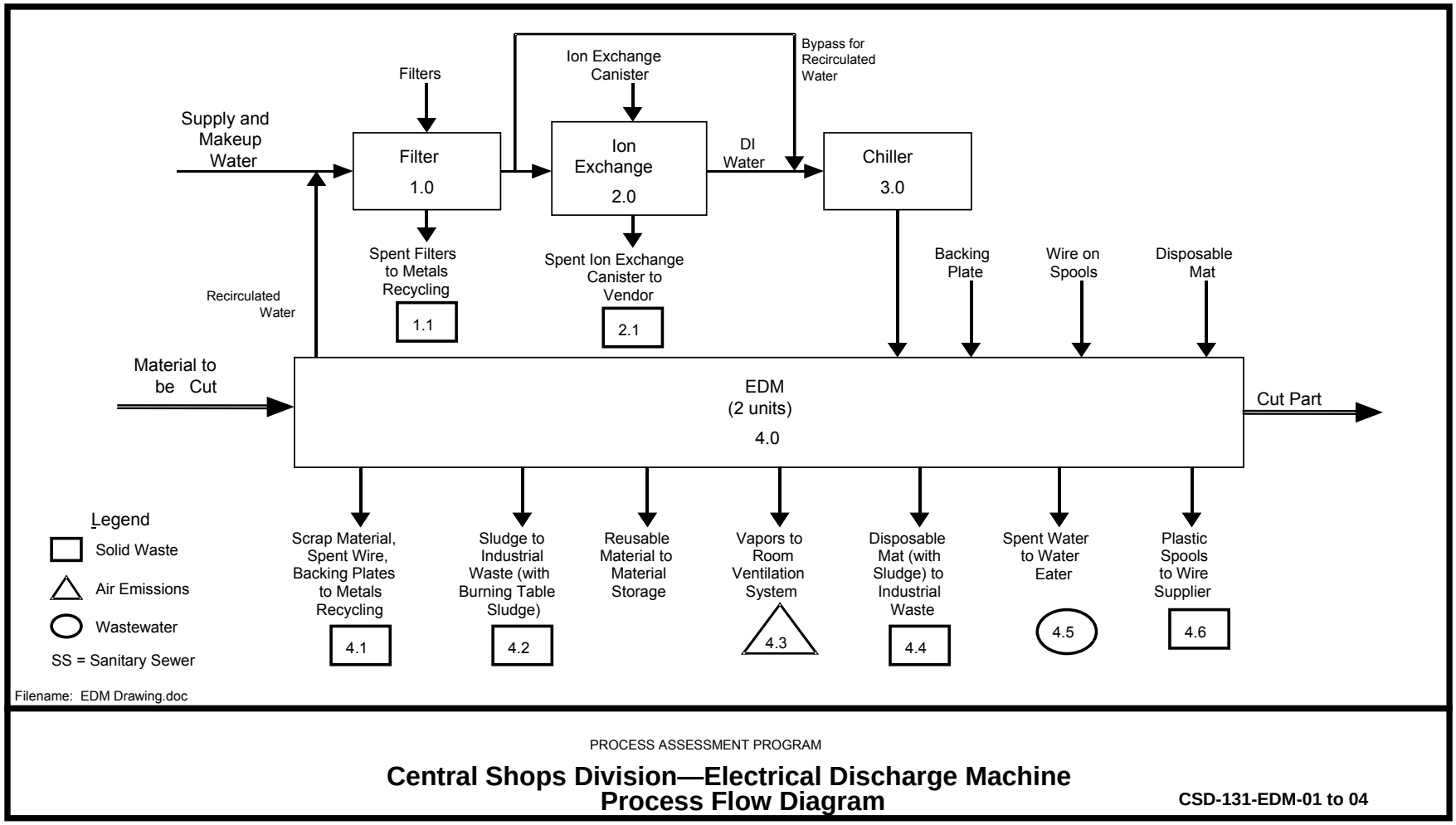
Section 7—Worker Feedback

This section is provided for the workers to feedback comments on ES&H issues from the job or on how to improve the work efficiency. The WCM/WCC may request worker feedback by answering yes to Section 7(a); if 7(a) is marked yes, then it is up to the WCM/WCC /Supervisor to solicit (and document on the WP or attached sheet) feedback from the workers. Regardless of the answer to 7(a) workers are encouraged to answer Section 7(b).

Section 8—Closeout

The original copy of the work permit is returned to the Work Control Coordinator who originated it initially. The Work Control Coordinator reviews the permit for consistency, signs off to close it out, and files it. The WCC provides feedback to appropriate personnel if any permit discrepancies occur.

APPENDIX D. METAL SHOP ELECTRICAL DISCHARGE MACHINE PROCESS MAP



PROCESS ASSESSMENT PROGRAM

Central Shops Division—Electrical Discharge Machine Process Flow Diagram

CSD-131-EDM-01 to 04

APPENDIX E. DEPARTMENT OF ENERGY POLLUTION PREVENTION AND ENERGY EFFICIENCY LEADERSHIP GOALS*

DOE will strive to minimize waste and maximize energy efficiency as measured by continuous, cost-effective improvements in the use of materials and energy, with the years 2005 and 2010 as interim measurement points.

A. Reducing Waste and Recycling.

- Reduce waste from routine operations by 2005, using a 1993 baseline, for these waste types:
  - Hazardous 90 percent
  - Low Level Radioactive 80 percent
  - Low Level-Mixed Radioactive 80 percent
  - Transuranic (TRU) 80 percent.
- Reduce releases of toxic chemicals subject to Toxic Chemical Release Inventory reporting by 90 percent by 2005, using a 1993 baseline.
- Reduce sanitary waste from routine by 75 percent by 2005, and 80 percent by 2010, using a 1993 baseline.
- Recycle 45 percent of sanitary wastes from all operations by 2005 and 50 percent by 2010.
- Reduce waste resulting from cleanup, stabilization, and decommissioning activities by 10 percent on an annual basis.

B. Buying Items with Recycled Content.

Increase purchases of EPA-designated items with recycled content to 100 percent, except when not available competitively at reasonable price or that do not meet performance standards.

C. Improving Energy Usage.

- Reduce energy consumption through life-cycle cost effective measures by 40 percent by 2005 and 45 percent by 2010 per gross square foot for buildings, using a 1985 baseline 20 percent by 2005 and 30 percent by 2010 per gross square foot, or per other unit as applicable, for laboratory and industrial facilities, using a 1990 baseline.
- Increase the purchase of electricity from clean energy sources:

*Secretary of Energy Memorandum for Heads of Departmental Elements, dated November 12, 1999.

- Increase purchase of electricity from renewable energy sources by including provisions for such purchase as a component of our request for bids in 100 percent of all future DOE competitive solicitations for electricity.

- Increase the purchase of electricity from less greenhouse gas-intensive sources, including, but not limited to, new advanced technology fossil energy systems, and other highly efficient generating technologies.

D. Reducing Ozone Depleting Substances and Greenhouse Gases.

- Retrofit or replace 100 percent of chillers greater than 150 tons of cooling capacity and manufactured before 1984 that use class I refrigerants by 2005.

- Eliminate use of class I ozone depleting substances by 2010, to the extent economically practicable, and to the extent that safe alternative chemicals are available for DOE class I applications.

- Reduce greenhouse gas emissions attributed to facility energy use through life-cycle cost effective measures by 25 percent by 2005 and 30 percent by 2010, using 1990 as a baseline.

E. Increasing Vehicle Fleet Efficiency and Use of Alternative Fuels.

- Reduce our entire fleet's annual petroleum consumption by at least 20 percent by 2005 in comparison to 1999, including improving the fuel economy of new light duty vehicle acquisitions and by other means.

- Acquire each year at least 75 percent of light duty vehicles as alternative fuel vehicles, in accordance with the requirements of the Energy Policy Act of 1992.

- Increase usage rate of alternative fuel in departmental alternative fuel vehicles to 75 percent by 2005 and 90 percent by 2010 in areas where alternative fuel infrastructure is available.