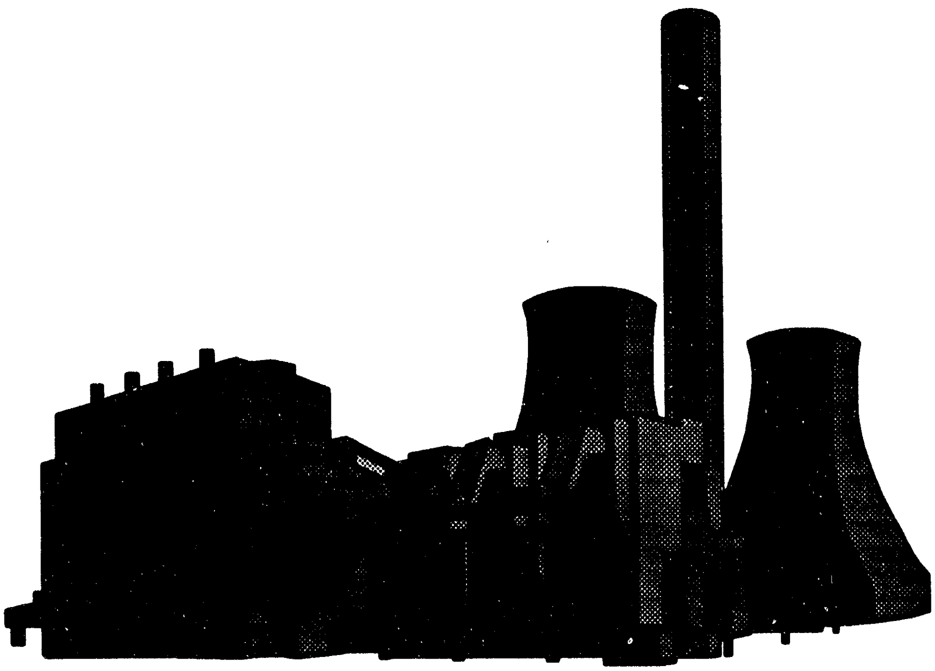
Orientation to Pollution Prevention for Facility Design



U.S. Department of Energy, Richland Operations Office

WHC-MR-0456

Orientation to Pollution Prevention for Facility Design

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This document was reviewed following the procedures described in WHC-CM-3-4 and is:

APPROVED FOR PUBLIC RELEASE

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WHC Information Release Administration Specialist:

Nikki Solis 1/28/94

(Signature) **(Date)**

January 31, 1994

Pollution Prevention for Facility Design: Course Contents

This material was developed to assist engineers in incorporating pollution prevention into the design of new or modified facilities within the U.S. Department of Energy (DOE). The material demonstrates how the design of a facility can affect the generation of waste throughout a facility's entire life and it offers guidance on how to prevent the generation of waste during design.

Contents include:

- *Orientation to Pollution Prevention for Facility Design* training course booklet,
- *Pollution Prevention Design Guideline,*
- *Orientation to Pollution Prevention for Facility Design* lesson plan,
- Training participant survey and pretest,
- Training facilitator's guide and schedule.

Orientation to Pollution Prevention for Facility Design Training Course Booklet:
The *Orientation to Pollution Prevention for Facility Design* training course familiarizes design engineers with the concepts of pollution prevention and walks them through the process of using the *Pollution Prevention Design Guideline*. This course was developed to be approximately 3 hours in length, but can be adjusted to suit individual needs. The first half of the course is dedicated to defining pollution prevention. Specific case studies or examples from the Hanford Site illustrate pollution prevention concepts, benefits, and their relationship to design. The second half of the course presents the *Pollution Prevention Design Guideline*, explains its features and use, and offers a case study exercise to practice using the guideline.

Distribution of course slides and overheads has been limited to allow for site or facility-specific alteration and revision.

Pollution Prevention Design Guideline
The *Pollution Prevention Design Guideline* is a compilation of nearly 250 questions organized to follow the structure of DOE Order 6430.1A, "General Design Criteria." The questions are intended to generate ideas, methods, and information that will assist in the prevention of pollution during the design process. The guideline is contained in the training course booklet but can be removed for use as separate document. An electronic version of the guideline is being developed at the Hanford Site in 1994.

Orientation to Pollution Prevention for Facility Design Lesson Plan:
The *Orientation to Pollution Prevention for Facility Design* lesson plan describes the course objectives and provides information and discussion points that accompany the course slides contained in the training booklet. The intent of the lesson plan is to provide potential training course facilitators, engineering management, and participants with enough material to understand and/or present the course.

Training Participant Survey and Pretest:
To assess participants' knowledge and attitude toward designing for pollution prevention, before the session, a survey and pretest are sent to each participant to complete. The facilitator can then adjust the emphasis of the session appropriately. This same survey and pretest are administered soon after the session to ascertain whether any change of attitude has occurred as a result of the session.

Training Facilitator's Guide and Schedule.
The facilitator's guide provides the schedule and structure for the training course. It presents an overview of key points and elements of the course.

Material for the *Pollution Prevention Design Guideline* and the *Orientation to Pollution Prevention for Facility Design* training course were developed at the Hanford Site for the U.S. Department of Energy, Office of Environmental Restoration and Waste Management, Waste Minimization Division (EM-352). The project was a collaborative effort between Westinghouse Hanford Company (WHC) and Kaiser Engineers Hanford (KEH). David Encke (WHC) is credited with the original idea of developing a pollution prevention design guideline formatted after DOE Order 6430.1A. Inquiries or suggested additions or revisions to the design guideline can be directed to Judy Dorsey, KEH, at (509) 376-4624 or to Elizabeth Raney, WHC, at (509) 372-0469. Questions or requests for training course materials should be directed to the Quality and Training Resource Center, U.S. Department of Energy, Richland Operations Office at (509) 376-7117.

Orientation to Pollution Prevention for Facility Design

Facilitator Guide

CONTENTS SECTION

Orientation to Pollution Prevention for Facility Design

Facilitator's Key Points and Schedule

Course Length: 3 hours with 2 stretch breaks

I. Introductory Remarks (15 min)
   A. Facilitator self-introduction
   B. Participants self-introductions
      Name
      Company affiliation
      Job position
   C. Project history, goals, and deliverables
   D. Course Overview . . . . see page 1 of text

Option (if have not sent out to participants before session)
   Participant Survey and Pre-Test . . . . refer to participant handouts
   (5 min--with only 2-3 minutes to complete both sides of page)
   Note: Participants retain sheet until end of session (when participants can change before answers given)

II. Overhead/Slide Presentation
   A. Policy drivers . . . . overheads/slides 1 & 2 only
   B. Collective Recall Exercise . . . . see page __ in text
      Participants form small groups/pairs. Together, and as quickly as possible, identify each of the following laws/regulations by defining the acronym or initialism. If able, identify each of the Department of Energy Orders.
      When you've finished, tell the facilitator; this will end the exercise. The first team to finish will read off their responses; any other team may challenge (i.e., correct) a definition.
      (At conclusion, tell participants KEY is on last page of text)

III. Stretch break (10 min)

IV. Design Guideline Table Presentation . . . . see page __ in text
   A. Opening comments (2 min)
   B. Introductory text (5 min) . . . . see page 1-1
   C. Summary of Applicable Divisions Table(2 min) . . . . . see page 3-1
   D. Table Features-Navigating (2min)

E. Table Features-Sample Page (10 min)
F. Demonstration (10 min)

V. Stretch break (10 min)

VI. Case Study Exercise
A. Transition Remarks
B. Directions & Case Background Data .... see page __ in text
Form small groups (who select a project leader to report back at end of 5-10 min work activity).
Read "Project Background" and study tank drawing.
Select applicable divisions.
Identify potential Opportunities (and be prepared to discuss reasons for response).
C. Debrief (15-30 min)
Project manager presents findings.
Facilitator presents actual project results.

VII. Survey/Post-test (5 min)
Key is on last page of informational booklet

ORIENTATION TO POLLUTION PREVENTION FOR FACILITY DESIGN

This is a new concept--both the Design Guideline and the orientation session. We would like your opinions to help us understand our audience better. For each of the following statements, circle the number best representing your level of agreement.

1. I can explain the difference between waste minimization and pollution prevention.

1	2	3	4	5	6
Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

2. I feel confident that I'm aware of the most current regulations and policies concerning pollution prevention.

1	2	3	4	5	6
Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

3. I read environmental magazines covering waste minimization and pollution prevention topics (such as *Hazmat World* or *Pollution Engineering*).

1	2	3	4	5	6
Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

4. I can explain the Environmental Protection Agency's hierarchy of environmental management practices.

1	2	3	4	5	6
Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

5. Responsibility to look for opportunities for pollution prevention belongs to me as an individual.

1	2	3	4	5	6
Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

6. I can identify at least six different benefits for pollution prevention in facility design.

1	2	3	4	5	6
Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

TEST

1. Pollution prevention is a RCRA solid waste program.
   TRUE FALSE

2. Pollution prevention is the reduction of all pollutants to all media.
   TRUE FALSE

3. Recycling is the use, reuse, or reclamation of a material.
   TRUE FALSE

For questions 4 through 6, circle all answers that apply.

4. Which of the following represents pollution prevention?
   (a) Source reduction
   (b) Energy conservation
   (c) Recycling
   (d) Disposal

5. Which of the following are considered methods for the treatment of waste?
   (a) Incineration
   (b) Segregation
   (c) Neutralization
   (d) Storage

6. Which of the following pollution prevention practices saves money or provides an economic benefit?
   (a) Reduce consumption of energy
   (b) Reduce use of raw materials
   (c) Reduce disposal
   (d) Reduce waste handling

Number the following practices in order of priority for effective pollution prevention.

___ Recycling
___ Disposal
___ Source reduction
___ Treatment

FACILTITATOR KEY

TEST

1. Pollution prevention is a RCRA solid waste program.
   TRUE ▣ **FALSE**

2. Pollution prevention is the reduction of all pollutants to all media.
   ▣ **TRUE** FALSE

3. Recycling is the use, reuse, or reclamation of a material.
   ▣ **TRUE** FALSE

For questions 4 through 6, circle all answers that apply.

4. Which of the following represents pollution prevention?
   ▣ **(a) Source reduction**
   ▣ **(b) Energy conservation**
   (c) Recycling
   (d) Disposal

5. Which of the following are accepted methods for the treatment of waste?
   ▣ **(a) Incineration**
   (b) Segregation
   ▣ (c) Neutralization
   (d) Storage

6. Which of the following pollution prevention practices saves money or provides an economic benefit?
   ▣ **(a) Reduce consumption of energy**
   ▣ **(b) Reduce use of raw materials**
   ▣ **(c) Reduce disposal**
   ▣ **(d) Reduce waste handling**

Number the following practices in order of priority for effective pollution prevention.

2 Recycling
4 Disposal
1 Source reduction
3 Treatment

KEY

There are numerous opportunities in the guideline table that are applicable to this project. Three specific opportunities that the project has implemented are provided here. It is estimated that implementation of these opportunities will eliminate 946,000 liters of raw water discharge to the soil column, and reduce air emissions from 3,000 scfm (840 Ci/yr) to 1,000 scfm (18 Ci/yr).

Opportunity: 11.A.16 Can closed-loop cooling systems be used instead of once-through cooling if the system being cooled contains hazardous materials (e.g., tank ventilation systems)?
Implementation: Install recirculating, closed-loop cooling system - drawing vapors from the tank and passing them through a condenser, which reduces the vaoprs to liquids. The liquid is returned to the tank.

Opportunity: 1.A.47 Can effluent and/or emission points be consolidated to reduce amount of monitoring necessary?
Implementation: Design a centralized ventilation system used by multiple tanks.

Opportunity: 1.A.22 Can the facility be designed to reduce the sources of potential leaks?
Implementation: Maintain tanks at negative pressure to prevent leakage. Seal existing coverblocks and other sources of inleakage of air. Add HEPA filters to ventilation air inlets to prevent backflow.

Lesson Plan No.			
WHC-MR-0456	**LESSON PLAN COVER SHEET**		QUALITY TRAINING AND RESOURCE CENTER

Lesson Plan Title	Course Length (hrs)	Draft Date
Orientation to Pollution Prevention for Facility Design	3 hrs	3/ 2/94

Learning Objectives

Participants will define pollution prevention terms.
Participants will recall the hierarchy for reducing waste.
Participants will identify benefits of pollution prevention.
Participants will apply the Design Guideline table.

Training Module References

- DOE-Office of the Secretary, 1993, "1993 Waste Minimization Pollution Prevention Crosscut Plan," Predecisional Draft Rev.2, October 28, 1993.
- DOE Order 6430.1A, 1989, "General Design Criteria"
- Chase, C. J., 1993, *Pollution Prevention Accomplishments Book*, WHC-SA-2047-VA, Westinghouse Hanford Company, Richland, Washington.

Prepared by	Date	Notes for Reviewers
J.K. Whitehead, Instructional Designer	1/94	Task Project description for DOE-HQ (EM 352) called for "Training Plan" development only, no implementation. Implementation at various sites may require site-specific revisions (case studies).
Reviewer Approved for Public Release	Date	

Reviewer Comments:

INSTRUCTOR PREPARATION

PURPOSE OF THE COURSE
This orientation is to provide a learning environment that will introduce a *Design Guideline* job aid—its philosophy and application. This "training" session results from a project completed by the Department of Energy, Richland Operations Office/Westinghouse Hanford Company and funded by the Department of Energy, Waste Minimization Division (EM-352).

Participants will hear about and practice incorporating pollution prevention (P2) into facility designs (new or modifications), using the newly-developed *Design Guideline* "opportunities table." Emphases will be on encouraging participants to espouse the philosophy of P2 in their own design projects, as well as to acknowledge the role that each individual plays in supporting P2.

RECOMMENDED COURSE SIZE: 24 participants per session
- Facility Design Engineers
- Project Engineers

KEY POINTS OUTLINE AND SCHEDULE
I. Introductory Remarks (15 min)
   A. Facilitator self-introduction
   B. Participants self-introductions
   Name, company affiliation, job position, comment on involvement with facility design and pollution prevention.
   C. Project history, goals, and deliverables
   D. Course Overview . . . . see page 1 of text

Optional (if not sent out and collect from participants before session)
Participant Survey and Pre-Test . . . . . . refer to participant handouts
   (5 min--with only 2-3 minutes to complete both sides of page)
   Note: Participants retain sheet until end of session (when participants can change responses before answers given)

II. Overhead/Slide Presentation (45 min)
   A. Policy drivers . . . . overheads 1 & 2 only

   B. Collective Recall Exercise . . . . see page __ in text
   Participants form small groups/pairs. Together, and as quickly as possible, identify each of the following laws/regulations by defining the acronym or initialism. If able, identify each of the Department of Energy Orders.
   When you've finished, tell the facilitator; this will end the exercise.

INSTRUCTOR PREPARATION

The first team to finish will read off their responses; any other team may challenge (i.e., correct) a definition.
(At conclusion, tell participants that KEY is found on page 33)

III. Stretch break (10 min)

IV. Design Guideline Table Presentation . . . . . see page ___ in text
- A. Opening comments (2 min)
- B. Introductory text (5 min) . . . . see page 1-1
- C. Summary of Applicable Divisions Table(2 min) . . . see page 3-1
- D. Table Features-Navigating (2min)
- E. Table Features-Sample Page (10 min)
- F. Demonstration (10 min)

V. Stretch break (10 min)

VI. Case Study Exercise
- A. Transition Remarks
- B. Directions & Case Background Data . . . . . . see page __ in text (15 min)
  Form small groups (who select a project manager who will report back to class at end)
  Read "Project Background" and study tank drawing.
  Select applicable divisions.
  Identify potential Opportunities (and be prepared to discuss reasons for response).
- C. Debrief (15-30 min)
  Project managers present findings.
  Facilitator presents actual project results.

VII. Survey/Post-test (5 min)

INSTRUCTOR PREPARATION

Introductory Remarks Pollution is driven by **laws and regulations** (with shifts in current trends--from pollution control to pollution prevention) 1990 Pollution Prevention Act (a national strategy) 1993 Exec.Order 12856 "Fed Compliance with Right-to-Know Laws & Pollution Prevention Requirements"-- requires voluntary goals to reduce toxic pollutants.	☐ *OVH: National Trends* ☐ *OVH: Pollution Prevention at Federal Facilities* *TURN OFF PROJECTOR* *Interactive exercise: Collective Recall (of initialisms and acronyms to full titles of laws/regulations, with extra credit for identifying effects of DOE orders). Small group activity with "race" to see who completes first (and then verify accuracy)*
P2 as defined by the Pollution Prevention Act of 1990	☐ *2 OVHs: Definition of P2*
EPA Hierarchy of Pollution Prevention: Source reduction is top priority. Next consideration: recycling. Third consideration: treatment Last alternative: disposal.	☐ *OVH: EPA Hierarchy*
Waste Min was precursor to P2 and a RCRA solid waste program. It is all encompassing—all pollutants to all media and energy & resource conservation. Shifts to a narrower focus of source reduction, but the scope increases to all media and all pollutants. Program elements and hierarchy remain the same.	☐ *OVH: P2 vs WMin*
Solid Waste, RCRA, and hazardous wastes characterize WMin. Air, water, energy, raw materials, and source reduction characterize P2.	☐ *OVH: Quiz group to identify which activities listed are characterized as WMin and which are P2 (write on OVH) Ask for any actual cases that participants know of.*
Definition of Recycle: use, reuse (note distinction), and reclamation.	☐ *OVH: Definition of Recycle*

COURSE CONTENT	TECHNIQUES
Definition of Treatment: technological processes that reduce the quantity, toxicity, or mobility of waste after it has been created. Examples: incineration, vitrification, neutralization, chemical extraction, physical separation, solidification/stabilization.	☐ *OVH: Definition of Treatment*
How the terms relate: starting at the center with P2, then work outward to the other programs that become more inclusive—to WMin to Waste Reduction.	
GOAL is to reduce, at source, the amount of material that must be disposed of as a waste. (When not possible to reduce or recycle, treat to reduce volume, toxicity, or mobility before storage and disposal)	
WHAT activities are considered Pollution Prevention? Examples from the Hanford Site. **NOTE: Other locations may substitute their own case study examples in this section.** Case: Vehicle Maintenance -- Recyling Product Challenge: Prevent pollution by reducing antifreeze waste in fleet operations. Scope: Approximately 3,200 government-owned vehicles Response: Purchased a recycling unit and modified product to allow 100% reuse and/or recovery. When buying additional product, purchased recycled materials. Result: Avoided waste (38,000 kg). Reduced both purchasing costs and disposal costs (saving $195,700)	☐ *Photo slide or text OVH: Antifreeze Recycling [antifreeze tank in bin]*

COURSE CONTENT	TECHNIQUES
Case: Lead paint removed by CO_2 Pelletization (refer to informational packet for case facts)	☐ *OVH: Photo [corroded battery]* ☐ *Photo slide or text OVH: Lead Paint Removed by CO_2 Pelletization [supply unit no.3 and fan duct]*
Case: Minimize and Reuse Parts Washer Solvent Challenge: Prevent pollution by reducing hazardous substance use and waste generation during processing Scope: Fleet operations--parts cleaned routinely to remove debris Response: Design and build a small, portable filtering system, through which the cleaning solvent is run before it is reused. Debris and metal particles (removed from the parts during the cleaning process) are collected as a sludge and disposed of as regulated waste. Result: Reduced new product replacement and disposal costs (initial savings of $32,500)	☐ *Photo slide or text OVH: Minimize and Reuse Parts Washer Solvent*
Case: Records Management -- Reducing chemical usage Challenge: Prevent pollution by minimizing chemical wastes created when processing microfiche. Scope: Five chemicals -- in a "kit" and two waste streams identified (six year previous) as regulated hazardous waste. Reponse: Implemented new procedure to swab a defoaming agent (to prevent bubbling and spilling over) inside caps of chemical bottles. Took new waste stream samples. Results: Allowed to re-designate waste stream and dispose "down the drain" and, thereby, reducing the use, generation, and disposal of waste materials. Also reduced the added cost of handling and disposing regulated materials. Reduced number of chemical kits purchased annually (by extending the life of the materials).	☐ *Photo slide or text OVH: Microfiche Process Changes [workers at records storage carousel]*

COURSE CONTENT	TECHNIQUES
Example of reducing use by extending lifecyle Case: Automotive Parts -- Challenge: Prevent pollution by using batteries that are non-corrosive and made out of recyclable material. Scope: Company fleet operations maintains 3,200 government-owned vehicles. Response: Conduct market research on batteries available. Return standard batteries to vendor for recyling and replace with non-conventional model that meets specifications (no free-flowing acid, no corrosion, no vent holes for hydrogen, last twice as long). Result: Using a safer, cleaner, long-lasting battery. Reduced source materials consumption by using batteries that are made with 98% recycled materials.	☐ *Photo slide or text OVH: Noncorrosive Batteries [old and new batteries on shelf]*
Example of reducing disposal Case: Custodial Services -- reducing disposal Challenge: Decrease costs of cleaning materials and reduce wastes for landfill disposal. Scope: Operations plants and offices to clean regularly (approximately $84,000 cost annually to purchase paper towels) Response: Use cloth diapers instead of paper towels. Wash and reuse. Result: Saved produce purchasing costs (initial $81,000) and reduced disposal wastes (24,500 kg or 90 yd^3 landfill space). **WHY** look for opportunities for P2?	☐ *Photo slide or text OVH: "Diapers Save Landfill" [worker at washing machine]*

COURSE CONTENT	TECHNIQUES
Time: for future reference--awaiting the final version of the DOE's Waste Cost/Avoidance Model, which will incorporate justifications provisions **Money**: investing now for future benefits (recognize future ramifications as well as benefits) **Future Benefits**: environmental, economic, productional, legal, social.	☐ *OVH: Invest now for future benefits*
BENEFITS OF A COMPREHENSIVE WMIN/PP PROGRAM Environmental: conserves resources, reduces pollutant releases, increases environmental awareness and improves stewardship of the environment.	☐ *OVH: Environmental Benefits of P2*
Economic: reduces raw material, energy, waste handling, and costs of disposing--resulting in an improved competitive position and reducing the costs to the taxpayers.	☐ *OVH: Economic Benefits*
Productional: improves material handling, conserves energy, increases productivity, creates safer working conditions, and develops improved processes and technologies.	☐ *OVH: Productional Benefits*
Legal and regulatory: improves compliance with environmental regs, reduces long-term liabilities, reduces record keeping and administrative costs.	☐ *OVH: Legal Benefits*
Social: reduces health and accident risks, improves employee and employer relations, and improves public image.	☐ *OVH: Social Benefits*

COURSE CONTENT	TECHNIQUES
	☐ *Photo slide or text OVH: Case—Excess Chemical Sales [workers in protective clothing by tank truck]*
Example (from true-to-life situation) Recyling: "Surplus Chemicals" Challenge: establish and streamline the process for excessing surplus chemicals. Case Stats: products are no longer needed. Range from supermarket-size cans to spray paint to tens of thousands of liters of specialized bulk chemicals (heavy duty industrial products--such as nitric acit/sulfuric acid/tributyl phosphate). Resolution: Set up a screening process to find buyers, following a heirarchy of potential purchasers (public auctions held) Targeted specific bidders, screen carefully, identified contents (packaging and quantities and contents). If packaged, sold new/unopenied in original containers. If bulk, put through validation. Results: sold over 200K gal & 100K lbs of chemicals, generating $100K revenue. Saved over $1 million in waste disposal costs	
Overview of Case Benefits Environmental: improved stewardship Economic: Dollars saved Productional: improved working conditions, increased productivity Regulatory: reduced liabilities (by contractural language) Social: improved public image and reduced health risks	☐ *OVH: "Overview of Case Benefits"*
WHEN should PP be incorporated? Throughout the entire life of a facility! Start at the "beginning"- during design. Continue during construction, during operations, up through decontamination and decommissioning.	☐ *OVH: When Should P2 Opportunities..."*

COURSE CONTENT	TECHNIQUES
Case Example: Buying Recycled Products Challenge: increase use of goods that are made of recycled materials. Response: require bidding vendor or manufacturer state amount of recycled material used in product and state is product is recyclable. Establish minimum levels of recoverable material to qualify award/purchase of that product. Results: increased number of recycled products identified--that contained recycled materials. Won award for excellence/recognition by DOE	☐ *Photo slide or text OVH: Buying Recycled Products [graphic--world with price tag]*
Case: Preventing Pump Failure--selecting alternative materials Challenge: find way to prevent pumps from failing when cavitation occurs. Avoid replacing pumps when process is upset or discontinue. Response: Evaluate at "front end" -- i.e., the equipment (purchasing) Solution: Replace dry head pumps with stainless steel, liquid-sealed pumps Results: reduced waste; extended equipment life; cut down annual disposal costs; eliminated additional costs (to make equipment corrosion resistant).	☐ *Photo slide or text OVH: Chocrane Pumps [Picatti brand pump]*
Case: Glovebox Waste Minimization (Valve 390)— **At the design stage** Case: Preventing Reoccurrence--changing location. Challenge: Prevent hazardous waste generation. Response: Locate the source of problem (a leaking valve). Change the location of the valve. Results: Eliminate unnecessary generation of waste. Provide a safe environment by preventing contamination. Save disposal costs.	☐ *Photo slide or text OVH: Case—Glovebox [glovebox in hoisting & rigging staging area]*

COURSE CONTENT	TECHNIQUES
Case: Engine Steam Cleaning Challenge: reduce high costs of shipping waste water (generated in/from process of steam cleaning the engines) to an offside pretreatment facility. Response: purchased a water maze with a series of filters to remove contaminants, then put in holding tanks for reuse. Results: new capabilities--reuse water in company fleet vehicles (wash) and ability to discharge into city waste water system. Returne filters to manufacturer--saving on disposal costs.	☐ *Photo slide or text OVH: Case—Engine Steam Cleaning* *[Delta brand equipment on flatbed]*
Example of OPERATIONS Case: Emergency Response Cabinet	☐ *Photo slide or text OVH: Case—Plexiglas...* *[Plexiglas™ cabinet with supplies]*
Case: Demolition **At the D & D stage** Case: Preventing Waste--recycling materials. Challenge: Recover reusable materials during demolition of a pump house complex and, at the same time, decrease volume of materials to bury. Response: Use a universal processor (consisting of a hydraulic shear, concrete breaker, and concrete pulverizer) that has been purchased for another project. Use the shears to cut I-beams, as well as to remotely slice and stack them. Use the shears to remotely handle any materials considered regulated wastes. Separate metal from the concrete. Break large sections of concrete, send to recyling plant to reduce concrete to size of gravel. Results: Sold recyclable steel as salvage scrap iron. Use reduced-size concrete for construction backfill, road beds, and cover materials.	☐ *OVH: Photo* *[hydraulic shear with I-beam]*

COURSE CONTENT	TECHNIQUES
Design Guideline Table Demonstration (Refer to Attachment C for talking points) Relationship to DOE Order 6430.1A "GENERAL DESIGN CRITERIA"-- 16 divisions reflected on table to highlight opportunities that may fall within the applicable divisions. If an opportunity is listed on the table and is specified as a requirement in DOE orders or other regulations, the column "For More Information" will direct user to publication. Responsibility lies with user and applicability of project.	*Direct participants to page ___ of the information booklet (and instruct to "follow along" as facilitator explains format and appropriate responses).*
Limitations of Guideline Applies to design issues only. Opportunities are not mutually exclusive; may have several different methods for achieving the same objective (therefore, select one method only but evaluate every opportunity).	*Refer participants to example, shown on page ______, number________*
Integration into the Design Process Update table at each new major phase of project (design activities occure during many different phases). Complete the Summary page at completion.	*Direct participants attention to Summary Page to review columns. Q & A as necessary.*

COURSE CONTENT	TECHNIQUES
The Format of the Table Note: always review Division 1 "General Requirements" Column 1: subdivided according to hierarchy Column 2: citations--for full reference see lists at end of guideline. Also, contacts for more info. Column 3: check which are applicable and which will be CONSIDERED for implementation Column 4: what to "remark"? Not applicable or reason why not implemented. Importance?	*Direct participants to follow along as describe table. Encourage questions.*
Exercise: Using the Table Directions to small groups or pairs: Using the project background information given in the participant booklet, and using the Design Guidelines table, identify some possible areas where potential pollution prevention measures might be applicable. New ideas (not suggested on the table) are welcome and encouraged. If you need more information about the situation, ask one of the facilitators.	*Direct participants to turn to page ___ of the information booklet to read the case study.* ☐ *slide: Photo [underground storage tank]*
Debriefing. Which division or divisions within the table did you find most applicable? Which (if any) DOE orders or environmental regulations apply? Which opportunities did you identify to consider?	*Project managers present each groups recommendations and reasons. Facilitator adds comments on findings, and then shares actual results. Refer to Attachment B for case key.*

COURSE CONTENT	TECHNIQUES
CLOSING ACTIVITIES Post Test/Survey (key on last page of participant booklet).	*Direct participants to either re-take the Survey/Test (if completed before session) OR to re-examine their responses on the "pre-test" to see if they wish to change any responses.* *Facilitator reads "answers" from back of participant booklet.* *Ask for questions and comments.*
Closing remarks: future plans 1. Continued development of the table (contact names and numbers located at beginning of Design Guideline), including development of hypermedia format for better usability. 2. New developments, if any.	

ATTACHMENT A

COLLECTIVE RECALL EXERCISE

Form a small group (3-4 people). Drawing on your collective knowledge and experience, write out the complete title of each of the following initialisms or acronyms.

Example: DOE/Department of Energy

1) RCRA ____

2) FFCA ____

3) EPCRA ____

4) PPA ____

5) CERCLA ____

6) CAA ____

7) CWA ____

8) OSHA ____

When you have identified all items, tell the facilitator.

EXTRA CREDIT: For each of the following DOE Orders, give a descriptive title.

DOE 5400.1 ____

DOE 5820.2A ____

DOE 5400.3 ____

DOE 6430.1A ____

KEY

RCRA	Resource Conservation and Recovery Act
FFCA	Federal Facilities Compliance Act
EPCRA	Emergency Planning & Community Right-to-Know Act
PPA	Pollution Prevention Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CAA	Clean Air Act
CWA	Clean Water Act
OSHA	Occupational Safety & Health Act

EXTRA CREDIT
DOE 5400.1 requires WM/PP plans, annual waste reduction reports, and a pollution prevention awareness program.
DOE 5400.3 adds RCRA requirements to DOE environmental programs
DOE 5820.2A: requires Waste Management Plans, including actions to minimize radioactive waste generation
DOE 6430.1A: "General Design Criteria" provides general design criteria for use in acquisition of DOE facilities

ATTACHMENT B

FACILITATOR KEY TO CASE STUDY EXERCISE

Debriefing Questions
- Which division or divisions within the table did you find most applicable?
- Did any of you find DOE orders or environmental regulations that apply to this case?
- Which items did you find that applied or generated ideas?

Actual solutions:

1. Separate the tank's waste cooling system from the ventilation system.

2. Install recirculating, closed-loop coolant system--drawing vapors fron the tank and passing them through a condenser, which reduces the vapors to liquids (by a heat transfer media). The liquid is returned to the tank.

3. Design a centralized ventilation system (used by multiple tanks)--maintain a negative pressure to prevent leakage, and diluting potentially flammable gas.

4. Seal, protect existing coverblocks (and other sources of inleakage of air). Add heated, filtered inlets to control air entering each tank.
   Note: results show that the cooling system modifications eliminated 946,000 liters of raw water discharge to soil column. By providing separate systems **in the project design** decreased air flow rate reduces air emissions from 3000 scfm (standard cubic feet per minute) to less than 1000 scfm. The filtered tank inlets prevent the releases.

ATTACHMENT C

DESIGN GUIDELINE TABLE TALKING POINTS

I. Opening Comments (2 mins.)
- 1st hour: P2 concepts, definition, benefits - examples
- now all "sold", need tools to actually do P2
- remainder of course - introduce new tool and practice using
- new name, familiar concepts: relate P2 to ALARA, D&D, GEP

II. Guideline - Introductory Text (5 mins.)
- find guideline in course materials. follow along as I highlight key points
- p. 1-1, purpose - not all inclusive, not a checklist
- p. 1-1, relationship to 6430.1A - 16 divisions, 6430.1A already contains many P2 requirements
- p. 1-1, requirements vs considerations, example TSD Organic air emissions require vent and control device
- p. 1-2, list of design opportunities, stimulate thinking, ideas only - need more analysis for implementation and comparison of opps., not mutually exclusive
- p. 1-2, integration into design - meant to be applied project-specific, updated each design phase.
- pp. 2-1/2-2, I'll cover material as go thru table, but point out its here to refer to when bring to your work place.

III. Summary of Applicable Divisions Table (2 mins.)
- Go thru each column w/appropriate response (use W236 as example)
- Change table to make Div. 1 applicable by default
- not the environmental engineer's job - discipline ownership
- way to narrow scope of study up front
- repeat with each phase

IV. Table Features - Navigating the Table (2 mins.)
- 16 divs correspond to applicable divs table (& TOC)
- page numbering by division to facilitate navigation
- Example - most all facilities use coatings/paints - turn to division 9

V. Table Features - Complete a Sample Page (10 mins.)
- Work through Division 9 using W236 as example of how to use table
- Note; KEH paint accounts for >50% of hazardous waste stream
- column 1: opps, numbering system - 9=div., A-D=hierarchy, "Other"
- column 2: for more info., DOE req'd vs. literary references, look up in bibliography/reference sections.
- column 3/4: go thru firs 7 entries, providing appropriate responses using W-236 as example and writing on overhead.

- wrap up: use applicable divisions table to get to individual division tables. review opps one at a time, top to bottom. Most will be N/A. If app., can reference other project documents or indicate when in future design phases opportunity will be considered.

VI. Opportunities: Use examples to demonstrate features (10 mins.)
- Now that reviewed how to use table, want to elaborate on the opportunities themselves
- Over 300 opportunities presented
- As review them, recall orientation materials and try to identify how that opportunity is P2.
- Recall that resource conservation (includes water and raw materials), energy conservation (includes lighting and efficiency for electrically operated equipment), and source reduction (includes spill prevention, inventory control) are all P2.
- Put overhead up of select opportunities to demonstrate particular points
- review 1st 3, have class respond how each is P2. Point to make: on-site (1.A.25, 1.A.44) vs off-site (1.B.4).
- review next 3, having class respond how each is P2. Point to make: cons. (1.B.17) vs ops (15.A.23) vs d&d (11.A.7)
- review next 2, having class respond how each is P2. Point to make: eng study (1.B.5) vs def. design (11.A.11)
- not always P2 - needs analysis: example 10.A.3
- overview: these examples point out differences between 300 opps.

VII. Introduce Simulation Exercise (3 mins.)
- pep talk - doing great, now lets try using entire guideline on a real project, will compare to what actual project team is doing
- read through exercise with class following along
- assign a project manager, encourage creativity, brainstorm, don't worry about particulars of implementation, just identify what your project "should consider"
- PM will have to defend to review board (the class) how the project is meeting DOE 5820.2A "Each DOE-low-level waste generator preparing a design for a new process or process change shall incorporate principles into the design that will minimize the generation of low-level waste."
- recognize that guideline is new tool, but suggest some strategies for exercise (ie check off opps to consider/add others).

VIII. Working in Groups (15 mins.)
- answer questions
- listen to groups talking, keep them on track, provide clues where needed

IX. Debriefing (10 mins.)
- PM from each group presents findings,
- no wrong answers!
- Review what the actual project team implemented

ORIENTATION TO POLLUTION PREVENTION FOR FACILITY DESIGN

PACKING LIST

Class Date ____________________

Facilitators: ____________________

____

Participant materials
- ☐ Informational booklet and
- ☐ PACKET, including
  - Name plate
  - Course Evaluation form
  - Survey/Test form

Room Equipment
- ☐ Overhead projector
- ☐ 35mm Slide projector

Facilitator materials
- ☐ Overheads (3-ring binder)
- ☐ 14 photo slides (in pocket protector)
- ☐ Water-soluble, colored pens
- ☐ Pre/Post Test — Facilitator Key
- ☐ Key Points Outline and Schedule

Orientation to Pollution Prevention for Facility Design
Session Evaluation Form

Location: Facilitator(s): Name (*optional*) ________________
Date:

Circle the number that best represents your opinion.

THE COURSE	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. This session will be helpful in my job.	1	2	3	4	5
2. This session covered too much information in the time alloted.	1	2	3	4	5
3. This session provided helpful handouts.	1	2	3	4	5
4. I would recommend this session to anyone involved in facility design or modification.	1	2	3	4	5
5. The material presented was new to me.	1	2	3	4	5
6. I like the session the way it stands.	1	2	3	4	5
7. I would like more time with the Design Guideline Table.	1	2	3	4	5
8. The "Collective Recall" exercise was a good way for me to review the laws and regulations.	1	2	3	4	5
9. The case study exercise using the Design Guideline Table for valuable.	1	2	3	4	5
THE FACILITATOR(S)					
1. The facilitator was knowledgeable.	1	2	3	4	5
2. The facilitator answered participants' questions well.	1	2	3	4	5
3. The facilitator stayed on task.	1	2	3	4	5

Is there anything you would like us to know about the session or the facilitator?

____
____
____

Orientation to Pollution Prevention for Facility Design

Rev. 0
January 1994

Quality Training & Resource Center

U.S. Department of Energy, Richland Operations Office

Quality Training and Resource Center

The Quality Training and Resource Center (QTRC) is a multicontractor organization designed to provide comprehensive training in Quality Assurance, Safety, and Environmental Compliance. It was created to offer consistent, efficient, high-quality training for the U.S. Department of Energy, Richland Operations Office, and its contractors.

The Department of Energy has ultimate authority for the selection and design of all courses under the QTRC umbrella. Administration of the Center is conducted by four contractors: Hanford Environmental Health Foundation, Kaiser Engineers Hanford, Pacific Northwest Laboratories, and Westinghouse Hanford Company. Each of the contractors provides human and material resources in support of the Center.

Courses

The Quality Training and Resource Center offers state-of-the-art courses, covering a variety of disciplines, and taught by leading experts in each respective field. This comprehensive approach to quality has helped to successfully launch DOE's mission of environmental leadership.

The curriculum of the Center is not limited to compliance practices. "Quality is not inspected in, it is built in" is a basic tenet of the educational philosophy. The training curriculum is extensive and encompasses management activities that contribute to the quality, safety, and reliability of products and services. In addition, the Center offers guidelines for the development and implementation of effective training programs and performance measurement systems.

Staff

The full-time QTRC staff comprises experts in the areas of quality, safety, and environmental compliance; management controls; and human resource development. In addition, the services of subject-matter experts are enlisted from various contractors to develop and teach specific courses. External consultants are used occasionally to assist in the development, presentation, and evaluation of training modules, and to critique the overall effectiveness of the program.

QUALITY TRAINING AND RESOURCE CENTER
P. O. Box 1970 (MSIN G6-64)
Richland, Washington 99352
(509) 376-7117

Table of Contents

Course Overview

Introduction to Pollution Prevention

- What is pollution prevention?
  - concepts
  - definitions
  - examples from the Hanford site
- Why pollution prevention
  - benefits of pollution prevention
  - example from the Hanford site
- When should pollution prevention be considered for a facility?

Using Pollution Prevention During Design

- Introducing the Pollution Prevention Design Guideline

Design Guideline

- Exercise: Using the Design Guideline Table

Slide Presentation

Pollution Prevention — A National Trend

- Previous emphasis on pollution control
- 1990 Pollution Prevention Act
- EPA incorporating Pollution Prevention into all new regulations

Notes

Pollution Prevention at Federal Facilities

- DOE Crosscut Plan
- Executive Order 12856 mandating pollution prevention compliance at federal facilities
- 1994 funding allocated to review and revise DOE Orders, policies, and procedures to incorporate pollution prevention

Notes

Notes

Definition of Pollution Prevention (P2)

P2 as defined by the Pollution Prevention Act of 1990:

- ...any practice which 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.

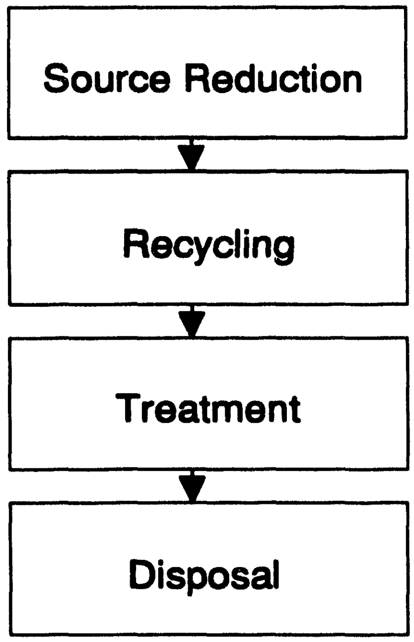
Notes

Definition of Pollution Prevention (P2) (cont.)

The term includes equipment or technology modifications, process or procedure modifications, reformulation or redesign of products, substitution of raw materials, and improvement in housekeeping, maintenance, training, or inventory control.

It also includes other practices that reduce or eliminate the creation of pollutants through: (a) increased energy efficiency in the use of raw materials, energy, water, or other resources; or (b) protection of natural resources by conservation.

EPA Hierarchy of Pollution Prevention



Notes

Pollution Prevention vs. Waste Minimization

- Waste minimization was a precursor to P2 and a RCRA solid waste program
- P2 is all encompassing, all pollutants to all media and
  - energy conservation
  - resource conservation
- Shifts to a narrower focus of source reduction, but the scope increases to all media and all pollutants
- Program elements and hierarchy remain the same

Notes

Notes

Characterize WMin and P2 Activities

Solid Waste	Air
RCRA	Water
Hazardous Waste	Energy
	Raw Materials
	Source Reduction

Notes

Definition of Recycle

Recycling is the use, reuse, and reclamation of a material.

- Use/Reuse: involves the return of a potential waste material either to the originating process as a substitute for an input material or to another process as an input material
- Reclamation: the recovery or regeneration of a useful or valuable material from a waste stream

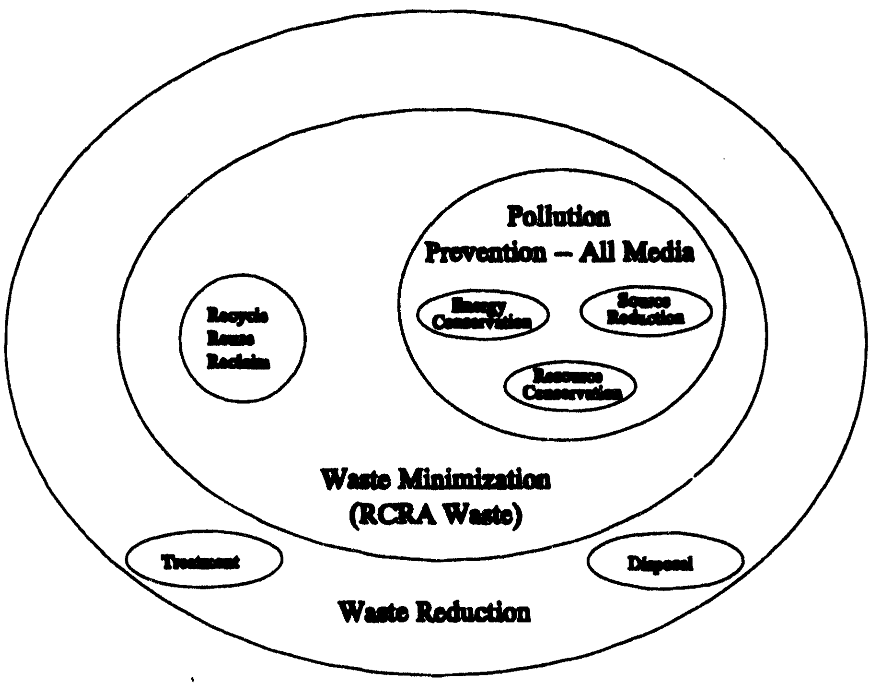
Definition of Treatment

Treatments are technological processes that reduce the quantity, toxicity, or mobility of waste after it has been created. The following list shows examples of treatments.

- Incineration
- Vitrification
- Neutralization
- Chemical extraction
- Physical separation
- Solidification/stabilization

Notes

How The Terms Relate



Notes

Notes

Goal of P2 Program

- Reduce
  - source
  - amount
    - waste generated
    - energy consumed
    - materials used

Notes

Case — Antifreeze Recycling

Challenge — Prevent pollution by reducing antifreeze waste from the vehicle maintenance operations, servicing approximately 4,500 government-owned vehicles.

Response — Use a recycling process to recycle all ethylene glycol. Close the loop by purchasing only a recycled antifreeze product.

Success — Avoided 38,000 kg of waste to date and saved $195,700 in new product purchase and disposal costs.

Case — Lead Paint Removed by CO_2 Pelletization

Challenge — Eight supply fan ducts and plenums are coated in lead paint testing as high as 420 ppm of lead. Conventional removal with sandblasting or chemical stripping will require 18 months labor and produce 64 to 80 drums of waste.

Response — Blast pellets of CO_2 onto surface with compressed air. The pellets sublime into harmless CO_2 gas.

Success — No secondary waste is produced. Waste is reduced by an estimated 50 drums and the estimated time to complete work package is reduced to 50 days.

Notes

Case — Minimize and Reuse Parts Washer Solvent

Challenge — Reduce hazardous substance use and waste generation by filtering and recycling parts washer solvent.

Response — Build a filtering system to collect parts washer solvent, run it through a small portable filtering system, and recycle it back to the parts washer. The debris and metal particles are collected as sludge and disposed as waste.

Success — Since initial use in 1990, the vehicle maintenance operations has reused 1,750 gallons of solvent, saving $32,500 in disposal and new product replacement costs.

Notes

Notes

Case — Microfiche Process Changes

Challenge — Minimize chemical waste and disposal costs when processing microfiche. System chemicals foam and bubble over when processing, spilling into the machine and wasting chemicals.

Response — Swab the inside of the chemical bottle caps with a defoaming agent preventing spills and extending life of the chemicals.

Success — New procedure reduces the number of chemical kits purchased each year and greatly extends the life of the materials and reduces hazardous substance use, generation, and disposal.

Notes

Case — Noncorrosive Batteries

Challenge — Find a safer, cleaner, longer-lasting battery made out of recyclable material.

Response — Replace automotive batteries with Optima 800U batteries that have no free flowing acid, no corrosion, no vent holes for hydrogen, and last twice as long as conventional batteries.

Success — Old batteries are returned to the vendor and replaced with Optima 800U. Optima 800U is made with 98% recycled materials and is more universal, eliminating the purchase of seven different types of batteries.

Case — Diapers Save Landfill

Challenge — Reduce waste: Terri Wipe* paper cleaning towels produce waste that goes to the landfill.

Response — Purchase cloth diapers for use as cleaning rags. Janitors launder rags using washing machines already in place.

Success — Product cost decreased from $84,000 per year to $3,000 per year; achieved a reduction of 24,500 kg of waste generated per year.

*Terri Wipe is a trademark of Scott Paper Co.

Notes

Invest now for future benefits

- Environmental
- Economic
- Productional
- Legal
- Social

Notes

Notes

Environmental Benefits of P2

- Conserves resources
- Reduces pollutant releases
- Increases environmental awareness
- Improves stewardship of the environment

Notes

Economic Benefits of P2

- Pollution Prevention pays — reduces costs for raw material, use of energy, waste handling, storage, treatment, and disposal
- Improves efficiency
- Reduces costs to taxpayers
- Improves national competitiveness

Productional Benefits of P2

- Improves material handling
- Conserves energy
- Increases productivity/efficiency
- Creates safer working conditions — ALARA (As Low As Reasonably Achievable)
- Develops improved processes and technologies

Notes

Legal and Regulatory Benefits of P2

- Improves compliance with environmental regulations
- Reduces long-term and potential liabilities
- Reduces record keeping and administrative costs

Notes

Notes

Social Benefits of P2

- Reduces health and accident risks
- Improves employee and employer relations
- Improves public image
- Improved environmental stewardship

Notes

Case — Excess Chemical Sales

Challenge — Recycle large quantities of bulk and consumer chemicals remaining after change in mission from weapons production.

Response — Put the chemical products through the government excess process. Simultaneously, seek interest for the chemicals and have ready for sealed bid or public auction sales process to the general public.

Success — Over 200,000 gallons and 100,000 pounds of chemicals sold to date. Generated over $100,000 in revenue and saved over $1 million in avoided waste disposal costs.

Overview of Case Benefits

- Environmental — improved stewardship
- Economic — dollars saved
- Productional — improved working conditions, increased productivity
- Regulatory — reduced liabilities (by contractual language)

Notes

When Should P2 Opportunities Be Considered for a Facility?

- During design phase
- During construction
- During operations
- During decontamination and decommissioning

P2 needs to be considered throughout the entire life of a facility.

Notes

Notes

Case — Buying Recycled Products

Challenge — Encourage the purchase and manufacture of goods using recycled materials. Stimulate market demand for recycled products by using more recycled products onsite.

Response — Change procurement procedures to request recycled content in product and ask if the product is recyclable. State that recycled content in a product is reason to give it preference. Require the review of purchase requisitions to eliminate possible requirements for virgin materials.

Result — Identified nearly 200 products containing recycled material. Received an award by the DOE recognizing the Hanford site for excellence in affirmative procurement and solid waste recycling.

Notes

Case — Chocrane Pumps

Challenge — Dean Line* dry head pumps fail when head space solution is lost due to cavitation. Over 20 pumps must be replaced when the process is upset or discontinued operations occur.

Response — Replace Dean Line* pumps with stainless steel Chocrane* liquid-sealed pumps which operate dry, without failure due to cavitation.

Success — Avoided an estimated five drums of TRU waste at a cost savings of $11,400. Experimental pump has lasted 1 1/2 years longer than the old pump. Stainless steel finish is corrosion resistant and does not require paint.

*Dean Line is a trademark of Dean Brothers, Inc.

*Chocrane is a trademark of Crane Co.

Case — Glovebox Waste Minimization (Valve 390)

Challenge — Leaking valve was located over the 15 plastic port of a glove box. The leakage created transuranic (TRU), low-level waste (LLW), and contamination from change out of the glove box.

Response — Relocate valve 390.

Success — Saved four TRU drums of waste per year at a disposal cost savings of $9,170 for the one valve.

Notes

Case — Engine Steam Cleaning

Challenge — Water from the process of steam cleaning engines generated 80,000 gallons each year, which was shipped offsite to a pretreatment facility.

Response — Water used to steam clean engines goes through a Land Delta 1000 Water Maze, purchased to filter out various contaminants. The water is then put into a holding tank and reused in the car wash operations.

Success — Water is reused in the car wash and then discharged into the city waste water system. The Water Maze filters are sent back to the manufacturer. Saved $117,000 in disposal costs.

Notes

Notes

Case — Plexiglas* Emergency Preparedness Box

Challenge — Emergency preparedness boxes are usually metal and their seal must be broken every six months to run through the checklist and account for all required contents.

Response — Make emergency preparedness boxes out of Plexiglas.

Success — Plexiglas box seals no longer need to be broken and in an emergency, items are quickly seen and obtained.

*Plexiglas is a trademark of Rohm and Haas.

Notes

Case — Demolition Recycling

Challenge — Recover as much reusable material as possible and decrease the volume of materials buried when demolishing.

Response — Purchase a universal processor that consists of hydraulic shears, concrete breaker, and concrete pulverizer. The hydraulic shears enable remote slicing and stacking of metal scrap. Large sections of concrete are sent through the processor to reduce the size of the concrete to gravel. Metal is separated from the concrete.

Success — Approximately 900 tons of recyclable steel, which can be sold as salvage scrap iron, will be recovered from the 190-B Pump House Complex. An estimated 13,000 tons of concrete and block will be crushed and reused from the 190-B demolition.

Collective Recall Exercise

Form a small group (3-4 people). Drawing on your collective knowledge and experience, write out the complete title of each of the following initialisms or acronyms.

Example: DOE/Department of Energy

1) RCRA ______________________________
2) FFCA ______________________________
3) EPCRA ______________________________
4) PPA ______________________________
5) CERCLA ______________________________
6) CAA ______________________________
7) CWA ______________________________
8) OSHA ______________________________

When you have identified all items, tell the facilitator.

Extra Credit

For each of the following DOE Orders, give a descriptive title.

DOE 5400.1 ______________________________

____

DOE 5820.2A ______________________________

____

DOE 5400.3 ______________________________

____

DOE 6430.1A ______________________________

____

Pollution Prevention Design Guideline

The Pollution Prevention Design Guideline, developed at the Hanford site for the U.S. Department of Energy, Waste Minimization Division (EM-352), is a collaborative effort between Westinghouse Hanford Company (WHC) and Kaiser Engineers Hanford (KEH). David Encke (WHC) is credited with the original idea of developing a pollution prevention design guideline formatted after DOE Order 6430.1A. Inquiries, suggested additions, or revisions to the guideline can be directed to Judy Dorsey, KEH Design Guideline lead engineer (509-376-4624) or to Liz Raney, WHC Design Guideline project manager (509-372-0469).

CONTENTS

1.0 INTRODUCTION

1.1 PURPOSE OF GUIDELINE

This design guide has been developed to assist engineers to incorporate pollution prevention features into Department of Energy (DOE) facilities. The guide was designed primarily for new facilities or major modifications to existing facilities. However, personnel conducting process waste assessments or engineers making minor modifications or routine upgrades to existing facilities will find the guide helpful.

The guide does not contain every pollution prevention option available, rather it should be used as a starting point for identifying opportunities. Only the engineers designing the new facility or modifications can identify the most beneficial options to incorporate. As new options are identified they should be added to this guide.

Use of this guide is not mandatory. However, completion of the guideline table will help to demonstrate compliance with DOE and federal regulations that mandate waste minimization be considered during design, but which provide little guidance on how this is achieved.

1.2 RELATIONSHIP TO DOE 6430.1A

The guideline table, found in section 4.0, has been divided into the sixteen divisions of DOE Order 6430.1A, "General Design Criteria". Because the use of this guide is not mandatory, the guideline table is not intended to be a compliance checklist for DOE 6430.1A.

Some design criteria in DOE 6430.1A appear in the table to highlight those pollution prevention opportunities that are explicitly required by the order. Therefore, a facility design that is compliant with DOE 6430.1A already includes certain design features that minimize waste. The intent of the guide is to suggest additional pollution prevention design opportunities for consideration during facility design.

1.3 REQUIREMENTS VERSUS CONSIDERATIONS

Although use of this guide is not mandatory, some of the opportunities listed in the Design Guidelines Table are actual requirements found in other DOE Orders or federal regulations. If this is the case, the exact paragraph containing the requirement is provided in the *For More Information* column. If the *For Information Column* is blank or contains a literary reference indicated by the author's name and year of publication, then the opportunity is merely a design consideration rather than a design requirement. The guideline user is cautioned that for a particular opportunity, the regulation cited may not be applicable to the project under consideration. It is the responsibility of the user to determine whether the regulation is a design requirement or a design consideration for the scope of the project under consideration.

1.4 GUIDELINE LIMITATIONS

The opportunities presented in the Design Guidelines Table are strictly design issues. Techniques for pollution prevention through operational practices, maintenance, good housekeeping, etc. are not explicitly included. Such opportunities may be suggested indirectly; for example, space allocation for hazardous materials storage, or recycling equipment. Some bibliographic entries may direct the reader to pollution prevention activities other than design.

This guide intends only to stimulate thinking in pollution prevention and to provide a method to document opportunities that are being considered for a specific project. Implementing pollution prevention measures will require consideration of such impacts as economics, technical feasibility, availability of required materials (particularly for recycled-content products), and life cycle cost.

Opportunities listed in the table are not mutually exclusive. Several opportunities present different methods or technologies for achieving the same objective. This does not preclude every opportunity from being evaluated, but it will be impossible to implement every opportunity.

1.5 INTEGRATION INTO THE DESIGN PROCESS

As in DOE 6430.1A, these guidelines apply to all design activities including engineering specifications as well as the preparation of design criteria during the project planning phase. Some opportunities will not be able to be implemented until definitive design, whereas others may be appropriate as part of the project-specific design criteria. Therefore the Design Guideline Table should be updated at each new major phase of design. The table should be completed for a specific project and remain with the project files.

2.0 USE OF THE GUIDE

2.1 SUMMARY OF APPLICABLE DIVISIONS TABLE

This table should be completed prior to beginning the design guidelines table. It is intended to evaluate the divisions of DOE Order 6430.1A that are applicable to the project under consideration. The project name and number should be recorded, as well as the date of table completion and the design phase the project was in at the time of guideline completion. For each applicable division, the guideline user responsible for that division should provide their name and location/phone.

2.2 DESIGN GUIDELINE TABLE

2.2.1 Column 1: Pollution Prevention Design Opportunity

The guide has been divided into sixteen divisions, the same divisions as DOE Order 6430.1A, "General Design Criteria". It was divided this way to allow engineers to quickly flip to the area of their expertise/interest. Besides the divisions applicable to the project being reviewed, every project should review Division 1, General Requirements, since this division contains options that could be applicable to any division. Opportunities that apply to more than one division are not repeated throughout the table, but are listed in Division 1.

Within each division, pollution prevention opportunities are sub-divided in order of preference according to the pollution prevention hierarchy: source reduction, recycling, treatment, and disposal. Within each sub-division, individual opportunities are numbered sequentially as they were added to the table. The numbering system was not meant to imply a rank within the sub-division.

Use the *Other* rows (at the end of each division) to record any additional opportunities that the project is considering. These blank rows are intended to encourage creative ideas and to emphasize that the list presented is not exhaustive of pollution prevention opportunities.

Many of the opportunities listed are techniques for energy conservation. Although energy conservation may not directly prevent or minimize wastes in the facility being designed, energy conservation is universally recognized as a form of pollution prevention, due to the environmental costs of electric power generation.

In addition to energy conservation, the following are also examples of viable source reduction strategies: spill prevention, preventative maintenance, inventory control, good housekeeping, product substitution/toxics use reduction, resource conservation and automated versus manual control systems.

Note that some opportunities listed will realize an almost immediate payback (ie during construction), whereas other opportunities will not prevent or minimize waste until the facility is decommissioned.

Division 13 - and the -99 sections of other divisions cover special facilities (nuclear). Many of the opportunities presented in these sections prevent pollution by limiting contamination spread or cross-contamination. Opportunities required for a nuclear facility are still useful considerations for all other facilities. Many of the opportunities presented in the table are also D&D and ALARA considerations. DOE Orders require that D&D and ALARA be considered during the design process.

2.2.2 Column 2: For More Information

This column contains references for the reader to obtain more information on the particular opportunity being presented. A complete reference list appears after the table. If the reference is a Department of Energy (DOE) Order or an environmental regulation, the specific paragraph within the order or regulation is provided in this column. In these cases, the reader is cautioned that the opportunity may actually be a design requirement for the project under consideration. It is the responsibility of the guideline user to obtain the reference to determine applicability on a case by case basis.

A list of additional contacts has been included in the Bibliography immediately following the References section of this guideline. For modifications to existing facilities, contact the facility waste minimization representative, if there are questions on specific opportunities or additional product information is needed.

2.2.3 Column 3: Will Consider

Check this column for those opportunities that are applicable to their facility and that will be considered for implementation.

2.2.4 Column 4: Remarks

For each opportunity listed, record a comment to indicate that the opportunity has been reviewed. If Column 3 *Will Consider*, was not checked, the remark should include why the opportunity will not be considered. If the opportunity does not apply to the project under consideration, N/A (not applicable) is a sufficient response for this column. If Column 3 *Will Consider*, was checked, indicate whether the opportunity will be implemented.

3.0 SUMMARY OF APPLICABLE DIVISIONS

Project Number and Title ______________________

Date ______________________

Design Phase ______________________

DIVISION	APP	REVIEWER	LOCATION/PHONE
1.0 General Design Requirements	X[1]		
2.0 Site and Civil Engineering			
3.0 Concrete			
4.0 Masonry			
5.0 Metals			
6.0 Wood and Plastic			
7.0 Thermal and Moisture Protection			
8.0 Doors and Windows			
9.0 Finishes			
10.0 Specialties			
11.0 Equipment			
12.0 Furnishings			
13.0 Special Facilities			
14.0 Conveying Systems			
15.0 Mechanical			
16.0 Electrical			

[1]Division 1 contains design opportunities applicable to all projects.

4.0 DESIGN GUIDELINE TABLE

4.1 DIVISION 1: GENERAL REQUIREMENTS

Division 1: General Requirements Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal		For More Information	Will Consider (Check)	Remarks
1.A.1	0110-1.2 Can two or more services or systems such as those noted below be integrated in order to minimize added construction materials due to duplicated functions?: Telecommunications, data communications, lighting controls, energy management system, HVAC control, security and alarm, closed-circuit television, vertical transportation controls, fire detection and alarm, public address system.	DOE 6430.1A 0110-1.2 Systems Integration		
1.A.2	Have changeable, movable, and/or demountable materials been considered where functional requirements are likely to change so that the extent of facility modification required is minimized?	DOE 6430.1A 0110-3 Flexibility		
1.A.3	Have the energy conservation requirements in this section been addressed?	DOE 6430.1A 0110-12 Energy conservation		
1.A.4	Does the layout of the facility provide specific control and isolation, if possible, of flammable, toxic and explosive gases, chemicals, and other hazardous materials admitted to the facility?	DOE 6430.1A 0110-99.0.4 Building Layout		
1.A.5	Where floor storage is operationally required, does the layout of floor areas and access areas take into consideration the requirements for secure location of storage containers, traffic control, and segregation?	DOE 6430.1A 0110-99.0.4 Building Layout		
1.A.6	Have precautions been taken to minimize the release of gases, vapors and exhaust emissions during site development construction activities? Have dust palliatives and soil waterproofers been used to mitigate air quality impacts?	DOE 6430.1A 0150-4.3 Construction Facilities, Air Pollution Control		
1.A.7	Has a Process Waste Assessment (PWA) and material balance been performed on the proposed facility/facility modification to identify potential waste streams?			
1.A.8	Has a life-cycle assessment been performed on the facility/process?	DOE 6430.1A, 0110-9, p. 1-58		

Division 1: General Requirements Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal		For More Information	Will Consider (Check)	Remarks
1.A.9	If the facility function will require provisions for duplicating engineering drawings, can white print machines be specified instead of blueprint machines in order to avoid the generation of hazardous ammonium hydroxide?	(DOE-RL, 1992)		
1.A.10	Can the use of disposable products in facility operations be avoided?	(Kusz, 1991)		
1.A.11	Can fail-safe features, interlocks, and alarms be incorporated into the facility to prevent accidental generation or release of hazardous materials to the environment?			
1.A.12	Is monitoring/detection equipment located where spills/problems are detected before large spills or amounts of waste will be generated? eg.) A sump alarm in conjunction with an outfall monitoring station would be preferred to just an outfall station.			
1.A.13	Is the facility floor plan such that heavily used corridors are located away from areas where hazardous materials are used or stored in order to reduce the risk of accidental spillage?			
1.A.14	Can unauthorized access to hazardous materials be controlled to reduce the risk of operator errors causing accidental releases?	DOE 6430.1A, 0110-99.0.2		
1.A.15	Is the facility designed for sequential areas of control/containment? eg.) Areas with most hazardous materials or areas where spills are most likely to occur have multiple containments/barriers.			
1.A.16	Can lead-free solder be utilized instead of lead-based solder?			
1.A.17	Can pipe materials be selected to avoid soil/groundwater contamination due to cracked, off-set joints, or corrosion of buried pipes?			
1.A.18	Can the facility be designed to reduce the sources of potential leaks? (eg. valves, pumps with seals, use of welded piping vs threaded/flanged piping)	(Freeman, 1990, p. 113)		
1.A.19	Can less hazardous/non-hazardous materials be used in place of the materials currently planned? If not, can the process be changed to operate with nonhazardous materials?			
1.A.20	Is the facility designed to handle bulk materials as opposed to bagged/packaged materials in order to minimize secondary waste generation associated with packaging materials?			

Division 1: General Requirements Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
1.A.21 Can monitoring equipment for monitoring raw material usage, energy consumption, air and waste water emissions be incorporated into the facility design so that optimum use of equipment is achieved?			
1.A.22 Are materials used in the facility compatible with the process mat ·ials so that waste associated with equipment failure, leakage, or corrosion is avoided? For example) Teflon is often used in gaskets and seals that will be subjected to harsh environments. However, teflon will not hold up in "harsh" radiation fields.			
1.A.23 Can point source hot water heaters be utilized instead of hot water tanks or hot water systems in order to conserve energy?			
1.A.24 Are storage areas designed to allow liquids to be stored away from solid and powder materials? Can powders and solids be stored on pallets or off the floor to prevent liquids from ruining the materials?			
1.A.25 Has a central material receiving area been identified in order to avoid duplicate materials and reduce waste associated with traffic, forklifts, etc.? This is applicable to both construction and operation phases of the facility.			
1.A.26 Can a computer-assisted plant inventory/material tracking system (eg. bar code system) be utilized to reduce excess materials and wastes due to expired materials?	(Freeman, 1990, p. 121)		
1.A.27 Are storage areas adequately illuminated to avoid accidents resulting in leaks and to spot leaks sooner?	(Freeman, 1990)		
1.A.28 Are spring-loaded/automatic shut-off valves used on faucets and at rinse stations and cleaning areas?			
1.A.29 Can underground piping be tested for pipe and joint integrity prior to backfilling?			
1.A.30 Can pipes be run above ground instead of underground, to avoid undetected leaks and potential groundwater contamination? Can above ground tanks be used instead of underground tanks?			
1.A.31 Can chemical and/or waste management systems be implemented and tested during the construction phase, by utilizing the chemicals and wastes generated by contractors during the construction?			

Division 1: General Requirements Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal		For More Information	Will Consider (Check)	Remarks
1.A.32	Have audits/assessments of similar facilities been conducted to identify better ways to manage and minimize waste streams?			
1.A.33	Can computer networks be used for electronic communication, record keeping, etc., to minimize the use of paper?			
1.A.34	Can backup generators for emergency and exit lighting be used instead of battery systems?			
1.A.35	Is spill and overflow protection provided on tanks?	40 CFR 280.20		
1.A.36	Can effluent and/or emission points be consolidated to reduce the amount of monitoring necessary?			
1.A.37	Are specifications written to meet minimum necessary materials requirements?			
1.A.38	Can process control systems be used to automate materials use?			
1.B.1	Is the facility/process designed to handle reusable materials in conjunction with bulk storage? For example, is it possible to eliminate individual aerosol cans by using bulk materials to fill permanent aerosol containers that are refilled and charged with compressed air? Are reusable, hand-pump aerosol bottles feasible?	(Kusz, 1991)		
1.B.2	Is it possible to use Gypsum Fiberboard that contains recycled newsprint as its source of fiber?	(Kusz, 1991)		
1.B.3	Is preference given to suppliers that take back containers/packaging materials?	(Kusz, 1991)		
1.B.4	Is priority given to use of recycled materials or products containing recycled materials (For example - building insulation products, paper, cement containing fly ash, retread tires, etc.)?	RCRA 6002(i), 40 CFR 248-253		
1.B.5	Do designs incorporate energy recycling to the maximum extent practicable? eg) use lighting for heat source, steam condensate for heating/pre-heating, used oil for energy recovery, cogeneration, etc.	DOE 6430.1A, 1620-1, 1589-3		
1.B.6	During facility construction/modification, have storage areas been set up for recyclable materials?			
1.B.7	Is storage space for reusable/returnable containers identified in the material receiving area?			

Division 1: General Requirements Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal		For More Information	Will Consider (Check)	Remarks
1.B.8	If drums are to be recycled/returned, has a drum rinsing station been included in the facility layout?			
1.B.9	Can temporary safety barricades use plastic mesh fencing that is made of recycled plastic?			
1.B.10	Can benches, picnic tables, landscaping timbers, etc. be made from recycled plastics or recovered wood fiber?			
1.B.11	Can surplus government property be used instead of buying new materials? Has a review of the Excess Surplus Property database been conducted to identify useful materials?	(HLAN)		
1.D.1	Have satellite accumulation areas and emergency spill control stations been included in the facility design?	WAC 173-303-220		
1.D.2	Has a central area within the facility been identified for handling;management of waste?			
1.D.3	During construction, are oil drums, gas storage tanks, etc. stored in contained/bermed areas?			
Other				
Other				
Other				

4.2 DIVISION 2: SITE AND CIVIL ENGINEERING

Division 2: Site and Civil Engineering Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal		For More Information	Will Consider (Check)	Remarks
2.A.1	Has the possibility of cross-contamination been reduced by confirming that there are no interconnections among storm water systems, the sanitary waste system and radioactive or other hazardous material handling systems or areas?	DOE 6430.1A 0273-99.0 Water Pollution Controls, Nonreactor Nuclear Facilities		
2.A.2	Has landscaping been considered for use as an element in energy conservation design solutions for buildings, including reduction of solar radiation during cooling season, heat loss from wind, and heat loss during the heating season?	DOE 6430.1A 0290-1 Landscaping-General		
2.A.3	Have plants been selected to minimize the need for irrigation while maximizing the cooling benefits (e.g., shading windows and condensing units)?	DOE 6430.1A 0290-3.1 Landscaping-Design Considerations		
2.A.4	Can the building layout be designed to minimize building materials use without compromising structural and functional integrity?	(Kusz, 1991)		
2.A.5	Can terracing steep slopes reduce stormwater run-off?	(Stormwater Pollution Prevention Plan)		
2.A.6	Can trees, shrubs, grass, landscaping be used to reduce the amount of stormwater run-off?			
2.A.7	Can percolation areas be utilized to reduce the amount of stormwater runoff?			
2.A.8	Can storage piles be covered, bermed/diked, or otherwise enclosed to prevent contamination of stormwater runoff?			
2.A.9	Are areas where there is a potential for spills (eg. truck unloading stations) diked so as to prevent contamination of storm sewers?			
2.A.10	Can the facility use earthen berms or be built underground to reduce energy usage?			
2.A.11	Will drainage from paved areas be evaluated to minimize creation of a waste stream or introduction of the stream into natural water courses?			

Division 2: Site and Civil Engineering Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal		For More Information	Will Consider (Check)	Remarks
2.B.1	Have recycle and recovery systems been implemented, where feasible, within industrial waste streams to conserve energy and resources?	DOE 6430.1A 0275-3.3 Industrial Wastewater Treatment-Recycle/Recovery Systems		
2.B.2	Can used concrete be crushed and utilized for road beds or aggregate?			
2.B.3	Can asphalt be reused for roads?			
2.B.4	Can asphalt containing recycled tires/rubber be used?			
2.B.5	Can Geotextiles made of, or containing recycled materials, be used?			
2.B.6	Can topsoil made from compost/sludge be used for landscaping?	40 CFR 503 (Sieger, 1993)		
2.B.7	Can used bricks or blocks, that would otherwise go to the landfill, be utilized for road beds or fill material?			
2.B.8	Can blasting mats made from recycled tires be used during use of explosives?			
2.B.9	Can parking bollards and parking stops be made from recycled rubber/plastic?			
2.B.10	Can marine fenders (on docks, tugboats, etc) be made from recycled tires/rubber?			
2.B.11	Can reclaimed wastewater be used for irrigation?			
2.B.12	Can hydraulic mulch made from recycled paper be used?			
2.C.1	Have alternative waste treatment techniques been considered for potential cost and energy savings? Evaluations of alternative treatment techniques shall include LCC, environment impacts, sludge generation and disposal methods.	DOE 6430.1A 0275-3.3 Wastewater Treatment-Alternative Waste Treatment Techniques		
2.D.1	In order to prevent secondary waste generation, does the design include adequate provisions for the safe collection, packaging, inventory, storage, and loading for transport of solid waste that is contaminated with radioactive material?	DOE 6430.1A 0285-99.0		

Division 2: Site and Civil Engineering Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
2.D.2 Has pollution prevention been considered in the selection of where storm water will be discharged? (ie process wastewater treatment system, public sewer, dead end sump)?	(Stormwater Pollution Prevention Plan)		
Other			
Other			
Other			

4.3 DIVISION 3: CONCRETE

Division 3: Concrete Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
3.A.1 In order to prevent secondary waste generation from contamination spread, do vaults located in hazardous waste storage facilities, have chemical resistant water stops provided at all construction joints located below the hazardous liquid level?	40 CFR 264.193(e)(2)(iii)		
3.B.1 Can cleanup wastes from concrete tools and equipment be captured and used for mixing the next batch of concrete, rather than being washed into the ground?			
3.B.2 Can concrete containing fly ash be used?	40 CFR 249		
3.B.3 Can cement be obtained from kilns which used "hazardous" waste, used oils, for energy recovery?			
Other			
Other			
Other			

4.3 DIVISION 4: MASONRY

Division 4: Masonry Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
4.A.1 Can non-hazardous cleaners be used for cleanup of masonry work?			
4.B.1 Can concrete or grout containing fly ash be used?	40 CFR 249		
4.B.2 Can the cement/grout be obtained from kilns which used "hazardous" waste and used oils for energy recovery?			
Other			
Other			
Other			

4.5 DIVISION 5: METALS

Division 5: Metals Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
5.A.1 Are non-hazardous protective coatings used? eg.) lead and chromium free paints and plating.	DOE 6430.1A, 0900-4 (see bibliographic entry 23)		
5.A.2 Can cathodic protection be used to reduce corrosion so that potential leaks are avoided, the need for repainting surfaces is reduced, and replacement costs and materials use is reduced?	40 CFR 280		
5.B.1 Are products made from, or containing recycled metal being used?			
5.B.2 Can metal working fluids be recycled?	(Higgins, 1989, Ch. 3)		
Other			
Other			

4.6 DIVISION 6: WOOD AND PLASTIC

Division 6: Wood and Plastic Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
6.B.1 Can "wood" made from recycled plastic or recovered wood fiber be used?			
6.B.2 Can recycled plastics be used instead of virgin plastics?			
6.B.3 Can benches, picnic tables, landscaping timbers, etc. be made from recycled plastics?			
Other			
Other			
Other			

4.7 DIVISION 7: THERMAL AND MOISTURE PROTECTION

Division 7: Thermal and Moisture Protection Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal		For More Information	Will Consider (Check)	Remarks
7.A.1	Are storage pads, tanks, etc. designed with covers/roofs to prevent stormwater from becoming contaminated?			
7.A.2	There is some evidence that glass fiber insulation may be a "potential" carcinogen. If feasible, can a "less hazardous" insulation be utilized such as treated paper. This could avoid costly remediation in the future.			
7.B.1	Can drainage piping made of recycled plastics be used?			
7.B.2	Can insulation made from recycled materials be used?	40 CFR 248		
7.B.3	Can roofing made from recycled materials be used?			
7.B.4	Can wood siding composed of recovered wood fiber or waste wood by-products be used?			
Other				
Other				

4.8 DIVISION 8: DOORS AND WINDOWS

Division 8: Doors and Windows Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal		For More Information	Will Consider (Check)	Remarks
8.A.1	Are doors & windows constructed to be energy efficient?			
8.A.2	Can skylights and windows be used instead of electrical lighting in order to conserve energy?			
8.A.3	Can passive solar energy gained through energy efficient windows be used to help heat a facility?			
8.B.1	Can doors or windows from facility modifications be reused/recycled?			
8.B.2	Can doors and windows containing recycled materials be utilized?			
Other				
Other				
Other				

4.9 DIVISION 9: FINISHES

Division 9: Finishes Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal		For More Information	Will Consider (Check)	Remarks
9.A.1	Where radioactive or other hazardous materials are processed or handled, and contamination can occur, are washable or strippable finishes used on walls, floors, and ceilings in order to prevent further spread of contamination and ultimately secondary waste generation?	DOE 6430.1A 0900-3 Hazardous Materials Contamination		
9.A.2	Have finish material and its support, backup, and substrate been selected, designed, fabricated, assembled, and installed to exclude or prevent the escape of fibers, such as asbestos, and the escape of emissions from volatile organic compounds, such as formaldehyde, and combinations of volatile organic compounds that have been determined to be a health hazard?	DOE 6430.1A 0900-4 Indoor Air Quality (Kapsanis, 1993a)		
9.A.3	Can two (or more) paint booths be provided in order to keep hazardous and non-hazardous paint wastes segregated?	(Fredrickson, 1992), (Fromm, et al, 1986)		
9.A.4	If the facility will include painting operations, can dual media spray equipment which mixes paint at the gun be utilized so that only the amount of paint actually used is mixed, thereby eliminating excess or waste mixed paint requiring disposal?	(Fredrickson, 1992)		
9.A.5	Can coatings containing non-hazardous pigments be used in order to minimize the toxicity of the waste generated?	see bibliographic entry 23		
9.A.6	Is painting equipment with the best transfer efficiency being utilized (i.e electrostatic painting, air assisted airless spray guns, etc.)?	(Higgins, 1989, Ch. 6)		
9.A.7	Can consumable/sacrificial coatings be used on surfaces that will be subjected to contamination?	see bibliographic entry 23		
9.A.8	Can on-site paint blending reduce the stock of pre-mixed paints? (unmixed paints can be returned to the manufacturer or used on another job.)	see bibliographic entry 23		
9.A.9	Can dipping, rolling or brushing be used rather than spray application to minimize waste paint associated with overspray?	see bibliographic entry 23		
9.A.10	Can high-solids paints/coatings be used to reduce VOC emissions?	(Higgins, 1989, Ch.6)		
9.A.11	Can fly ash be used as filler in coatings?	(Kapsanis, 1993b)		

Division 9: Finishes Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
9.B.1 Can painting solvents be recovered and recycled?	(Higgins, 1989, cH. 4-6)		
Other			

4.10 DIVISION 10: SPECIALTIES

Division 10: Specialties Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
10.A.1 Are low flow water saving devices used on shower heads?			
10.A.2 Can air hand dryers be used instead of paper towels to reduce paper trash?			
10.A.3 Can composting toilets or electric incinerator toilets be used at remote facilities?	(Petrich, 1993)		
10.B.1 Can shower dividers, toilet partitions, locker room benches vanities, etc. be made from recycled plastics/materials?			
Other			
Other			
Other			

4.11 DIVISION 11: EQUIPMENT

Division 11: Equipment Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
11.A.1 To prevent the contamination of equipment, have all equipment components not functionally required to operate directly in the presence of radioactive materials been located outside the enclosure?	DOE 6430.1A 1161-1 General		
11.A.2 To reduce migration of contamination, have closure devices or permanent seals been provided on entrances and exits of piping, ducts, or conduits penetrating confinement barriers? Do such closures or seals have an integrity equal to or greater than the barrier itself?	DOE 6430.1A 1161-2 Construction		
11.A.3 Are ventilation systems installed on enclosure systems maintained at a negative pressure with respect to the operating area in order to prevent leakage of contamination out of the enclosure?	DOE 6430.1A 1161-4 Ventilation		
11.A.4 Have HEPA filters been provided at the interface of the enclosure outlet and the ventilation system to minimize the contamination of ductwork, and at the enclosure inlet to prevent movement of contamination within the enclosure to the operating area in the event of a flow reversal?	DOE 6430.1A 1161-4 Ventilation		
11.A.5 Can equipment be designed to minimize materials use without compromising performance criteria?	(Kusz, 1991)		
11.A.6 Is it possible to design equipment for disassembly by using like materials to avoid segregation during demolition?	(Kusz, 1991)		
11.A.7 Can equipment be designed for life extension? For example, is the component easily repaired and can it be easily rebuilt with updated componentry?	(Kusz, 1991)		
11.A.8 Are solvent tanks provided with lids to minimize evaporative losses? Roll-type covers reduce solvent air emissions by 24-50% over hinged lids.	29 CFR 1910.107(d) (EPA, 1990), (Durney, 1984)		
11.A.9 Are sumps sized so that residual after pumping is minimized?			
11.A.10 Are solvent tanks located away from heat sources in order to minimize evaporative losses?	(Freeman, 1990, p. 117)		
11.A.11 Is equipment and equipment location designed for easy servicing?			

Division 11: Equipment Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
11.A.12 Can closed-loop cooling systems be used instead of once through cooling if the system being cooled contains hazardous materials (ie tank ventilation systems)?			
11.A.13 Can seal-less pumps be used instead of pumps with seals to reduce the potential for leakage?	(Freeman, 1990, p. 121)		
11.A.14 Can sealed magnetic drive pumps be used instead of pumps with couplings to reduce the potential for leakage?			
11.A.15 Can air-dryers be used instead of pre-heaters to preclude downstream condensation?			
11.A.16 Can pressure gauges be used instead of manometers containing mercury, acetylene tetrabromide or other hazardous material?			
11.A.17 Can digital/dial thermometers be used instead of liquid or mercury thermometers?			
11.A.18 Do high energy systems or systems that could leak or have spills have "double-valve" isolation?			
11.A.19 Do sumps, tanks or containers which could contain hazardous materials have high level alarms?	40 CFR 280		
11.A.20 Do flexible pipes, hoses and unloading stations have "dry break" couplings?			
11.A.21 Are all lines, tanks, vessels, and valves clearly labeled as to what they are for and what they contain in order to prevent waste due to cross-contamination?			
11.A.22 Can blind flanges be installed to prevent inadvertent cross contamination of systems?			
11.A.23 Can rupture diaphragms be installed in systems to prevent accidental cross contamination?			
11.A.24 Can valves or systems be easily locked/isolated to prevent unauthorized cross connections?			
11.A.25 Can fugitive emissions and leaks be reduced or eliminated by changing any of the following pieces of equipment: relief valves, flanges, drains, compressors, pumps, valves, seals, gaskets & packing, blowers, testing equipment, piping or monitoring equipment?	40 CFR 264/265 SUB BB		
11.A.26 Can syphon breaks or anti-syphon devices be installed on tanks or piping to prevent accidental draining of systems?			

Division 11: Equipment Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Conside (Check)	Remarks
11.A.27 Can unloading stations use different type/size couplings for each product/process to prevent accidental cross contamination?			
11.A.28 Can smooth heat exchanger tube surfaces (e.g., teflon) be used to minimize the sites available for scale formation and to reduce the cleaning frequency and therefore the volume of waste cleaning solutions?	(Fromm, et al, 1986)		
11.A.29 Can ozone, which decomposes more readily, be used to destruct microorganisms in cooling water rather than biocides?			
11.A.30 Are the discharges from relief valves and other over pressure protection devices contained or directed towards sumps/holding tanks?			
11.A.31 Are leak detection instruments/devices located downstream of pressure relief valves to warn that over pressurization has occurred and/or to detect leaking valves or valves that have not reseated properly?			
11.A.32 Has a storage area/record area been identified for storage and use of vendor maintenance manuals and equipment repair history files, in order to avoid waste due to improper repair techniques or frequency?	(Freeman, 1990, p. 119)		
11.A.33 Can bellows-seal valves be utilized to reduce the potential for leakage?	(Freeman, 1990, p. 121)		
11.A.34 Are floating roof tanks utilized for VOC control?	40 CFR 264/265 SUB CC		
11.A.35 Are conservation vents used on fixed roof tanks for VOC control?	40 CFR 264/265 SUB CC		
11.A.36 Are vapor recovery systems utilized?			
11.A.37 Are drums elevated off the concrete to prevent concrete "sweating"?	(Freeman, 1990)		
11.A.38 Are robots and computerized operations utilized to reduce waste generated by human error/carelessness? (eg. robotic spray painting)			
11.B.1 Is equipment designed so that fluids (lubricants, refrigerants, etc.) can be recovered for recycling/reclaiming during maintenance?	40 CFR 82		
11.B.2 Can materials/equipment from facility modifications be reused?			

Division 11: Equipment Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
11.B.3 Can cutting oils be recycled?	(Higgins, 1989, Ch. 3)		
11.C.1 Can oil/water separators be utilized? eg) on sumps, compressor blowdowns, etc.			
Other			
Other			

4.12 DIVISION 12: FURNISHINGS

Division 12: Furnishings Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal		For More Information	Will Consider (Check)	Remarks
12.A.1	Have furnishings been designed and constructed to exclude or prevent the escape of emissions from volatile organic compounds, such as formaldehyde, and combinations of volatile organic compounds that have been determined to be a health hazard?	DOE 6430.1A 1201 General		
12.A.2	Does shelving or storage areas have shake-proof designs to prevent containers from vibrating/shaking off the shelves.			
12.A.3	Can carpet "tiles" be used so that individual tiles can be replaced rather than requiring recarpeting entire offices or hallways?	Boylan, 1993		
12.B.1	Can furnishings containing recycled materials be utilized?			
12.B.2	Can carpeting or carpet padding made of recycled materials be utilized? (Recycled materials tend to give off less toxic vapors.)			
12.B.3	Can benches, picnic tables, landscaping timbers, etc. be made from recycled plastics?			
12.B.4	Can floor matting, anti-fatigue matting made of recycled rubber/plastic be used?			
Other				
Other				
Other				

4.13 DIVISION 13: SPECIAL FACILITIES

Division 13: Special Facilities Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal		For More Information	Will Consider (Check)	Remarks
13.A.1	Does the facility design provide for routine maintenance, repair, or replacement of equipment subject to failure in order to prevent failures that could result in a release of hazardous materials?	DOE 6430.1A 1300-3.5 Safety Class Criteria - Maintenance		
13.A.2	Is ancillary equipment, such as pumps, blowers, motors, compressors, gear trains, and controls, located in an area least likely to be contaminated?	DOE 6430.1A 1300-3.5 Safety Class Criteria - Maintenance		
13.A.3	Does the design of equipment that must be located within confinement systems allow for in-place maintenance or replacement?	DOE 6430.1A 1300-3.5 Safety Class Criteria - Maintenance		
13.A.4	Are change rooms designed to ensure that clean clothing and protective clothing are segregated? Does the design ensure that storage of contaminated protective clothing will control contamination so that it does not spread beyond the storage container?	DOE 6430.1A 1300-6.8 Radiation Protection - Change Rooms		
13.A.5	Does the facility design provide for the segregation of hazardous wastes into compatible groups for storage?	DOE 6430.1A 1300-8.4 Waste Management-Segregation		
13.A.6	Has spill prevention and control been considered in the design stage of the facility to minimize the possibility of accidentally releasing hazardous materials to the environment?	DOE 6430.1A 1300-8.5 Waste Management-Spill Prevention and Control		
13.A.7	Are such items as service piping, conduits, and ductwork kept to a minimum in areas that may become contaminated with radioactive or other hazardous materials?	DOE 6430.1A 1300-11.1 Decontamination		

Division 13: Special Facilities Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
13.A.8 Are filters positioned in ventilation systems in locations that minimize contamination of ductwork?	DOE 6430.1A 1300-11.1 Decontamination		
13.A.9 Are walls, ceilings, and floors finished with washable or strippable coverings in order to minimize the volume of building materials that will have to be disposed of as hazardous waste during decommissioning?	DOE 6430.1A 1300-11.1 Decontamination (ANSI, 1975)		
13.A.10 Has equipment, waste routing, and spare storage volume been installed and available to transfer the contents of one tank to another if a tank shows indication of excessive leakage or other conditions that warrant taking the tank out of service?	DOE 6430.1A 1323-4.3 Radioactive Liquid Waste Facilities-Storage and Transfer Systems		
13.A.11 Has the design been reviewed for bypasses or drains in the radioactive liquid waste treatment system by which waste may inadvertently be released directly to the environment?	DOE 6430.1A 1323-4.4 Radioactive Liquid Waste Facilities-Treatment Systems		
13.A.12 Doe the design allow for spills, overflow, or leakage from storage vessels or other primary confinement structures to be collected and retained within a suitable secondary confinement structure? For outdoor applications, does the capacity include maximum predicted precipitation? Does the structure design preclude overtopping due to wave action from the primary vessel failure and, in outdoor applications, to wind-driven wave action?	DOE 6430.1A 1323-5.1 Radioactive Liquid Waste Facilities-Confinement Systems		
13.A.13 For hazardous waste storage tanks, is it possible to use process waste water as makeup for evaporative losses rather than raw water? For example is it possible to return filter backwash and rinse water from sample lines back into the storage tank?			
13.A.14 For hazardous wastes that are cooled, is the waste maintained at a negative pressure with respect to the coolant, so that in the event of a leak, the coolant will leak into the waste rather than the waste leaking into the coolant?			
13.A.15 Are individual tanks isolated/segregated to prevent the unintentional commingling of waste?			

Division 13: Special Facilities Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
13.A.16 For hazardous waste tanks, are pump risers equipped with spray rings to washdown pump assemblies during removal in order to lessen contaminant drag-out?			
13.A.17 *Do hazardous waste tanks and vaults have sloped floors to a collection point?*	WAC 173-303-640		
13.A.18 When the transfer line into a hazardous material tank is below the liquid level, is a 1-way check valve or other backflow prevention device located as close to the bulk storage tank as possible?	(Lewis, 1992)		
13.A.19 Before detailed facility design has been completed, have the process design and conceptual layouts been analyzed to assess the types, quantities, and locations of hazardous materials in the process areas & systems at final shutdown?			
13.A.20 Are surfaces which may come in contact with hazardous materials free of crevices or lined to facilitate decontamination?			
13.A.21 Are pipe penetrations, ventilation duct penetrations, drainage trenches, doorways, etc. designed to allow easy decontamination?			
13.A.22 Can pipe penetrations, drainage trenches, doorways, etc. be located /designed so that if a spill occurs the penetrations will not act as a pathway for spread of the spill? Eg., Pipe penetrations located above floor/maximum spill level, doorways with raised sills, trenches that have isolation points/valves at penetration points, etc.			
13.A.23 Are storage tanks/containers designed so that all the hazardous materials stored in them can be completely drained/removed prior to dismantlement?			
13.A.24 Are closed storage and transfer systems utilized to reduce loss of materials (ie covered tanks, enclosed piping, and covered trucks, boxes, bins, etc.)?	(Freeman, 1990, p. 114)		
13.A.25 Can countercurrent rinsing systems be used to increase rinsing efficiency and therefore decrease the volume of rinsing solution needed?	(Freeman, 1990, p. 114)		
13.A.26 Can fire hydrant and waterline flushings be directed to uncontaminated areas? (For example: flushing fire lines into chemical sumps or a catch basin surrounding an oil or chemical tank should be avoided.)			
13.A.27 Are gutters, storm sewers, etc. designed to prevent runoff from fire hydrant and waterline flushings from entering contaminated areas?			

Division 13: Special Facilities Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal		For More Information	Will Consider (Check)	Remarks
13.A.28	Can instruments be used for sample analysis as opposed to using chemicals for the analysis (ie can instrumental chemistry be used in lieu of wet chemistry)?			
13.B.1	Can solvents from laboratory extractions be reclaimed?			
13.B.2	Can spent solvents be distilled for reuse/recycle?			
13.B.3	Can metal catalysts be recovered?			
13.B.4	Can mercury recovery and recycling be used in laboratories?			
13.B.5	Can surplus and/or contaminated equipment from other DOE sites be utilized instead of using new equipment?			
13.C.1	Has volume reduction for both liquid and solid wastes been considered where feasible?	DOE 6430.1A 1300-8.1 Waste Management-General		
13.D.1	Do waste container storage areas have a roof to prevent intrusive storm water, and a recessed floor with separate drains for each segregated area?	40 CFR 264 (¶ 175.b) RCRA, Use and Management of Containers, Containment		
13.D.2	Is storage space for contaminated clothing provided in changerooms to assist in controlling contamination spread?	DOE 6430.1A, 1300-6.8		
13.D.3	Is space provided in the facility to segregate hazardous and non-hazardous wastes?	DOE 6430.1A, 1300-8.4 (Scher and Munn, 1992)		
Other				
Other				
Other				

4.14 DIVISION 14: CONVEYING SYSTEMS

Division 14: Conveying Systems Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
14.A.1 Are freight elevators designed so that if hazardous materials are spilled, the materials are contained sufficiently so they won't contaminate the entire elevator shaft?			
14.B.1 Can belts/conveyors from recycled rubber be used?			
Other			
Other			
Other			

4.15 DIVISION 15: MECHANICAL

Division 15: Mechanical Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal		For More Information	Will Consider (Check)	Remarks
15.A.1	Where automatic sprinkler systems or standpipes are fed from a potable water system, have approved check valves been installed in sprinkler lead-ins to preclude the introduction of pollutants from systems or recirculation of stagnant water that would contaminate the domestic water system?	DOE 6430.1A 1530-9 Water Storage and Distribution		
15.A.2	Are backflow preventers and air gaps used to prevent cross-connection (contamination) of potable water supplies?	DOE 6430.1A 1540-1.5 Plumbing-Safety Devices		
15.A.3	Have collection systems been provided for water runoff, such as from firefighting activities, from areas within special facilities containing radioactive material?	DOE 6430.1A 1540-99.02 Plumbing-Special Facilities		
15.A.4	Has consideration been given to the collection and monitoring of radioactive and nonradioactive contaminants in natural runoff (eg roof drainage) and blowdowns from heating and cooling systems before discharge to the environment?	DOE 6430.1A 1540-99.0.3 Plumbing-Special Facilities		
15.A.5	Does safety shower water and personnel decontamination shower water drain to the contaminated process water waste system?	DOE 6430.1A 1540-99.0.3 Plumbing-Special Facilities		
15.A.6	Have air-cooled condenser intakes been located away from locations that receive peak solar heat gain, in order for the condenser to operate more efficiently and consume less energy?	DOE 6430.1A 1550-2.1.3 HVAC-Condensers		
15.A.7	Have air filtration units been installed as close as practical to the source of contaminants to minimize the contamination of ventilation system ductwork?	DOE 6430.1A 1550-99.0.2 HVAC-Special Facilities-Confinement		
15.A.8	Have roughing filters or prefilters upstream of a HEPA filter been considered to maximize the useful life of the HEPA filter and reduce radioactive waste volume?	DOE 6430.1A 1550-99.0.2 HVAC-Special Facilities-Confinement		

Division 15: Mechanical Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
15.A.9 Has the use of regulated CFCs in HVAC installations been minimized to the maximum extent feasible?	DOE 6430.1A 1565-1.1 Refrigeration-Coverage		
15.A.10 Have systems for the storage and handling of coal and ash been designed to prevent the release of significant quantities of dust to the atmosphere?	DOE 6430.1A 1589-4.5 Air Pollution Control-Coal and Ash Handling		
15.A.11 Is the HVAC system designed to cascade from areas of least potential for contamination to areas of greatest potential for contamination in order to minimize contamination spread and the area of the facility requiring future decontamination?	DOE 6430.1A, 1550-99.01		
15.A.12 If the facility design includes cooling towers, does the water treatment program employ the least hazardous additives compatible with performance requirements?	DOE 6430.1A 1550-2.1.4		
15.A.13 Do oil storage tanks have fail-safe engineering design such that failure of a component will not allow release of oil from the tank (ie pumps will fail off, valves will fail closed)?	40 CFR 280, NFPA 30		
15.A.14 Do hazardous materials storage tanks have retrieval capabilities and spare capacity to facilitate system pump-out in the event of a leak?	40 CFR 280		
15.A.15 Are underground vaults and tanks sealed to prevent stormwater or runoff infiltration?			
15.A.16 Have timers, flow reducers and/or flow meters been considered for rinse water lines so that only the amount of water required is used?	(EPA/WMACs)		
15.A.17 Have foam-plug pipe cleaning systems been considered in lieu of water or solvent rinses to prevent secondary liquid waste generation?	(EPA/WMACs)		
15.A.18 Have mechanical fasteners been considered in lieu of adhesives in order to facilitate recycling and avoid hazardous waste streams often associated with adhesives?	(EPA/WMACs)		
15.A.19 Are reusable filters utilized wherever feasible to prevent secondary solid waste generation from filter disposal?	(EPA/WMACs)		

Division 15: Mechanical Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal		For More Information	Will Consider (Check)	Remarks
15.A.20	For facilities that process hazardous materials, is the HVAC system designed so that building pressure is negative with respect to the atmosphere, so that hazardous materials cannot leak outward to the atmosphere?			
15.A.21	Do HVAC units utilize an approved refrigerant, that is not on the Montreal Protocol list of ozone depleting substances?	40 CFR 82		
15.A.22	Can filters on ventilation systems/other systems be easily changed out without generating large amounts of waste?			
15.A.23	If used filters could contain hazardous waste, are the filters made out of materials that are compatible with the treatment/disposal methods used on the hazardous waste?			
15.A.24	Have HEPA filters been tested with materials that will cause them to be designated as hazardous waste when they are disposed? eg.) In Washington state, DOP, used to test the efficiency of HEPA filters, could cause them to become regulated waste.			
15.A.25	Can mercury switches be replaced with switches that don't contain hazardous materials?			
15.A.26	Is closed loop cooling water utilized instead of once-through in order to minimize waste water generated?			
15.A.27	Are there leak detection instruments/devices downstream of relief valves and other over pressure devices to warn you that over pressurization has occurred and/or to warn you that the valves are leaking or have not reseated properly?			
15.A.28	Do vacuum pumps have filters on their exhaust to prevent oil mists from becoming airborne?			
15.B.1	Has the possibility of the sale of ash as a means of disposal been considered?	DOE 6430.1A 1555-2.6.3 Central Plant Heat Generation/ Distribution-Ash Handling		
15.B.2	Has air pollution control planning included an analysis of the characteristics of the pollutants and the feasibility of conversion to usable or salable products? Has priority been given to the potentials for conservation and recovery of resources?	DOE 6430.1A 1589-3 Air Pollution Control-Planning		

Division 15: Mechanical Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal	For More Information	Will Consider (Check)	Remarks
15.B.3 Have you considered collecting and recycling/reuse of VOC emissions?			
15.B.4 Have you considered air treatment methods that employ pressure swing absorption, refrigeration or carbon regeneration technologies to recycle/reuse VOCs?			
15.B.5 Can antifreeze/coolant be recycled?	(WDOE, 1993)		
15.B.6 Have heat-recovery systems been considered for incorporation into the building HVAC system design?	DOE 6430.1A 1550-1.6 HVAC-Energy Conservation		
15.C.1 Can sludge dehydrators be utilized to reduce the volume of sludge disposed?			
15.D.1 Does the stack height and location preclude subsequent uptake into facility air intakes?	DOE 6430.1A, 1550-99.02		
Other			
Other			
Other			

4.16 DIVISION 16: ELECTRICAL

Division 16: Electrical Pollution Prevention Design Opportunity Approach Hierarchy A. Source Reduction B. Recycling C. Treatment D. Disposal		For More Information	Will Consider (Check)	Remarks
16.A.1	Has energy efficient lighting been considered?			
16.A.2	Can solar powered battery chargers, remote equipment be used instead of electric operated chargers/equipment?			
16.A.3	Are monitoring devices installed on facilities/equipment to monitor energy consumption?			
16.A.4	Can occupancy sensors be used to reduce lighting usage?			
16.A.5	Will burnt out lights (mercury vapor, sodium vapor) be considered hazardous waste? Can non-hazardous bulbs be used instead?			
16.A.6	In storage areas, is electric circuitry protected from accidental cutting/crushing by fork-lift forks or loaded drums falling against it?			
16.A.7	Are computers and peripherals equipped with sleep or power down modes to conserve energy and prevent data loss or equipment damage?			
16.A.8	Can the use of battery powered clocks be eliminated to prevent battery disposal?	Boylan, 1993		
16.B.1	Has cogeneration been considered if steam is being produced for on-site processes or if it is possible to achieve greater economy in power costs?	DOE 6430.1A 1620-1 Power Generation-General		
Other				
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Other				

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[19] League of Women Voters
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Case Study

Pollution Prevention in Design Training Exercise: Using the Guideline Table

Instructions: Divide into groups of 4-5 people. In this exercise, your group is the design team for a major modification to an existing tank farm in the 200 East Area of the Hanford site. The project background, provided after these instructions, may help with completing this exercise.

Using the design guideline table, identify pollution prevention opportunities that may be applicable to the project. You will only have 15 minutes to brainstorm opportunities, so you may want to begin with the "Summary of Applicable Divisions" table on page x of the guideline to plan your attack.

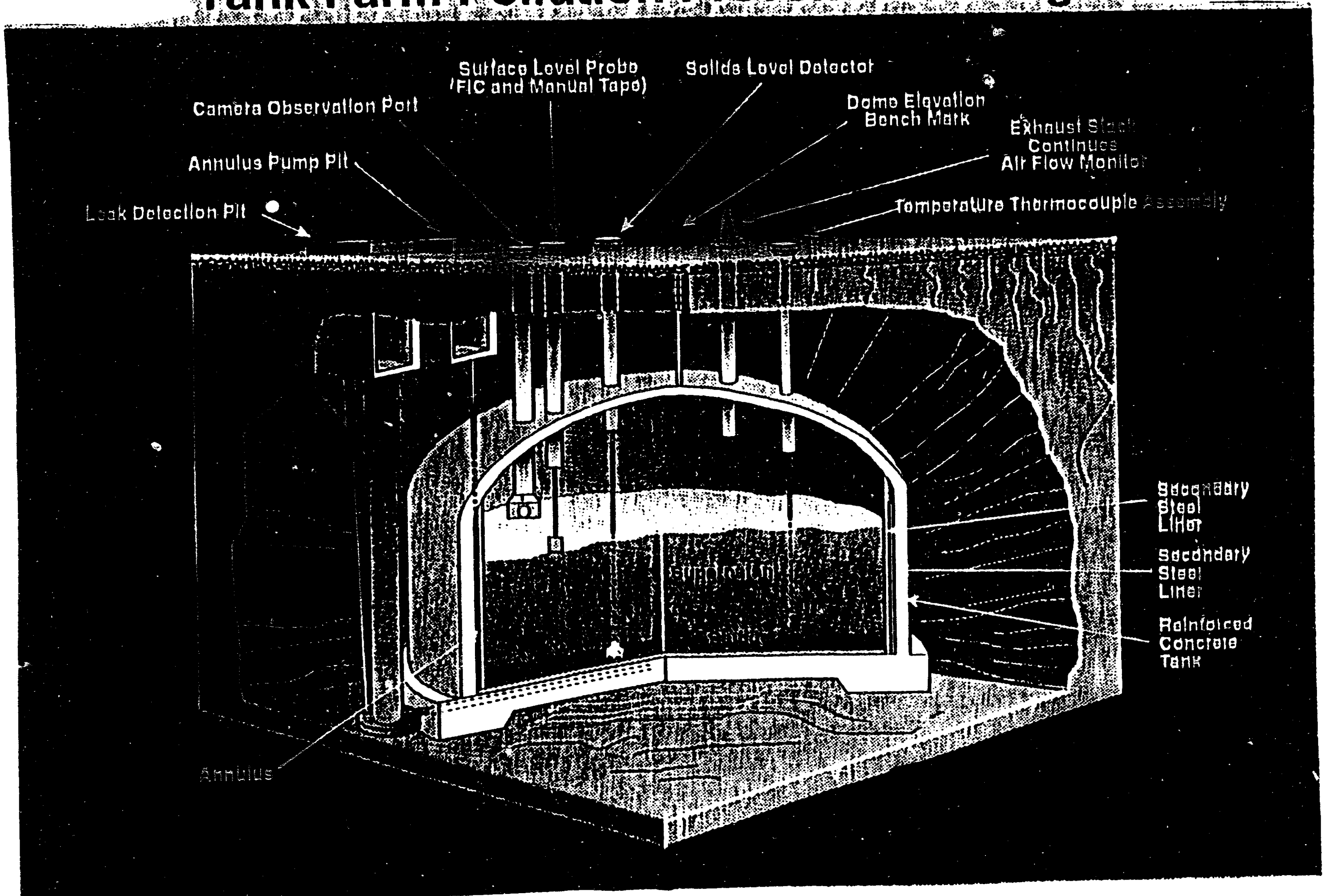
You may then choose to assign the applicable divisions to individual group members, based on their discipline, or you may choose to work together as a group. You are encouraged to come up with additional opportunities not listed in the table.

Remember, you only need to identify potential opportunities, but be prepared to discuss the reasons for your responses with the class. If you need more information about the situation, ask one of the facilitators. When we reconvene, your team will be asked to share three opportunities with the class. Then we'll compare the groups' responses with the opportunities implemented by the actual design team working on this project.

Project Background: The 241-AY and 241-AZ Tank Farms were constructed in the 1970's. Each tank farm contains two double-shelled tanks that store radioactive liquid wastes. Current Hanford site waste volume projections identify a need to use the four tanks beyond year 2000. This requires upgrades to and/or replacement of, some of the tank farm subsystems to extend their useful life and comply with current codes, standards, and regulations.

This project addresses the replacement of the primary tank ventilation subsystem. The new ventilation system will originate at the tanks, but ventilation equipment, instrumentation, and electrical equipment will be housed in a new ventilation building. Additional structures include a standby diesel generator building and a control building. A new stack and stack monitoring system are also provided.

Tank Farm Pollution Prevention Designs



Glossary

DECOMMISSIONING The process of closing and securing a nuclear facility, or nuclear materials storage facility so as to provide adequate protection from radiation exposure and to isolate radioactive contamination from the human environment.

DECONTAMINATION The removal of unwanted material (typically radioactive material) from facilities, soils, or equipment by washing, chemical action, mechanical cleaning, or other treatment techniques.

DISPOSAL Waste emplacement designed to ensure isolation of waste from the biosphere, with no intention of retrieval for the foreseeable future, and that requires deliberate action to regain access to the waste.

DOE ORDERS Internal requirements that establish DOE policy and procedures for compliance with applicable laws and regulations.

FACILITY Systems, buildings, utilities, services, and related activities whose use is directed to a common purpose at a single location.

LIFE CYCLE The stages of a product, process, or package's life, beginning with raw material acquisition continuing through processing, materials manufacture, product fabrication, and use, and concluding with any variety of waste management options.

OPPORTUNITY ASSESSMENT Systematic, periodic internal reviews of specific processes and operations designed to identify and provide information about opportunities to reduce the use, production, and generation of toxic and hazardous materials and waste.

POLLUTION PREVENTION Source reduction, as defined by 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.

RECLAMATION A material is reclaimed if it is processed to recover a usable product, or if it is regenerated (40 CFR 261.1[b][4]). Examples are recovery of lead values from spent batteries and regeneration of spent solvents.

RECYCLING A material is recycled if it is used, reused, or reclaimed (40 CFR 261.2 [7]).

SOURCE REDUCTION Any practice which 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; and any practice that reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants. Source reduction activities and techniques include substitution of less hazardous materials, process optimization or modification, technology changes and administrative changes such as inventory control, and housekeeping practices such as waste segregation. Source reduction results in reducing or eliminating the amount of potential waste material exiting from a process.

TREATMENT Any method, technique, or process designed to change the physical or chemical character of waste to render it less hazardous, safer to transport, store, or dispose of, or reduce in volume. (Technological processes that reduce the quantity, toxicity, or mobility of waste after it has been created. Examples include, but are not limited to, incineration, vitrification, neutralization, chemical extraction, physical separation, and solidification/stabilization technologies.)

USE OR REUSE A material is used or reused if it is employed as an ingredient in an industrial process to make a product, as long as distinct components of the material are not recovered as separate end products (i.e., metal recovery). Materials are also used or reused if they are employed in a particular function or application as an effective substitute for a commercial product (summary of 40 CFR 261.2[5]).

KEY

RCRA	Resource Conservation and Recovery Act
FFCA	Federal Facilities Compliance Act
EPCRA	Emergency Planning & Community Right-to-Know Act
PPA	Pollution Prevention Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CAA	Clean Air Act
CWA	Clean Water Act
OSHA	Occupational Safety & Health Act

Extra Credit

DOE 5400.1, "General Environmental Protection Program"

DOE 5400.3, "Hazardous & Radioactive & Mixed Waste Program"

DOE 5820.2A, "Radioactive Waste Management"

DOE 6430.1A, "General Design Criteria"

KEY

There are numerous opportunities in the guideline table that are applicable to this project. Three specific opportunities that the project has implemented are provided here. It is estimated that implementation of these opportunities will eliminate 946,000 liters of raw water discharge to the soil column, and reduce air emissions from 3,000 scfm (840 Ci/yr) to 1,000 scfm (18 Ci/yr).

Opportunity: 11.A.16 Can closed-loop cooling systems be used instead of once-through cooling if the system being cooled contains hazardous materials (e.g., tank ventilation systems)?
Implementation: Install recirculating, closed-loop cooling system - drawing vapors from the tank and passing them through a condenser, which reduces the vaoprs to liquids. The liquid is returned to the tank.

Opportunity: 1.A.47 Can effluent and/or emission points be consolidated to reduce amount of monitoring necessary?
Implementation: Design a centralized ventilation system used by multiple tanks.

Opportunity: 1.A.22 Can the facility be designed to reduce the sources of potential leaks?
Implementation: Maintain tanks at negative pressure to prevent leakage. Seal existing coverblocks and other sources of inleakage of air. Add HEPA filters to ventilation air inlets to prevent backflow.

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