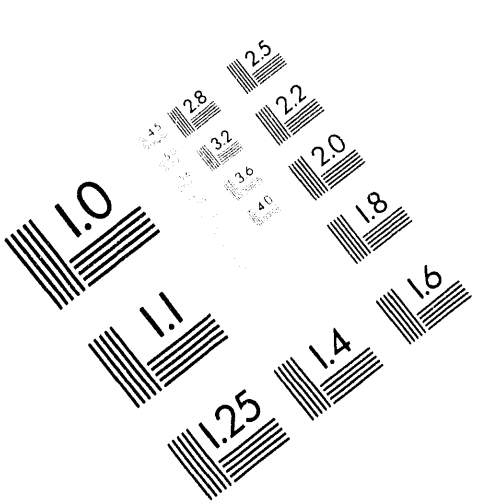

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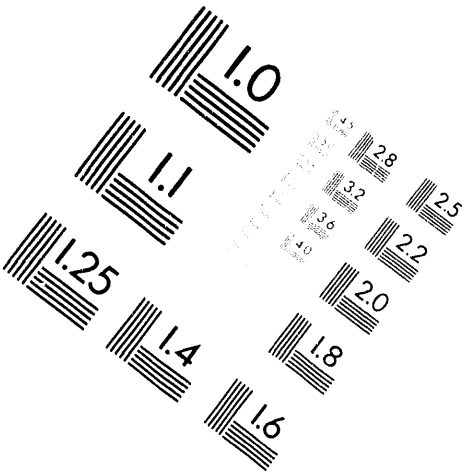

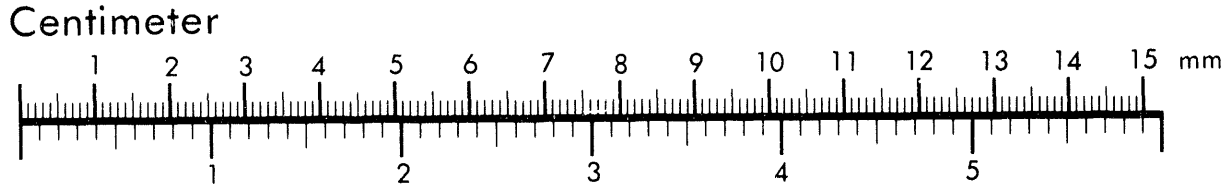

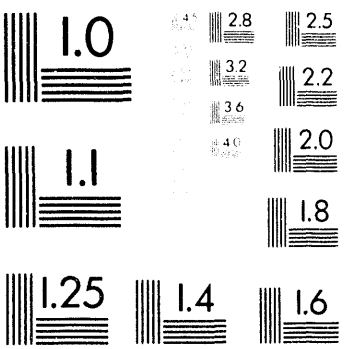

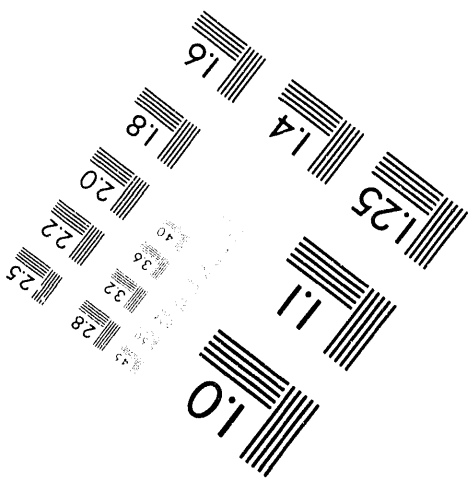

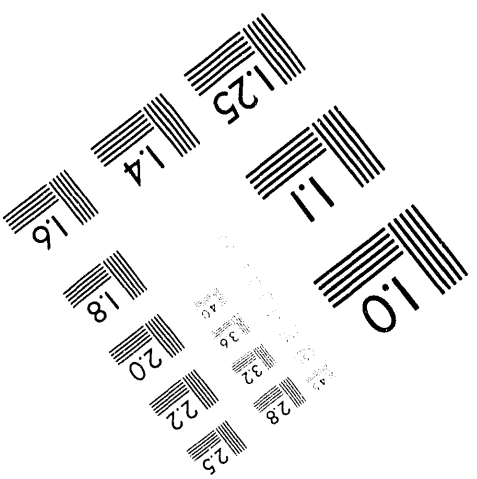

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POLLUTION PREVENTION TRAINING FOR FACILITY DESIGNERS

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POLLUTION PREVENTION TRAINING FOR FACILITY DESIGNERS

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THE COURSE AT A GLANCE

An *Orientation to Pollution Prevention for Facility Design* training course was developed for the U.S. Department of Energy (DOE), Office of Environmental Restoration and Waste Management, Waste Minimization Division (EM-352). The 3-hour course will be offered at the Hanford Quality Training and Resource Center beginning Summer, 1994. The course, intended for design engineers and project managers, contains two modules. The first module defines pollution prevention using actual success stories to illustrate pollution prevention concepts, benefits, and their relationship to design. The second module presents a newly developed job aid, the *Pollution Prevention Design Guideline*.

The main challenges of developing the course were to present the material in a manner that participants would *want* to design for pollution prevention, and to provide tools so that participants *could* design for pollution prevention. As such, the course is very interactive and uses a variety of presentation techniques. Participants are challenged to discuss the course materials in the context of their own design projects, and they practice using their new knowledge on an actual design project. The biggest measure of the course's success is the extent to which the participants bring the materials back to their work place. An attitudinal survey and a knowledge-based questionnaire are administered before and after the course in order to gage this.

THE TRAINING PACKAGE

In addition to the actual course being offered at the Hanford Site this summer, a Training Package was delivered to EM-352 as the project's 1993 deliverables. The training package materials can be easily transferred to other sites interested in modifying the course to meet their own unique needs. The training package contains an outline describing the course sequence and estimated time for each activity, the facilitators' lesson plan, overheads and slides used to present the material, course hand-outs, and course surveys, tests, and evaluation forms.

COURSE CONTENT: POLLUTION PREVENTION CONCEPTS AND USING THE DESIGN GUIDELINE

This course was developed so that design engineers and project managers would be able to answer the following questions:

- What is pollution prevention?

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[1]Pacific Northwest Laboratory is operated by Battelle Memorial Institute for the U.S. Department of Energy under Contract DE-AC06-76RLO 1830.

- Why is pollution prevention important?
- When does pollution prevention need to be considered during the life of a facility?
- Who is responsible for pollution prevention?
- How do I go about preventing pollution during the design of a facility?

The first module of the course addresses questions 1-4 and the second module provides a solution to the last question.

Concepts and Case Studies

The first half of the training course begins with a pollution prevention pre-test and attitudinal survey that are distributed to participants before their attendance at the course. The pre-test and survey are used to understand the knowledge base of participants and their acceptance of pollution prevention. This information can then be used by facilitators to adjust the content and detail of the course accordingly. The pre-test and survey are administered again at the end of the course and participants are offered the opportunity to change their answers. The goal is to determine if participants have learned the material and to see if a behavior or attitude change towards preventing pollution in the workplace has occurred.

The discussion of what pollution prevention is begins with a description of regulatory drivers and how, historically, they have shifted from pollution control to pollution prevention. A collective recall exercise is administered at this time to test participants' knowledge of Federal regulations and requirements and DOE Orders. Those DOE Orders requiring the minimization of waste during facility design are specifically noted. The collective recall exercise emphasizes that most current and future regulations will contain some aspect related to pollution prevention. The collective recall exercise is an interactive method of covering the regulations without devoting a large portion of time to them.

Further understanding of pollution prevention is provided through definitions and the hierarchy for minimizing waste. Terms defined include source reduction, recycling, and treatment. Some discussion is given to the difference between waste minimization and pollution prevention and the shift in focus toward source reduction, energy, and resource conservation. Course material is highlighted with specific case studies that bring home the basic concepts of pollution prevention. The case studies range from the complex to the simple in order to demonstrate that pollution prevention is often just common sense applied to everyday activities.

The benefits of pollution prevention are discussed next to help participants understand why pollution prevention is important. The economic, social, environmental, productional, and legal benefits are discussed and applied directly to a specific case study. The case study demonstrates benefits in each of these areas and again provides a real life example of why pollution prevention is important.

The first module of the course closes with a series of pollution prevention case studies from the different phases of a facility's life. Examples are given for design, construction, operation, and decontamination and decommissioning of a facility. Course participants are asked to identify the phase in the facility life in which the waste was created and to think about ways that waste could have been avoided if the facility had been designed differently. All fifteen or so case studies provide

real-life examples of pollution prevention and help course participants identify with the concepts. These last case studies particularly bring home the importance of pollution prevention during facility design and make for a good transition into the next half of the course which answers the question of how one goes about minimizing waste during facility design.

Using the Design Guidelines Table

The first half of the course introduces pollution prevention concepts, definitions, and benefits through the use of specific examples from the Hanford Site. At this point, the audience is hopefully "sold" on designing for pollution prevention, but they still need the tools to actually do this. Thus, the second half of the course introduces the *Design Guideline Table*, and the participants practice using this new tool. Before introducing the table, the audience is reminded that although pollution prevention might be a new phrase to them, it is a familiar concept because of its intrinsic ties to related design issues such as ALARA, process efficiency, and simply "good engineering practice".

The *Design Guidelines Table* is described as a list of pollution prevention design opportunities. The list is not all inclusive, but rather is intended to stimulate creative ideas for pollution prevention implementation. The guideline contains nearly 250 opportunities sorted into the 16 divisions of DOE Order 6430.1A "General Design Criteria". Within each division, opportunities are further sorted in order of the EPA's pollution prevention hierarchy (introduced during the first half of the course): 1) source reduction, 2) reuse/recycle, 3) treatment, and 4) environmentally sound disposal. Sorting by the divisions of DOE 6430.1A enables the engineers to quickly reduce their review to those opportunities applicable to their project. For each opportunity presented, the "For More Information" column presents a reference for the reader to learn more about how to implement the opportunity. If the reference is an environmental regulation, the opportunity may actually be a design requirement, and it is up to the reader to determine applicability on a case by case basis. The reader is further cautioned that the table is simply a list of opportunities and as such, may require further analysis to evaluate, compare, and implement the opportunities based on project specific circumstances.

As the table is being introduced, its intended use within the DOE design process is also discussed. The table is meant to be applied on a project-specific basis, being updated with each new design phase. Furthermore, it is meant to be a collaborative effort between the applicable engineering disciplines, not to be assigned to the project's environmental engineer.

After introducing the guideline, the course facilitator guides the class through the mechanics of using it. The class follows along in their own guideline as they work together to navigate the table, discussing typical responses for a sample project. Now that the table has been introduced, including how to use it, selected opportunities are discussed to elaborate on characteristics to consider when reviewing the opportunities. The audience participates by answering questions intended to point out that some opportunities require large capital investments whereas others have virtually no implementation cost. Some opportunities will realize a pollution prevention savings during construction, whereas others will not provide their intended payback until operations, or possibly even decommissioning of the facility. In addition, some opportunities will directly benefit the facility being designed, whereas others have offsite benefactors, such as the community land fill. Finally, the earliest design stage that each of the examples would need to be considered is discussed. This points out that designing for pollution prevention is an iterative process that needs to be revisited with each new design phase.

Now that the class has the tools to design for pollution prevention, they end the course by practicing using the guideline on an actual design project at the Hanford site. An overview of a tank farm design project is provided to the class. The class then breaks into small groups and practices using the guideline by generating a list of opportunities that they would consider as the project's design team. They are encouraged to simply brainstorm ideas, to come up with ideas not listed in the table, and to not be preoccupied with implementation so much as just identifying opportunities that they would consider. The class then reconvenes and discusses their results. Finally the opportunities implemented by the actual project team are provided. The actual design team implemented three opportunities listed in the *Design Guideline Table* to eliminate 946,000 liters of raw water discharge to the soil column, and to reduce radionuclide emissions from 840 curies per year to just 18 curies per year.

OBTAINING INPUT FROM PEER REVIEWERS AND END USERS

After the course was developed, a Dry Run Training was presented to a combination of design engineers and staff members active in pollution prevention. The purpose was to solicit comments from prospective participants and subject matter experts alike. It also provided an opportunity to test the timing and flow of the course. The participants provided valuable feedback, and the course was further refined accordingly. As a result, the course was expanded to 3 hours (it was originally 2 hours). More importantly, the dry run identified areas that may have made sense to the course developers, but needed more explanation or clarification for the first-time viewers.

A second technique to improve the course was to conduct an Executive Summary version for engineering managers. The purpose was to market the course to the managers who would need to authorize their staff to ultimately attend. In addition, it allowed the managers to provide additional input to the course content. Engineering managers are more familiar than the course developers with what their staff already knows, and what they would need to know in order to practice pollution prevention.

WRAP UP

The *Orientation to Pollution Prevention for Facility Design* course offered at the Hanford Site is the first pollution prevention course within the DOE system dedicated to training design personnel. The DOE estimates that 70 percent of the opportunity to reduce or eliminate pollutants is gained or lost during design[1]. This course is a first step towards ensuring that opportunities are addressed during design, when they are the easiest and most cost effective to implement. The course is intended to be very practical; it was developed with input from the end users, and it provides tools and case studies that the participants can bring back to their work place. The Training Package is designed to provide flexibility so that the course can be tailored to the interests and specific needs of other DOE sites.

REFERENCES

1. Waste Minimization Pollution Prevention Crosscut Plan, predecisional draft - rev. 2, United States Department of Energy - Office of the Secretary, October 1993.

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