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Educational Understanding of Pollution Prevention in Decontamination and Decommissioning/ Environmental Restoration Activities

Prepared for the U.S. Department of Energy
Office of Environmental Management

Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
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M. D. Betsch
Westinghouse Hanford Company

R. A. Lewis
Bechtel Hanford, Inc.

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Mary D. Betsch
Westinghouse Hanford Company
(509) 372-1627

R. Aaron Lewis
Bechtel Hanford, Inc.

Demolishing outdated structures from the U.S. Department of Energy Hanford Site in Washington, generates large quantities of waste which can be minimized. The Hanford cleanup is one of the world's largest and most complex environmental restoration efforts. Approximately 280 square miles of ground water and soil are contaminated; there are more than 80 surplus facilities, including nine shut-down nuclear reactors in various stages of decay; and there are 177 underground waste storage tanks containing highly radioactive waste. In all, 1,500 cleanup sites have been identified and the Environmental Restoration Contractor (ERC) is currently responsible for surveillance and maintenance of 170 structures.

A two hour orientation training in pollution prevention was developed by the Westinghouse Hanford Company to provide all Decontamination and Decommissioning/Environmental Restoration (D&D/ER) personnel with the knowledge to apply waste minimization principles during their cleanup activities. The *ERC Team Pollution Prevention Workshop* serves to communicate pollution prevention philosophies and influences the way D&D/ER projects are conducted at the Hanford Site.

Course Preparation

Waste disposal is a significant cost for any D&D/ER project that generates radioactive or hazardous waste. Waste disposal costs for D&D/ER projects at Hanford is about $1,800 per cubic meter ($50 per cubic foot) for low level waste and about $5,300 per cubic meter ($150 per cubic foot) for mixed waste (hazardous and radioactive).

When the original Environmental Restoration Management Contract (ERMC) proposal was developed in 1992, the Environmental Restoration Contractor (ERC) planners sensed that environmental remediation activities were inherently waste minimizing. The ERC planners felt that since the workplans were subject to multiple reviews during the CERCLA process and to constraints imposed by the Record of Decision (ROD) process, waste minimization plans for an environmental remediation project were basically a regulatory technicality. Thus, waste minimization for the ERC team was delegated to the Regulatory Support Group and assigned a minimal budget. The actual D&D/ER work was delayed for over a year and a half due to protests by losing bidders.

During the delay in starting work, DOE policy changed to require increased emphasis on waste minimization. Since many DOE and DOE contractor organizations had not budgeted for the increased effort in pollution prevention and waste minimization, DOE (EM-334) solicited and funded proposals for additional waste minimization activities. The ERC received funding to provide project engineers, planners and task leaders with waste minimization awareness and training to prepare them for conducting Pollution Prevention Opportunity Assessments (P2OAs). Because the projects' budgets had been cut, the regulatory group expected the projects to resist paying for the training, and money was requested from EM-334 to pay for the participants time.

Previous to the ERC Team assuming D&D/ER operations at the Hanford Site, the Westinghouse Hanford Company was responsible for these activities. The Westinghouse Hanford Company accomplished numerous waste reduction successes which were driven by pollution prevention awareness. Several Westinghouse Hanford Company employees that demonstrated initiative in pollution prevention became managers for the ERC team. Thus, when the ERC Team Regulatory Support asked the ERC Team Field Support to identify employees for P2OA training, they responded favorably. They wished to train all Field Support personnel in the basics of pollution prevention as a

precursor to the more complex P2OA training. Regulatory Support agreed to develop an orientation to pollution prevention training course. Regulatory Support subcontracted the development of the curriculum and the actual teaching of the *ERC Team Pollution Prevention Workshop* to the Westinghouse Hanford Company Pollution Prevention group.

Knowing the audience is important in the design and eventual success of a pollution prevention training effort. Audience analysis was conducted and concluded that the participants would be a mixed audience, containing members with different functions, motivations, and needs. It becomes extremely difficult to meet the wide range of needs for a mixed audience. Therefore, a "core" audience was chosen. The crafts personnel were chosen as the target audience since they were identified as the primary agents of pollution prevention implementation and comprised the largest number of participants.

One unique characteristic of this training is that it was tailored to the ERC Team 100-N and 200 Area activities. To achieve this, a facility walk-through was conducted to gather pollution prevention practices already achieved, and identify potential pollution prevention opportunities. Three areas, soil washing, 190-D demolition, and pump and treat, were identified for the tour. Short informational interviews were conducted with the designated guides while on tour throughout the 100-N and 200 Areas. During the facility walk-through, photos were taken of waste minimization techniques that demonstrated source reduction, recycling, and treatment accomplishments. Additionally, wood waste and asbestos waste were also photographed as potential opportunities for pollution prevention techniques. The photos were made into overheads and used in the workshop to help illustrate the ERC Team's pollution prevention accomplishments and opportunities.

The elements of the workshop include:

- a lesson plan,
- participant workbooks,
- overheads, and
- evaluation forms.

Course Objectives

Objectives serve to give participants a sense of the content of the workshop, as well as what might be expected of them after the training. Objectives also serve to focus training design and delivery discussions. Two objectives were identified for workshop participants. (1) Identify terms and concepts relative to pollution prevention; and (2) Recognize pollution prevention opportunities in the workplace.

Choosing teaching methods and media that will most effectively reach the objectives is critical to the success of the training. Presentation of the objectives for the *ERC Team Pollution Prevention Workshop* was through interactive exercises, case studies, and lecture material. Combined, these methods gave participants a better understanding of the incentives for practicing pollution prevention by hearing, seeing, and doing.

Course Contents

Module 1 Pollution Prevention Principles

Module 1 is dedicated to delivering information on the philosophy of pollution prevention. To achieve this, a working definition of pollution prevention is presented with further explanation that waste management practices and regulations have historically moved from pollution control to pollution prevention. Four Hanford-specific pollution prevention examples, including the challenge, initiative and success are described to support the definition.

There are several terms and concepts related to pollution prevention which are clarified using a diagram (see figure 1). The diagram depicts waste minimization and waste management solutions. The diagram is broken down and delivered in three segments which are source reduction, recycling/reuse, and treatment. Several pollution prevention technologies are presented for each segment. For example, the source reduction segment includes input substitution, good housekeeping, process modification,

improved equipment design, and procedure changes. A Hanford-related example is presented to clarify the principles. Concluding Module 1 is a discussion on the pollution prevention hierarchy contained in the Pollution Prevention Act of 1990.

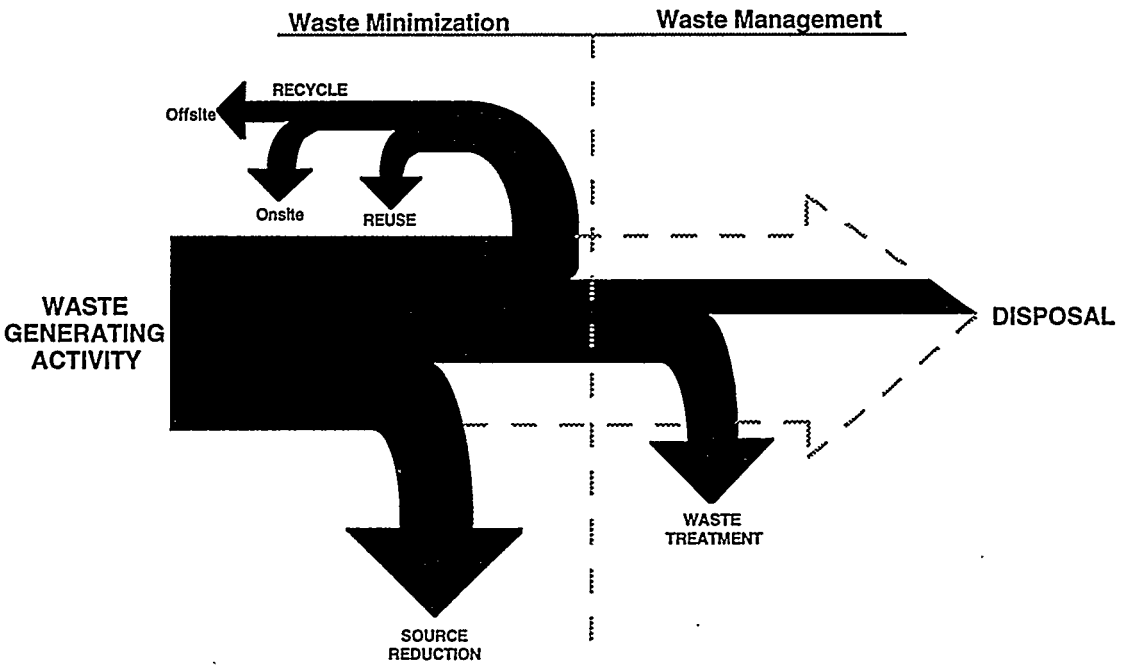

Figure 1. Pollution prevention program.

Module 2 Pollution Prevention Benefits

The pollution prevention drivers are introduced in Module 2. There are over 35 legally binding pollution prevention drivers including statutory/regulatory and Order requirements. Four of the pollution prevention drivers relating to D&D/ER work activities are explained in detail. They are: (1) The Pollution Prevention Act of 1990; (2) CERCLA; (3) DOE Order 5400.1; and (4) RCRA. Most notably is the RCRA driver which states that waste generators must have a waste minimization program in place. CERCLA plays a key role in D&D/ER projects as generators reduce future liability by reducing waste.

Included in Module 2 is an interactive exercise on the barriers and incentives to pollution prevention. A facilitated discussion is led to help participants think of and understand the potential obstacles and benefits they will face when they begin practicing pollution prevention in their workplace. Some of the barriers identified by participants were: (1) Management commitment; (2) Lack of in-house expertise; (3) Product quality; and (4) Up-front cost. Most importantly, participants recognize the benefits to pollution prevention as well. The pollution prevention incentives identified by participants included: (1) Environmental protection; (2) Public relations; (3) Improved efficiency of operations; (4) Cost savings; and (5) Reduced liabilities. At this point in the workshop, participants have an understanding of pollution prevention and can easily identify some of the problems and benefits associated with pollution prevention. The incentives mentioned by the participants are listed and then grouped into five categories which are: (1) Environmental; (2) Economical; (3) Operational; (4) Legal; (5) and Social.

Module 3 Pollution Prevention Techniques

The majority of the workshop is devoted to emphasizing common pollution prevention techniques and how participants can incorporate these techniques into their work activities. First, a

series of techniques is examined in detail including input substitution, redesign or modification, modernization, recycling/reuse, minimizing excavation of clean material, keeping clean materials clean, treatment, and segregation. All these techniques are acceptable waste reduction options for D&D/ER activities.

After the techniques are described, four case studies are presented. During an interactive exercise, the participants answer the question: "Is this case study an example of pollution prevention?" Using the pollution prevention techniques described earlier in the course, participants identify which technique was employed in the example.

A mini slide show is presented using the photos from the facility visit. Pollution prevention activities at soil washing include: (1) Redeployed fractionators; (2) Redeployed detectors and lead bricks; (3) Recirculated contaminated water; and (4) Reduced contaminated soil. The pollution prevention activities at 190-D include: (1) Recycled metal; (2) Reused crushed concrete; (3) Redeployed equipment; (4) Segregated trench materials. Pump and treat pollution prevention efforts included: (1) Treated contaminated groundwater; and (2) Reduced contaminated plume. Participants see their own work activity successes which fosters enthusiasm for the following discussion on pollution prevention opportunities.

Two pollution prevention opportunities, wood waste and asbestos waste, were identified on the facility tour. A description of these waste streams is presented followed by a brainstorm session. Facilitated brainstorming allows the participants to begin identifying potential solutions to some of the waste streams found in their own work environments. Participants are asked to expand their vision of the solutions to include global, regional, and local environmental considerations, as well as other creative innovations that will foster sustainability. Solutions for the wood waste ranged from termites to incineration. One solution for the asbestos waste was to purchase an asbestos waste conversion unit and transform the asbestos into a non-hazardous material. Encouraging as much participation as possible in defining the problem, and finding the solutions, started the participants thinking, and improved their attentiveness.

The workshop concluded with a discussion on achieving pollution prevention. Participants accomplish pollution prevention by implementing the pollution prevention techniques explained. Opportunities can be discovered through simple employee initiative or through the more formal P2OA process. Pollution Prevention Opportunity Assessments are a systematic, planned approach used to evaluate input materials and parameters of a process or activity, identify pollution and waste exiting the process or activity, and generate and evaluate options for pollution prevention. In an effort to identify individuals that would comprise a Pollution Prevention Opportunity Assessment Team, participants were given the opportunity to sign up for the P2OA Workshop.

A behavior change towards pollution prevention practices at home was integrated to show that pollution prevention practices and techniques identified at work can also be translated to the home. Recycling opportunities and household hazardous waste opportunities found in the local community was briefly explained. Additionally, literature on safer substitutes and recycling was made available.

Conclusions and Evaluation

Measuring the attitudinal and behavioral change of training is difficult. Additionally, there is increased pressure on training to prove its contribution to an organization's goals. Behavioral outcomes include specific, observable techniques, practices, skills, and behaviors that participants will be able to do on the job after the training program.

One measure of the workshop's success is the extent to which the participants implement the materials back in their work place. After training was conducted, individuals on the ERC Team developed a variety of waste minimization checklists. A Work Control Package is the planning document that instructs Field Support on how to perform work activities. All ERC Work Control Packages must now contain waste minimization procedures.

Additionally, a "Radwaste Minimization Checklist" and a "Radioactive Waste Minimization Procedure" for all work packages conducted in the 105-N Basin facility have been developed. The checklists emphasize using the pollution prevention techniques, such as reuse and input substitution, discussed in the workshop. The procedure for minimizing radioactive waste production during the 100N

Basin Stabilization Project included completion of the Pollution Prevention Workshop.

In another case, the workshop stimulated a group of people at a pump and treat operation to completely reevaluate their handling of granulated activated charcoal used to capture the contaminates.

A knowledge-based questionnaire was administered at the completion of the workshop in order to gauge the participants understanding of pollution prevention and pollution prevention techniques. The course evaluation form consisted of seven questions on the course content and the level of initiative one would take towards pollution prevention at work. Additionally, three questions are used to evaluate the course facilitator. The data received was used to improve the workshop's effectiveness and efficiency.

Pollution Prevention must be considered in the early stages of project planning to assist in the identification and minimization of environmental impacts during construction and closure/dismantlement. By exposing participants to the basics of the discovery and implementation of pollution prevention options through the *ERC Team Pollution Prevention Workshop*, the groundwork is prepared for the larger cultural change necessary in the waste management field.

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