P2 Integration Into Conduct of Decommissioning

L.E. Boing and R. Lindley
Argonne National Laboratory
Technology Development Division
Decontamination and Decommissioning Special Projects Group
9700 South Cass Avenue
Argonne, IL 60439

Keywords: decommissioning, environmental restoration, scrap metal recycling, technology demonstration, reactors

1. Introduction

Over the last five years, the D&D Program at the ANL-East site has completed decommissioning of three facilities. Currently, decommissioning of two facilities continues at the site with completion of the JANUS Reactor scheduled for September 1997 and completion of the CP-5 Reactor scheduled for late in CY 1999. In the course of this work, certain waste minimization/pollution prevention (WMin/P2) activities have been integrated into all these projects. In most cases, the P2 aspects were key components of the operations that made the best use of available project resources to complete the work safely, within the budget and on or ahead of schedule [1].

This paper will highlight those WMin/P2 activities found most suitable for these D&D operations. Activities covered will include: re-use of lead bricks from a research reactor for shielding material at an accelerator facility, re-use of a reactor out-building structure by the on-site plant services group, and several other smaller scope activities which have also helped heighten WMin/P2 awareness in decommissioning.

2. Background

Decontamination and decommissioning (D&D) operations have routinely been performed at the Argonne National Laboratory-East (ANL-East) site for more than 20 years [2-5]. Although WMin/P2 measures were incorporated into D&D procedures early on, no formal planning process existed and no particular emphasis was placed on such activities. In most cases, operations were conducted in a manner that made the best use of the time and resources allocated. In the late 1980s more emphasis was placed on formally integrating WMin/P2 into D&D operations. Options for disposing of materials started to be evaluated, and improved techniques for reducing waste volumes in D&D operations were optimized in performing all phases of the decommissioning. Currently, the ANL-East D&D Program is focusing on measures that will allow more material to be released for recycling and reuse and that enhance waste packaging and treatment thereby reducing waste volumes shipped for disposal.
DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.
3. Objectives
Recent activities to implement WMin/P2 programs in the ANL-East Site D&D Program are highlighted. Simple and innovative WMin/P2 practices that can easily be implemented in the field are described. Also, cases are presented in which materials removed during D&D operations have been reused, and the surveillance and maintenance costs of decommissioning minimized by WMin/P2 activities. Specific activities, such as recycling of metallic wastes from a reactor decommissioning project, reuse of buildings by other ANL-East departments, and some technology demonstration and evaluation activities are discussed.

4. Results
In recent years, major D&D projects have been undertaken at the Experimental Boiling Water Reactor (EBWR) facility and Chicago Pile-5 (CP-5) research reactor at ANL-East; in a smaller D&D project, 61 plutonium-contaminated gloveboxes in nine laboratories at Building 212 underwent D&D [6]. In addition, the Facility 317 Waste Storage Area underwent environmental restoration, including some D&D. The WMin/P2 activities at these projects can be divided into three categories: reuse of buildings and equipment, recycling of metallic wastes from reactor decommissioning, and reuse of materials.

EBWR
The EBWR facility operated from 1956 to 1967 to demonstrate the direct-cycle boiling-water reactor as a heat source to generate electricity for commercial distribution. After shutdown in 1967, the building was maintained in safe storage until D&D operations began in 1986; these operations were completed in 1996 [7].

Reuse and recycling were an integral part of the D&D operations. Several of the EBWR outbuildings were converted for reuse. In one conversion, a transuranic (TRU) waste storage facility was established in the former EBWR containment building. This building is uniquely suited for this follow-on use because it was originally designed for specific climatic and seismic stability conditions. This reuse has saved $2 million by eliminating the cost of constructing a new facility.

Also, scrap metals were recycled from the project with approximately 134,000 lb of lead being released for recycling from EBWR and used as shielding in the Advanced Photon Source (APS), a high-intensity X-ray facility recently built at ANL-East. Without recycling, the APS would have had to purchase new virgin lead for shielding. The savings in disposal cost amounted to $315,000; the cost savings of not buying new lead for shielding fabrication was about $50,000. More than 400,000 lb of scrap metal from EBWR was released for recycling, resulting in more than $38,000 for the Laboratory (on the basis of $185/ton for mixed scrap metal).
An innovation at EBWR was the substitution of a smaller-volume, higher-weight capacity, radioactive waste box for the box normally used for disposing of low-level radioactive waste (LLW). Due to the very dense materials being loaded into the boxes, better packages suited for these wastes were needed. In the end, the disposal effort required fewer waste boxes, fewer shipments, less void filler in the waste packages, and ultimately less disposal space at the U.S. Department of Energy's Hanford LLW burial site.

Also, contaminated paper, plastic, and cloth were used as void filler at EBWR, thus saving the cost of cleanfill and resulting in disposal of this radioactively contaminated material at effectively "no cost."

**CP-5 Research Reactor**
The CP-5 research reactor was the principal reactor used for producing neutrons for scientific research at ANL-East. Operations began in 1954 and continued until the reactor was shut down for the final time in 1979. As work progressed, over 70,000 lb of radioactive scrap metal from CP-5 was removed, shipped, melted, and refabricated into shielding materials by the Scientific Ecology Group (SEG) Facility in Oak Ridge, Tennessee [8]. This action was cost-neutral because the cost of shipment to Oak Ridge was comparable to the cost of shipment to Hanford. However, the scrap metal served as a resource and conserved raw materials that could be used for new material.

Rather than demolish an outbuilding, it was released and reused by another ANL-East department. The ANL-East Grounds Department is currently reusing the CP-5 Vaporsphere (Building 330M) to store road salt. Reuse of the Vaporsphere structure resulted in a savings of about $200,000, the estimated cost of erecting a new structure for salt storage.

More than 400,000 lb of scrap metal from CP-5 was released for recycling, which resulted in more than $38,000 for the Laboratory (on the basis of $185/ton for mixed scrap metal), and about 37,000 lb of lead ($13,000 savings) was free-released for unrestricted use [9].

Another recycling measure was to use contaminated soil from the CP-5 yard area as waste package void filler, rather than shipping the soil as a separate waste type and using virgin void filler. This action saved about $50,000.

**Building 212 Plutonium Gloveboxes**
Sixty-one plutonium-contaminated gloveboxes in Building 212 were decontaminated and decommissioned in 1995 to allow the facilities to be used for other programmatic research efforts [10]. The gloveboxes had been used in various energy R&D programs supporting research on the composition of unirradiated reactor fuel and basic studies on TRU metals.
Radioactive wastes generated during D&D were segregated by using the Pajarito Scientific Corporation waste assay system. As a result, 10% of the drums were reclassified from TRU to low specific activity for disposal. The reclassification also minimized the amount of waste requiring indefinite on-site storage until the Waste Isolation Pilot Plant opens or the TRU Waste Storage Facility is operational.

The publicity of the decommissioning project led a researcher to contact the D&D Department regarding the availability of any low-level-contaminated gloveboxes for his ongoing work. Three plutonium gloveboxes were reused on site, saving about $15,000.

**Building 317 Area**  
Recycling and reuse activities also were implemented at the environmental restoration project at the Facility 317 Area. Separating the mixed waste from the LLW saved $300,000. The contaminated concrete rubble and soil were used to package radioactive waste, reducing disposal costs by $100,000 [11].

**JANUS Research Reactor**  
The JANUS research reactor was used to study biological effects of ionizing radiation during the period 1963 to 1992. The reactor decommissioning was started in 1996 and to date over 200,000 lbs of lead brick has been released and recycled into other forms for re-use in other ANL research programs. This resulted in a cost savings of about $70,000 since new shielding material did not need to be procured. In addition to this, over 230 cubic feet of slightly activated lead brick has been turned over to an accelerator facility on site for use as shielding in beam target areas.

The other clean materials removed from the facility to date have consisted of over 4000 cubic feet (80, 500 lbs) of miscellaneous refuse (copper wire, steel, hard board, etc.) which is disposed of off-site through a recycler. Assuming $185/ton market value, this represents a savings to the DOE of about $7,500. Also, cadmium sheeting from the facility was re-used by an ANL accelerator facility on-site [12].

**Technologies Demonstrated and Evaluation**  
The ANL-East D&D Program has initiated a program of demonstrating and evaluating enhanced or new technologies which will further support WMin/P2 goals on future DOE and even non-DOE decommissioning projects. These technologies should help to 1) generate less secondary waste, 2) perform decontamination to a finer degree or to optimal levels rather than to gross levels, and 3) use characterization technologies to allow for less labor intensive demolition activities.
As an example of the latter item, in-situ piping characterization systems tested at several reactor facilities have potential to save considerable manpower and demolition efforts in the final facility dismantling.

This enhanced technology has already proven to be an effective cost saving method for decommissioning. The reader is referred to References 13-15 where it is shown that this technology resulted in an $8M cost avoidance in a commercial reactor decommissioning project.

As another example, a hard-sided, modular size reduction facility was used for a glovebox dismantling/packaging facility in another decommissioning project. This unit used strippable coatings on its interior to allow it to be decontaminated easily during operations and at the end of the project. The unit was released for re-use on other ANL decommissioning projects. There was a minimal amount of secondary waste generation from the project work and the unit could also be re-used.

As a part of an EM-50 Large Scale Demonstration Project (LSDP), the CP-5 Research Reactor decommissioning project site has served as a test bed for numerous technologies with the WMin/P2 applications. The reader is referred to the LSDP Internet home page at:

http://www.strategic-alliance.org/credits.html

for a full review of enhanced decommissioning technologies demonstrated on this project.

5. Conclusion
Because D&D and environmental restoration projects generate significant quantities of materials and wastes, ANL-East has implemented numerous WMin/P2 measures to assist decommissioning project managers in the reuse and recycling of facilities and materials from D&D activities. Reuse and recycling of materials from facility cleanup programs helps minimize the amount of waste requiring treatment, storage, or disposal, which results in cost savings for the project. At ANL-East, commitment to such programs has resulted in recycling or reuse of a significant amount of materials for beneficial purposes and in saving more than $2.8 million.

Other WMin/P2 methods associated with D&D of nuclear facilities are described elsewhere [16]. The application of these techniques is not limited to D&D activities; they can be implemented during any phase of the facility's life cycle, from construction to operations, and ultimately D&D [17,18]. Methods for incorporating WMin/P2 techniques, especially for radiological and mixed waste, should be incorporated in the design stages of a new facility to assist in future facility disposition.
Acknowledgment
This work was supported by the U.S. Department of Energy, Office of Environmental Management, under contract W-31-109-Eng-38.

The authors would like to thank the members of the ANL-E decommissioning project teams for their help in compiling the detailed information on the decommissioning projects.

References


[12] Telecon w/C. R. Fellhauer, JANUS D&D Project Manager, ANL.


