Waste Minimization and Pollution Prevention in D&D Operations at the Argonne National Laboratory-East Site

L.E. Boing□, M.J. Coffey, R.W. Ditch,
C.R. Fellhauer, and R.W. Rose

Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

□ The corresponding author may be contacted by phone: 708-252-6729; fax: 708-252-1885; e-mail: lboing@anl.gov

DISCLAIMER

Waste Minimization and Pollution Prevention in D&D Operations at the Argonne National Laboratory-East Site

L.E. Boing[†], M.J. Coffey, R.W. Ditch,
C.R. Fellhauer, and R.W. Rose

Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

Abstract: Argonne National Laboratory (ANL) is implementing waste minimization and pollution prevention activities into its conduct of decontamination and decommissioning (D&D) projects. Many of these activities are rather straight forward/simple approaches, yet they are often overlooked and not implemented as often as they could be or should be. Specific activities involving recycling and reuse of materials and structures, which have proven useful in lowering decommissioning and disposal costs on D&D projects at ANL, are presented.

1 Background

Decontamination and decommissioning (D&D) operations have been routinely performed at the Argonne National Laboratory (ANL)-East site for more than 20 years. Although waste minimization and pollution prevention measures were routinely incorporated into the D&D procedures in early years, no formal planning process was undertaken nor was any emphasis placed on these types of activities while performing the D&D. In most cases, operations were conducted in a manner that made the best use of the time allocated. In the late 1980s, more emphasis was placed on formally integrating waste minimization and pollution prevention into D&D operations. Currently options for disposition of materials are being evaluated, and techniques for reducing waste volumes in D&D operations are being optimized in performing all phases of the decommissioning. In the future, the focus will be on performing D&D operations such that more material will be released for recycling and reuse and that enhanced waste packaging and treatment will be used to reduce waste volumes

[†] The corresponding author may be contacted by phone: 708-252-6729; fax: 708-252-1885; e-mail: lboing@anl.gov

ultimately shipped for disposal.

2 Objectives

This paper will highlight the activities undertaken recently to implement waste minimization and pollution prevention programs in the ANL-East Site D&D Program. Simple and innovative practices to achieve waste minimization and pollution prevention that can easily be implemented in the field are described. Also, cases are presented in which materials removed during D&D operations have been beneficially reused and in which surveillance and maintenance costs of decommissioning were minimized through waste minimization and pollution prevention activities. Specific activities, such as recycling of metallic wastes from a reactor decommissioning project and reuse of building structures by other ANL departments, are discussed.

3 Results

In recent years major D&D projects were undertaken at ANL-East at the Experimental Boiling Water Reactor (EBWR) facility and at the Chicago Pile-5 (CP-5) research reactor; a smaller D&D project was undertaken to decontaminate and decommission 61 plutonium-contaminated gloveboxes in nine laboratories at Building 212 (ANL 1995). In addition, the Facility 317 Waste Storage Area underwent environmental restoration, including some D&D work. Waste minimization and pollution prevention activities that were carried out at these projects (Thuot 1996) can be divided into the several categories: reuse of buildings/equipment, recycling of metallic wastes from reactor decommissioning, and reuse of materials.

3.1 EBWR

The EBWR facility operated from 1956 to 1967 to demonstrate the use of a direct cycle boiling water reactor as a heat source to generate electricity for distribution to the commercial sector. After shut-down in 1967, the building was maintained in safe storage mode until D&D operations began in 1986; these operations were completed in 1996 (Fellhauer, Boing, and Aldana 1996).

Reuse and recycling activities were undertaken as part of the D&D operations. Several of EBWR's outbuildings were converted for

reuse. In one conversion, an ANL-East transuranic (TRU) waste storage facility was established in the former EBWR containment. This building is uniquely suitable for such a use because it was designed for climatic and seismic stability. This reuse saved DOE $2 million by eliminating the costs of constructing a new facility.

Scrap metals were also recycled. Approximately 134,000 pounds of lead was free-released for recycle from EBWR and used as shielding in the Applied Photon Source, a high-intensity X-ray facility recently built at Argonne. Without recycling, the Applied Photon Source would have had to purchase new lead shielding. The savings from disposal-cost avoidance amounted to $315,000. In other activities, more than 400,000 pounds of scrap metal from EBWR was free-released for recycling, realizing more than $38,000 for the Laboratory (on the basis of $185/ton value for mixed scrap metal).

An innovation used 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. As a result of using the smaller size box, the disposal effort required fewer waste boxes, fewer shipments, less void filler in the waste packages, and ultimately less disposal space at DOE's Hanford low-level-waste burial site.

Also, contaminated paper, plastic, and cloth were used as void filler at EBWR, thus saving the cost of clean fill and realizing disposal of radioactive material at "no cost."

3.2 CP-5 Research Reactor

The CP-5 research reactor was the principal reactor used for the production of neutrons for scientific research at ANL-E. Initial operations began in 1954 and continued until the reactor was shut down for the final time in 1979. An outbuilding from CP-5 was recycled for use by another Laboratory department rather than being demolished. The CP-5 Vaporsphere (Building 330M), is being beneficially re-used by the ANL Grounds Department for road salt storage. Reuse of the Vaporsphere saved DOE about $200,000, the estimated cost of erecting a similar new structure for salt storage.

More than 70,000 pounds of radioactive scrap metal from CP-5 was recycled for use as shielding materials and radioactive waste

containers by the Scientific Ecology Group Facility at Oak Ridge, Tennessee. This use was a cost-neutral action since the expense of shipment to Oak Ridge was comparable to the transportation cost to Hanford however, the scrap metal served as a resource and conserved raw ingredients that might have been used for new material.

As with the EBWR facility, more than 400,000 pounds of scrap metal from CP-5 was free-released for recycling, which realized more than $38,000 for the Laboratory (on the basis of $185/ton value for mixed scrap metal), and approximately 37,000 pounds of lead was free-released for unrestricted use.

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

3.3 Building 212 Plutonium Gloveboxes

A total of 61 plutonium-contaminated gloveboxes located in Building 212 were decontaminated and decommissioned in 1995 to allow the use of the facilities for other DOE programmatic research efforts. These gloveboxes had been used in various DOE energy research programs to support unirradiated reactor fuel composition research and basic studies on TRU metals.

During D&D, radioactive wastes that had been generated were segregated by using the Pajarito Scientific Corporation waste assay system. This segregation resulted in 10% of the drums being reclassified for disposal from TRU to low specific activity (LSA). 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.

Rather than all 61 gloveboxes being size-reduced and shipped for disposal, three plutonium gloveboxes were reused on-site, saving about $15,000. This particular reuse resulted in a researcher contacting the D&D Department regarding availability of low-level-contaminated gloveboxes for some of his ongoing work.

3.4 Building 317 Area

Recycling and reuse activities also were implemented at the environmental restoration project that had been undertaken at the Facility 317 Area. By segregating the mixed waste from the low-level waste components, $300,000 was saved. The contaminated concrete rubble and soils were used to package radioactive waste, reducing disposal costs by $100,000.

4 Conclusions

Because D&D and environmental restoration projects generate significant quantities of materials and wastes, Argonne has initiated several programs to assist project managers in identifying opportunities for beneficial reuse and recycling of facilities and materials from D&D activities. Reuse and recycling of materials from facility cleanup programs will help to minimize the volume of waste requiring treatment, storage, or disposal, which translates into 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 $3.7 million in DOE funds.

Many other methods for waste minimization associated with the D&D of nuclear facilities have been described in the recently published *Waste Minimization Handbook* (Boing and Coffey 1995). The application of these techniques is not limited to D&D activities; these practices can be implemented during any phase of the facility life cycle, from construction through operations to D&D. Methods for prevention of waste, especially radiological and mixed waste, should be incorporated into any new construction in the design stages of a new facility to plan for future facility disposition (IAEA, 1996).

5 Acknowledgments

Work supported by the U.S. Department of Energy, Office of Environmental Management, under contract W-31-109-Eng-38.

6 References

Argonne National Laboratory, 1995, *Fiscal Year 1995, Decontamination & Decommissioning Activities Photobriefing Book,* Technology Development Division, Decontamination & Decommissioning Projects Department, Argonne, Ill., U.S.A.

Boing, L.E., and M.J. Coffey, 1995, *Waste Minimization Handbook, Volume 1*, report ANL/D&D/TM-96/1, prepared for U.S. Department of Energy, Office of Environmental Management, by Argonne National Laboratory, Argonne, Ill., U.S.A.,

Fellhauer, C., L. Boing, and J. Aldana, 1996, unpublished information.

Thuot, J., 1996, *EM Funded Waste Minimization Accomplishments*, Argonne National Laboratory, Argonne, Ill., U.S.A.

IAEA, 1996, Draft Technical Report, *Design and Construction of Nuclear Power Plants to Facilitate Decommissioning*, International Atomic Energy Agency, Vienna, Austria.