SUMMARY

EXPERIENCES IN THE D&D OF THE EBWR REACTOR COMPLEX
AT ARGONNE NATIONAL LABORATORY*

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The Experimental Boiling Water Reactor (EBWR) was designed in the early 1950's as a prototype Boiling Water Reactor. It was constructed at the Argonne National Laboratory (ANL) East site near Chicago over a 19-month period and went critical in December 1957. It was a complete power producing unit, initially operated at 20 MWt, but eventually upgraded to operate at 100 MWt. A number of experimental cores were constructed and many features of BWR systems were investigated during the operating lifetime of the reactor plant. The EBWR reactor operations were terminated in July 1967 and the facility was placed in a dry lay-up condition, under a surveillance and maintenance mode for 19 years before the D&D project was funded and initiated.

The actual D&D work was planned out into four phases:

Phase I: Final Planning and Preparations for D&D
Phase II: Removal of Reactor Systems
Phase III: Removal of Reactor Vessel Complex
Phase IV: Final Decontamination and Project Close-Out

In the course of the D&D work, a detailed review of available cutting methods was made and the appropriateness of the methods to the specific applications determined. The
methods utilized for various aspects of the operations included plasma arc, abrasive water jet and mechanical milling. A comprehensive report on the applicability of these cutting methods was prepared.

In order to ensure safety, a comprehensive health physics and industrial safety program were undertaken. Based upon the determination of the operating history of the reactor, a calculational model was developed from which the anticipated spatial radiation dose distribution was determined. This calculated distribution was used for planning purposes. Actual measurements were made at each stage of dismantlement to normalize the calculations.

Despite these precautions, there turned out to be a measurable uptake of $^{241}\text{Am}$ by D&D workers in a period following underwater plasma arc cutting within the pool. Since the presence of actinides was not anticipated, this event caused great consternation and all operations were temporarily shut down and detailed investigations initiated. The cause of the problem was traced to an experimental $^{241}\text{Pu}$ foil (200 μg) that was lost in the mid-1960's in the reactor vessel. This was not documented in the facility close-out documents, and only incidentally mentioned in the experimental reports. The foil (after about 30 years) had a buildup of 560 μCi of $^{241}\text{Am}$. The $^{241}\text{Am}$ was deposited on the reactor vessel internal components and was evidently vaporized by the plasma arc torch in the course of D&D and became airborne, resulting in worker uptakes.

Several major lessons were learned from the episode. First, it is crucial to perform a thorough characterization of the facility prior to D&D. The project staff felt that this had been done in a sufficient level of detail but it did not show any alpha contaminant
problems. Secondly, research facilities present challenging problems since unusual experiments are often performed and record keeping in the past has not always been as detailed as today's standards require. Thus, it is necessary to expect the unexpected, and look for the presence of actinides and other radioisotopes that might be present based upon operational experiences. Diligence is required to continue to periodically monitor for the unexpected chance encounters with any and all radionuclides. Thirdly, an active, aggressive bioassay program for the workers is essential. In this case, it was the bioassay program that alerted project personnel to the fact that there were uptakes. Archiving of work place air samples provided the means to determine the worker exposure dates. This allowed for the precise isolation of the work that resulted in the release of the actinides. Finally, the safety analysis and review procedure for D&D operations need to be carefully considered since they represent considerably different situations than reactor operations. The last item is a relatively new issue for the D&D community, and is the subject of a fair amount of work.

The EBWR facility represents one of the very few cases of a prototypic reactor facility designed, operated, tested and now D&D'd by one organization. The wealth of lessons learned in this process can be made available to the community in order to allow better planning and execution of future D&D activities.