ANL/D&D/01-2

FISCAL YEAR 2000
DECONTAMINATION AND DECOMMISSIONING
ACTIVITIES PHOTOBRIEFING BOOK

FOR THE

ARGONNE NATIONAL LABORATORY-EAST
TECHNOLOGY DEVELOPMENT DIVISION
DECONTAMINATION AND DECOMMISSIONING PROGRAM

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Argonne National Laboratory

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Cover

A major milestone was reached in FY 2000 - the completion of the Chicago Pile-5 D&D Project. The photograph to the left (ANL Neg. 144-749) shows the CP-5 Reactor during operation (circa June 1965). The center photograph (ANL Neg. 25252K, Frame 12) shows the reactor tank after the bioshield and lead were removed (June 1999). Two Brokk demolition machines, shown in the photograph, were used to complete the removal. The photograph on the right (ANL Neg. 25385K, Frame 18A) shows the reactor pedestal after all loose concrete was removed. It looks amazingly like the day it was poured.

FOREWORD

The Decontamination and Decommissioning (D&D) Program in the Technology Development Division at Argonne National Laboratory-East (ANL-E) is a comprehensive, integrated program based on our nuclear operations experiences and technology development expertise. It is composed of three major elements.

Operations is dedicated to the safe and cost-effective D&D of surplus, contaminated facilities on the ANL-E site. The D&D of these facilities involves

- project identification, design, planning, and budgeting;
- project execution, including disassembling, size reduction, and packaging of all radioactive materials associated with the operation of a facility; demolition of all obsolete support structures; and decontamination of remaining structures and surrounding areas for unrestricted reuse or demolition; and
- project closeout and facility release.

Knowledge gained through successful project completions is shared with others in the DOE complex through topical presentations and lessons learned.

Technology Development, Demonstration, and Deployment draws on our operational experience, and technology development and evaluation capabilities. The development program involves

- novel chemical decontamination to remove corrosion on metal surfaces to remove radioactive deposits;
- robotics to develop and demonstrate a trusted software development methodology that produces reliable software for dual-arm robotic operation; and
- waste volume reduction using surface characterization and decontamination by laser ablation.

Training provides general D&D training courses or niche training courses for attendees with special interests. The courses are organized and planned by Technology Development Division personnel. The lecturers include Argonne personnel, as well as from other Department of Energy laboratories, DOE offices, the Nuclear Regulatory Commission, and commercial firms.

This photobriefing book is dedicated to Operations. To learn more about Technology Development, Demonstration, and Deployment and Training, visit our web site at www.td.anl.gov/Programs/dd/dd.html.

Thomas J. Yule
Associate Director
Technology Development Division

Introduction

INTRODUCTION

A major milestone was reached in Fiscal Year (FY) 2000 - the completion of the Chicago Pile-5 (CP-5) D&D Project. CP-5, the first reactor built on the Argonne National Laboratory-East (ANL-E) site, was a 5-megawatt, heavy water-moderated, enriched uranium-fueled reactor. It was the principal reactor on the Argonne site used to produce neutrons for scientific research from 1954 to 1979. The reactor was shut down and defueled in 1979, and placed in a lay-up condition. In 1990, funding was provided to begin the decontamination and decommissioning (D&D) of this facility, and work began in June 1991.

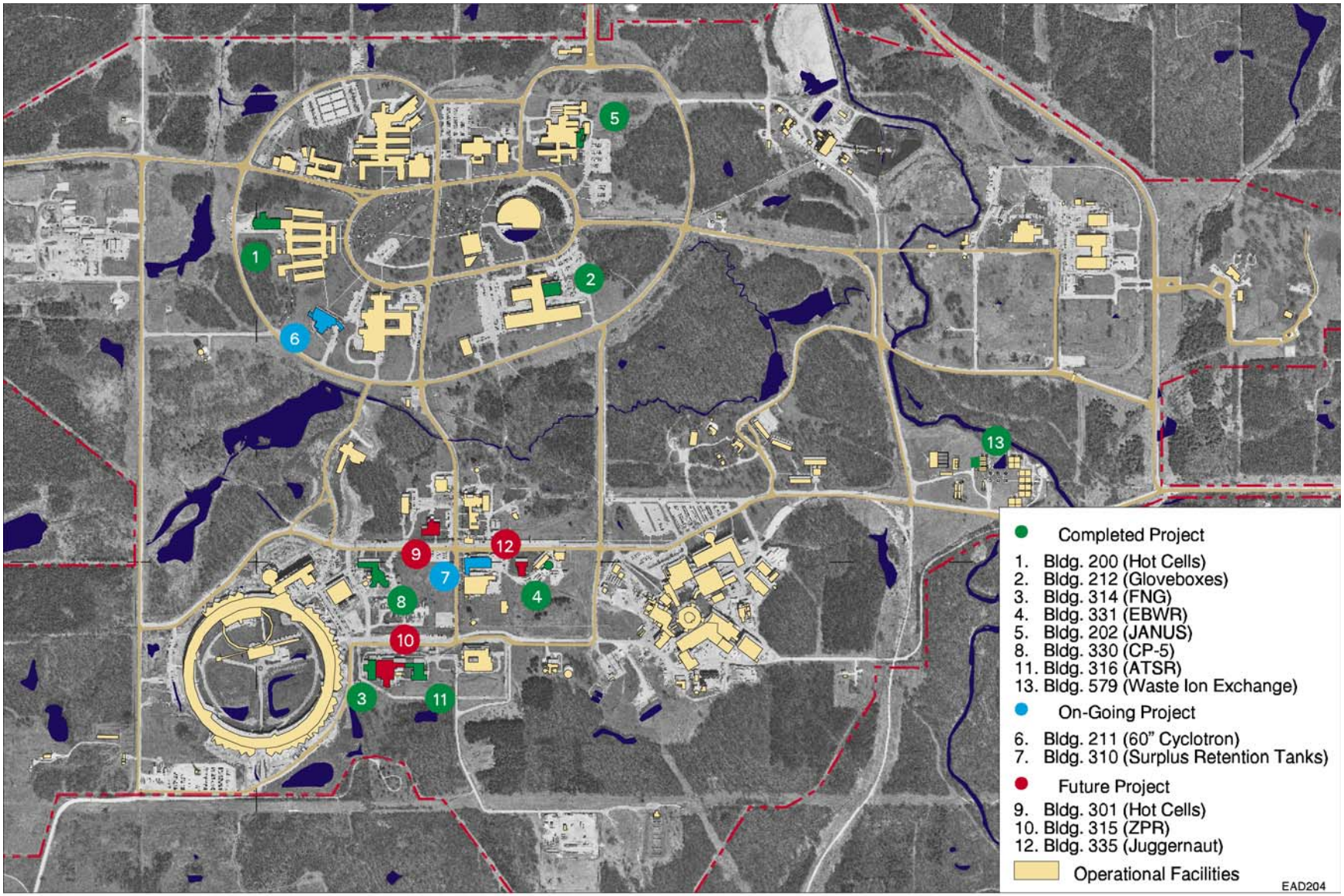
D&D tasks were performed by both ANL-E personnel and subcontractor personnel from Duke Engineering & Services, Marlborough MA, under the management of ANL-E D&D Program personnel. In July 2000, the final project report was presented to the Department of Energy, and the facility was formally decommissioned and transferred to the landlord. Total project duration was 97 months, and total project cost was $29.5M.

Also, in FY 2000, work began on the 60" Cyclotron D&D Project. An accelerator used for basic research, this facility produced beams of deuterons, helium ions, singly charged hydrogen molecules, and neutrons of a broad energy spectrum. This machine was built in 1952; operations ended in 1992. Late in FY 1999, MOTA Corporation, Columbia SC, was selected as subcontractor. MOTA used a custom-built 76-inch reciprocating saw manufactured by Reverse Engineering, Columbia SC, to cut the cyclotron's 220-ton steel yoke into blocks that were approximately 17,000 pounds each. This project is scheduled to be completed in March 2001.

In addition to a photographic chronology of FY 2000 activities at the CP-5 D&D Project and the 60" Cyclotron D&D Project, brief descriptions of other FY 2000 activities and of projects planned for the future are provided in this photobriefing book.

C. R. Fellhauer
D&D Operations Manager

D&D Operations



Status of D&D Projects at the Argonne National Laboratory-East Site (as of September 30, 2000)

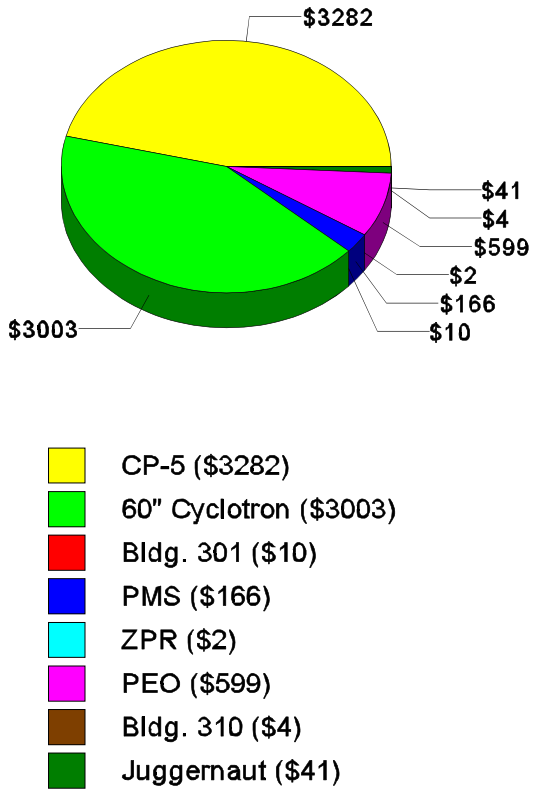
FY 2000 ANL-E D&D Program Highlights

FY 2000 D&D Project Status

- FY 2000 ANL-E project funding totaled $7108K
- CP-5 D&D Project was completed and Project Final Report was issued
- Award of contract to complete the 60" Cyclotron D&D Project was made to MOTA Corporation
- 60" Cyclotron subcontractor mobilized in January 2000
- Bldg. 301 Hot Cells Environmental Assessment was approved by DOE with a Finding of No Significant Impact
- Six D&D facilities were removed from the DOE Open Release Sites/Facilities List during FY 2000
- ANL-E Plant Facilities and Services Waste Management Operations selected to complete Building 310 Retention Tanks D&D Project
- Preparation of Juggernaut D&D Project documentation and project plans began
- FY 2000 Program Engineering/Oversight (PEO) and Program Management Support (PMS) activities were conducted

FY 2000 D&D Project Funding

(in $K)



FY 1993 - 2000 ANL-E D&D Project Status and Funding

D&D Projects Completed

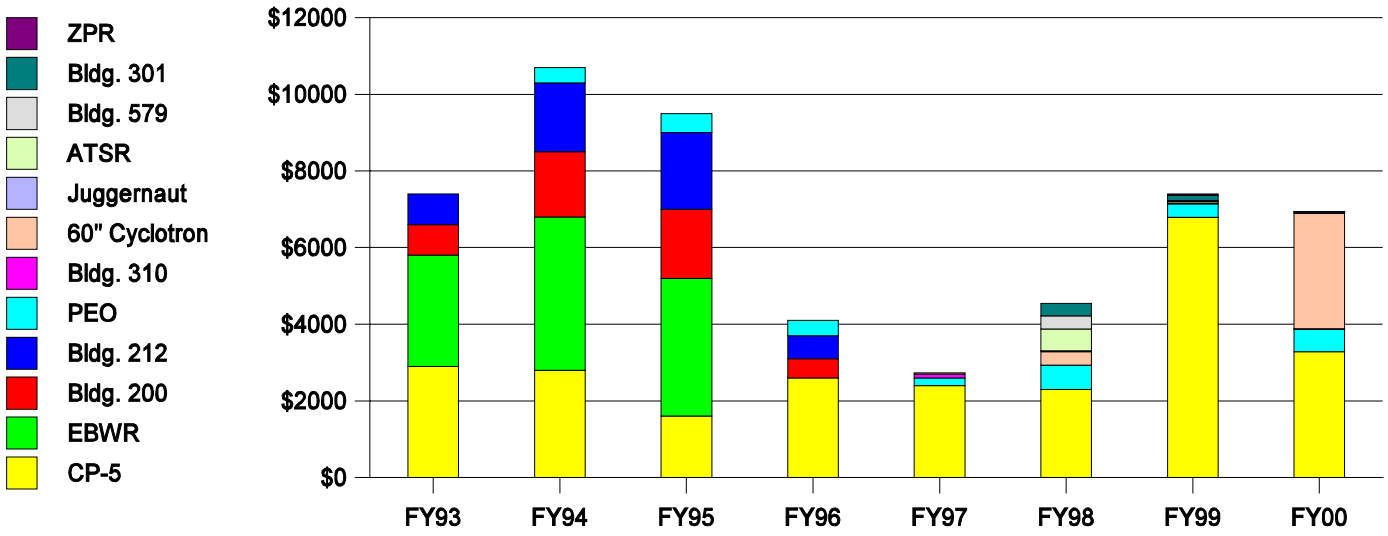
1996: Experimental Boiling Water Reactor (Bldg. 331)
M-Wing Hot Cells Facilities (Bldg. 200)
Plutonium Gloveboxes (61 gloveboxes in Bldg. 212)
Fast Neutron Generator (Bldg. 314)

1997: Janus Reactor (Bldg. 202)

1998: Argonne Thermal Source Reactor (Bldg. 316)
Waste Ion Exchange Facility (Bldg. 579)

2000: CP-5 Reactor (Bldg. 330)

D&D Project Funding by Fiscal Year (in $K)



CP-5 Research Reactor D&D Project

CP-5 Research Reactor D&D

An oxyacetylene torch was used during the removal and downsizing of the retention tank located in A-wing. As an environmental control, a containment tent was built to enclose the area. In this photograph, a D&D worker is putting the final touches on the negative air unit's exhaust trunk (ANL Neg. 25634K, Frame 17).

CP-5 Research Reactor D&D

Prior to size reduction, the retention tank surface was stripped of suspect lead-based paint. This was done using a needle gun equipped with a HEPA-capturing shroud. As shown in this photograph, the areas stripped of paint left a clearly marked cutting path. Calculations were then made to optimize material handling and waste packaging (ANL Neg. 25634K, Frame 5).

CP-5 Research Reactor D&D

A portion of the fuel pool in E-wing was cut into blocks using a diamond cable saw and, as shown in this photograph, lifted free using a crane. Precut, stitch-drilled holes were used to make the initial-cut path. Lifting eyes were drilled and fastened by a two-part cement epoxy made by the 3M Company (ANL Neg. 25696K, Frame 21).

CP-5 Research Reactor D&D

This photograph shows the disassembly of the hot cell located in the E-wing basement. Notice the distinct color variation in the concrete used for the ceiling and one wall compared to the concrete used in other parts of the hot cell. Darker in color, the ferrous concrete was used to improve shielding on thinner walls. Unfortunately, this ferrous concrete proved a bigger challenge for the Brokk compared to regular concrete. Also shown in this photograph are burn marks from torch cutting the steel plate from the interior of the hot cell (ANL Neg. 25487K, Frame 4A).

CP-5 Research Reactor D&D

This photograph shows the E-wing basement floor after removal of the hot cell. Due to considerable contamination, a lot of concrete removal was required in some areas. Contaminated sump covers were removed and disposed of, and replacement covers were made and installed (ANL Neg. 25890K, Frame 4).

CP-5 Research Reactor D&D

Other sections of the E-wing basement floor were not as contaminated as the hot cell area. D&D workers were able to bring the radioactive levels to release limits with the use of surface decontamination tools. In this photograph, a health physics technician is checking an area already cleaned using a concrete shaving machine (ANL Neg. 25800K, Frame 24).

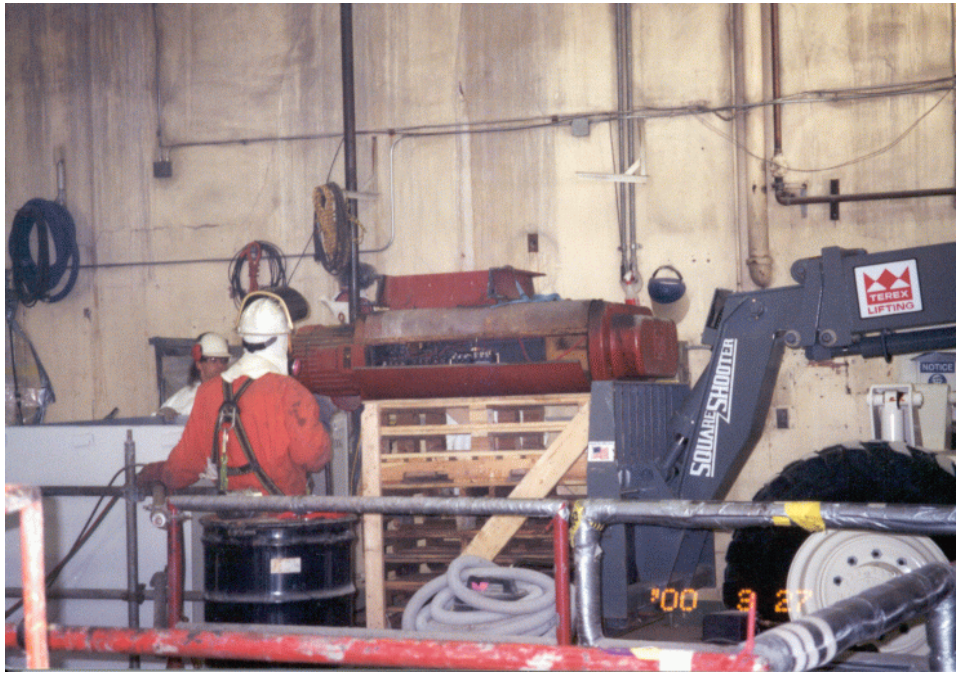
CP-5 Research Reactor D&D

Once the contaminated concrete was removed from the E-wing basement floor, a concern arose about water seepage. A decision was made to level the floor with a layer of new concrete. A truck pumped the concrete into the E-wing basement. Steel tubing and flexible heavy-gauge hoses were used to direct the concrete (ANL Neg. 25890K, Frame 11).

CP-5 Research Reactor D&D

This photograph provides a closer look at the smaller of two concrete shavers used at the CP-5 D&D Project. Both machines are equipped with a HEPA-vacuum shroud for capturing dust generated during the concrete shaving process. Shaving depth can be adjusted to minimize surface shaving and motor burden (ANL Neg. 25799K, Frame 22).

CP-5 Research Reactor D&D



An articulating boom forklift was used to remove the E-wing crane. With its 30-foot personnel basket, the forklift was used to position workers during cutting operations. Crane components were torch-cut loose from the crane trolley beams. The articulating boom forklift proved invaluable for positioning cribbing to lower the components once they were cut loose. Once on the ground, additional size reduction of the components was necessary for waste packaging (ANL Neg. 25800, Frame 14).

CP-5 Research Reactor D&D

In the B-wing truck-bay area, a containment tent was erected to cover the cesium spill area during the concrete removal process. Jackhammers were used for deep contamination removal, while the large cement shaver proved adequate for shallow contamination removal (ANL Neg. 25800K, Frame 18).

CP-5 Research Reactor D&D

The rod storage tubes were removed by over-drilling the various-sized steel tubes using a hydraulic drill press fitted with corresponding various-sized drill bits. Water was used during the drilling process instead of oil to eliminate the generation of mixed waste. The water used during the drilling was vacuumed up and put into a water-capturing drum. Sediment was allowed to settle, and the water was recycled (ANL Neg. 25634K, Frame 1).

This photograph provides a closer look at the hydraulic drill used during tube removal in the rod storage area. The rod storage tubes were drilled down to a seven-foot depth. A second tool was used to cut the inside diameter of the piping, allowing the removal of the rod storage tube and the concrete over-drill (ANL Neg. 25518K, Frame 19A).

CP-5 Research Reactor D&D

Core pieces from the rod storage area were staged inside the reactor shell for size reduction. The concrete was broken, exposing a survey point. Smears and direct frisks were taken to evaluate each piece prior to torch cutting. Once cut in half, the pieces were a suitable size for packaging as Low Specific Activity Radioactive Waste in approved B-25 containers (ANL Neg. 25518K, Frame 22A).

CP-5 Research Reactor D&D

Concrete remaining after core removal of the rod storage tubes was above release criteria. The Brokk was used to remove this concrete (ANL Neg. 25817K, Frame 17A).

CP-5 Research Reactor D&D

Work in the rod storage area was completed using the Brokk. The steel rim surrounding the rod storage area tube section was contaminated and had to be removed. As in other D&D projects, the Brokk proved effective, productive, and versatile in completing a variety of tasks (ANL Neg. 25817K, Frame 11A).

CP-5 Research Reactor D&D

Airlock doors that served as shielding during reactor operations were contaminated. In this photograph, a D&D worker is using a personnel lift for positioning and rigging the door in preparation for its removal (ANL Neg. 25799K, Frame 7).

It was also necessary to remove the airlock door frame members. After suspect lead-based paint was removed, the frame members were torch cut. A personnel lift was again used for positioning (ANL 25799K, Frame 12).

CP-5 Research Reactor D&D

The Brokk was used to remove a considerable amount of concrete from the reactor pedestal. Guardrails made from tube-and-clamp scaffolding were placed around the pedestal work area to alleviate fall hazards (ANL Neg. 25768K, Frame 12A).

CP-5 Research Reactor D&D

This photograph provides a top-side view from the control room side of the reactor pedestal. Contamination occurred predominantly in the center, with less moving outward. The isotrays, located on opposite sides of the reactor, were contaminated further from the center from their use during reactor operations (ANL Neg. 25800K, Frame 7).

CP-5 Research Reactor D&D

A substantial amount of concrete was removed from the reactor pedestal tunnel using chipping and jackhammers. Some parts of the tunnel had been poured to 12 inches thick, and it was necessary to chip 6 to 8 inches deep before meeting release criteria (ANL Neg. 25634K, Frame 13).

CP-5 Research Reactor D&D

The elevator room ceiling required surface decontamination. Hand-held electric roto-scabblers with HEPA-capturing shrouds were used for this task. Rolling scaffolds were used to provide the D&D workers a large walking surface (ANL Neg. 25768K, Frame 24A).

CP-5 Research Reactor D&D

In the upper reactor shell area, the 20-ton crane was dismantled and packaged as Low Specific Activity Radioactive Waste. A mobile crane was used during this demolition (ANL Neg. 25718K, Frame 4).

CP-5 Research Reactor D&D

This photograph shows a D&D worker planning his cuts for size-reducing the crane components. Many of the larger components required torch cutting before packaging into Low Specific Activity waste containers (ANL Neg. 25718K, Frame 3).

CP-5 Research Reactor D&D

Most of the catwalk plating in the reactor shell was above release criteria. This photograph shows D&D workers decontaminating the support frames that held up the catwalk near the control room (ANL Neg. 25799K, Frame 1).

60" Cyclotron D&D Project

60" Cyclotron D&D

Prior to the start of D&D activities at the 60" Cyclotron facility in Building 211, excess equipment and debris were present. These items were packaged for disposal to allow room to begin size reduction of the cyclotron (ANL Neg. 25695K, Frame 5A).

60" Cyclotron D&D

Once excess materials in the vault area were packaged, a fire-retardant containment area was erected for torch-cutting operations of large components. The framework for this structure is shown in this photograph (ANL Neg. 25715K, Frame 10).

60" Cyclotron D&D

Hydraulic jacks and wooden cribbing were used to lower the upper magnet coil enabling the coil to be downsized in sections while resting on the vault floor. In this photograph, the lower magnet coils have already been removed (ANL Neg. 25777K, Frame 14).

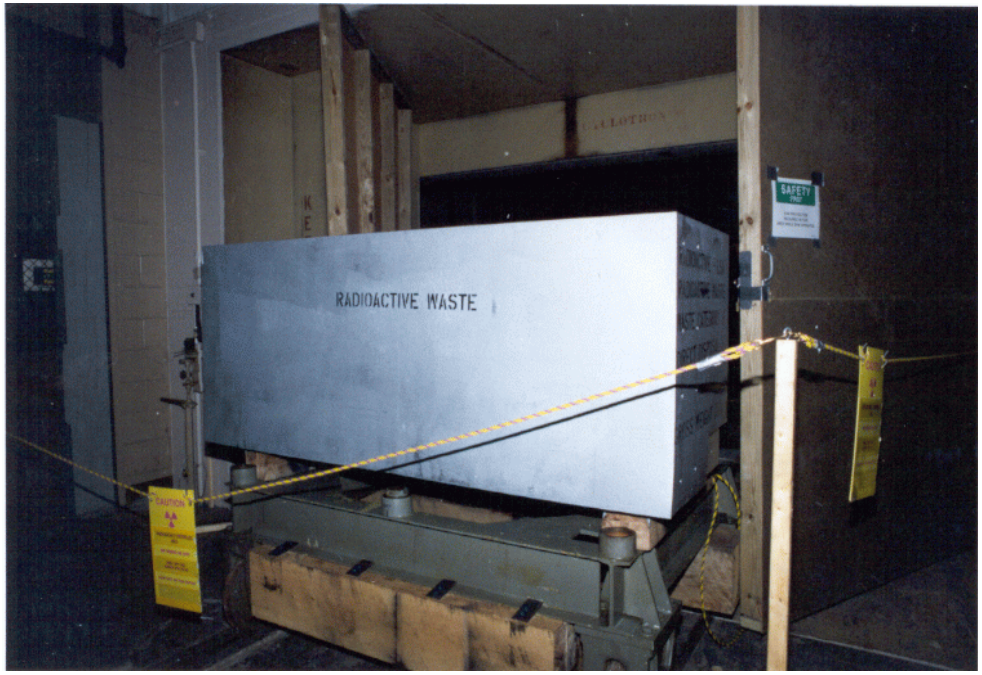
60" Cyclotron D&D

After the upper magnet coil was lowered, the outer skin was cut; removal of the upper magnet coils began (ANL Neg. 25777K, Frame 16).

60" Cyclotron D&D

When first built in 1952, the cyclotron was assembled and the vault area was erected around it. This presented special problems, and the size reduction of the yoke and pole sections required a speciality tool. Pictured here is the 76-inch, 60-HP hydraulic-driven reciprocating saw designed for this project by Reverse Engineering (Columbia SC). In this photograph, the saw is being attached to the upper yoke prior to making the first cut (ANL Neg. 25829K, Frame 6A).

60" Cyclotron D&D

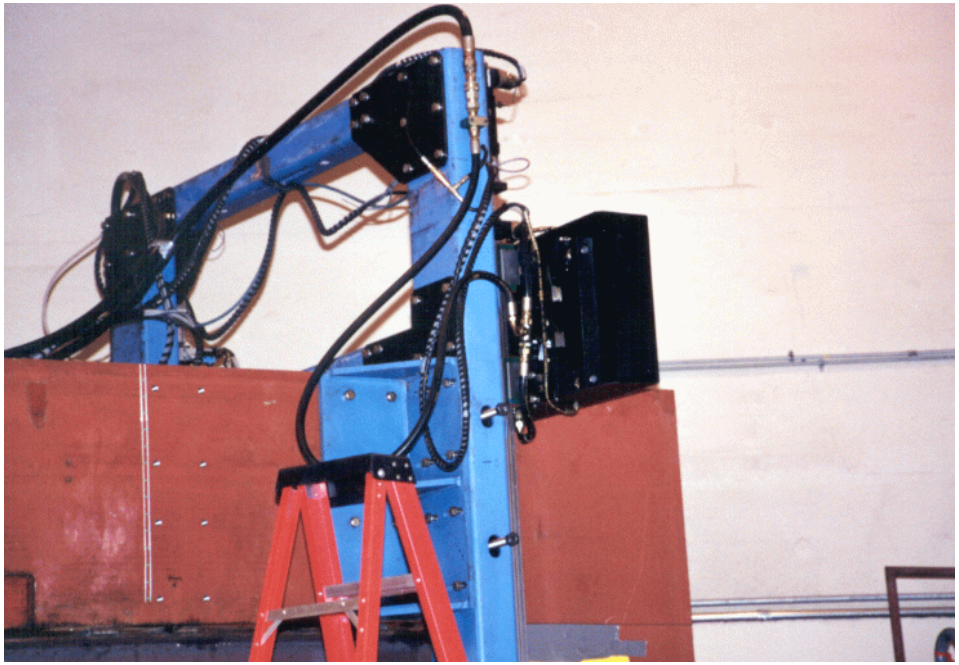


This photograph shows a block section cut from the upper yoke. Once the section is painted and labeled, it serves as a self-contained package. The block is placed on a cart that travels on an existing floor railing system, surveyed for release, and transported to the radiological yard storage area (ANL Neg. 25935K, Frame 15).

60" Cyclotron D&D

This photograph shows segmented pieces of the cyclotron lower magnetic pole. This is a good example of the saw's versatility. Employing this speciality tool alleviated the risks associated with torch cutting in radioactive environments (ANL Neg. 26012K, Frame 22A).

60" Cyclotron D&D

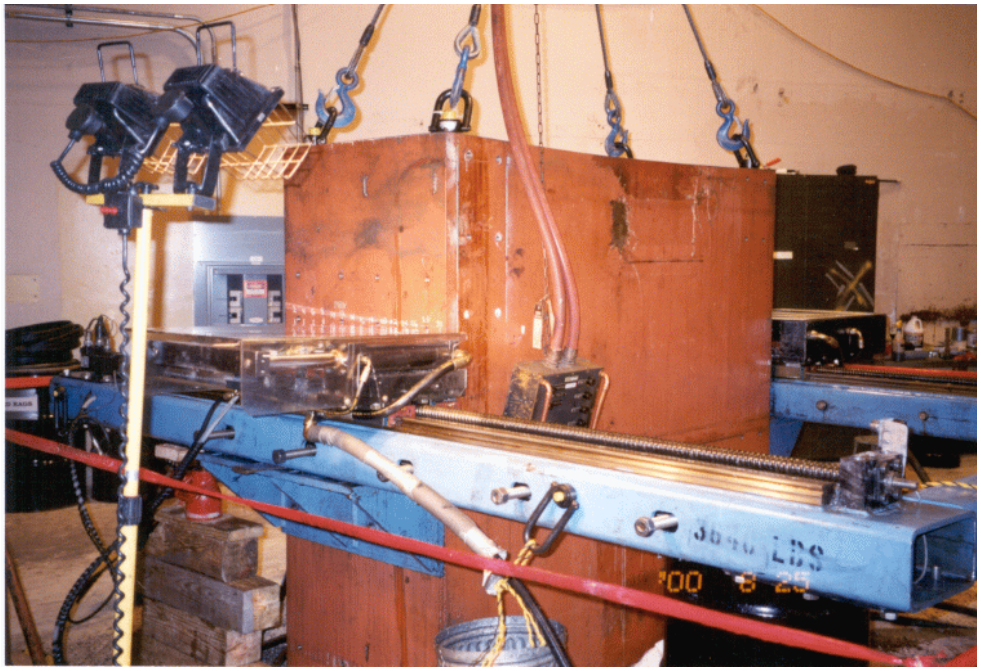


This photograph provides a closer look at the 76" reciprocating saw during setup. After holes are drilled and tapped on both sides of the section to be cut, the saw brackets are attached. A crane is then used to position the saw for attachment to the brackets. During attachment, the saw is checked to ensure that pitch and angle are at desired settings (ANL Neg. 25829K, Frame 10A).

60" Cyclotron D&D

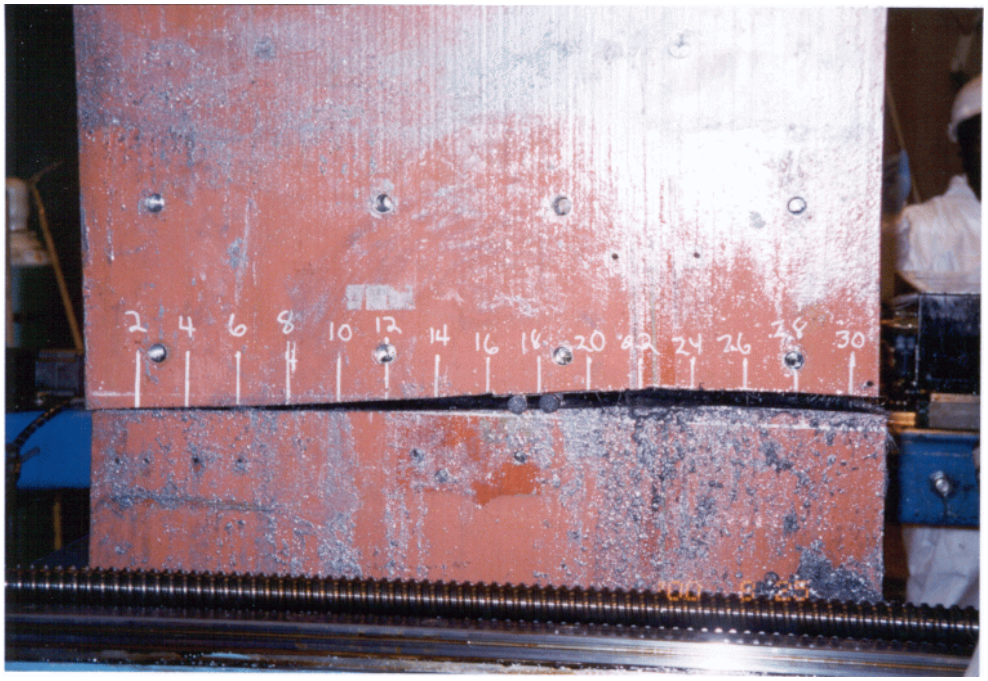
In this photograph, the saw is bolted to the south vertical section of the yoke in a horizontal configuration. An operator is lubricating the hydraulic saw blade to reduce friction and help speed the cut. The lubricating solution used is a non-toxic, nonflammable derivative of grape skins (ANL Neg. 26066K, Frame 2A).

60" Cyclotron D&D



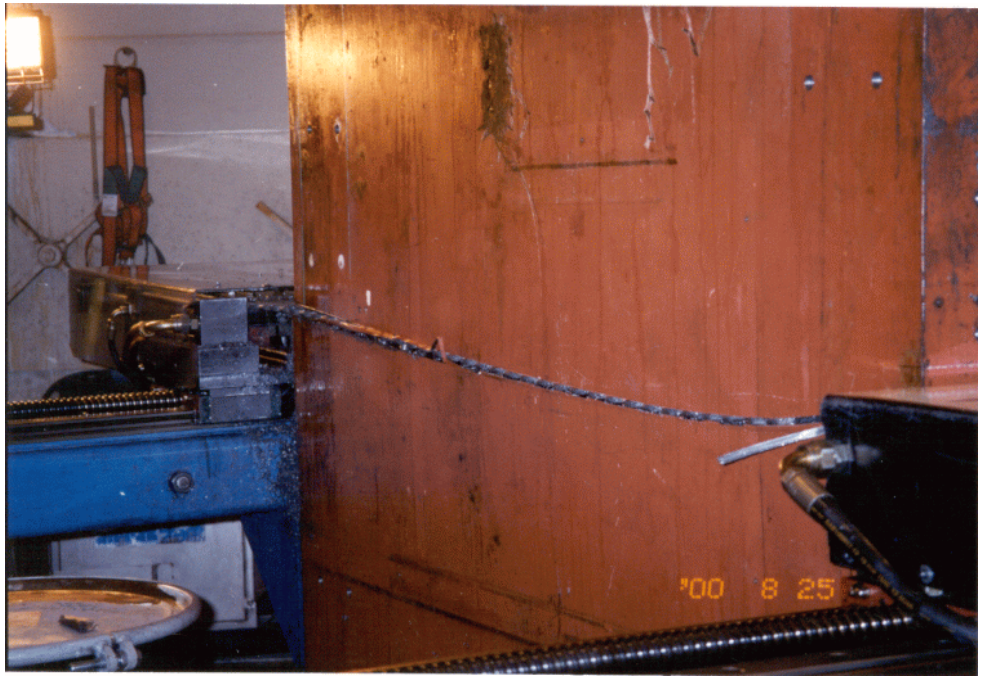
Controls were established to alleviate the chance of binding a blade prior to completion of a cut. A transweight was attached to the crane's hook, and rigging was attached to the block being cut. After the cut was 50% completed, 1000 lbs. of lifting force was put on the crane. Once the cut was complete, the crane lifted the block and transported it to the transition cart shown in this photograph (ANL Neg. 26066K, Frame 1A).

60" Cyclotron D&D



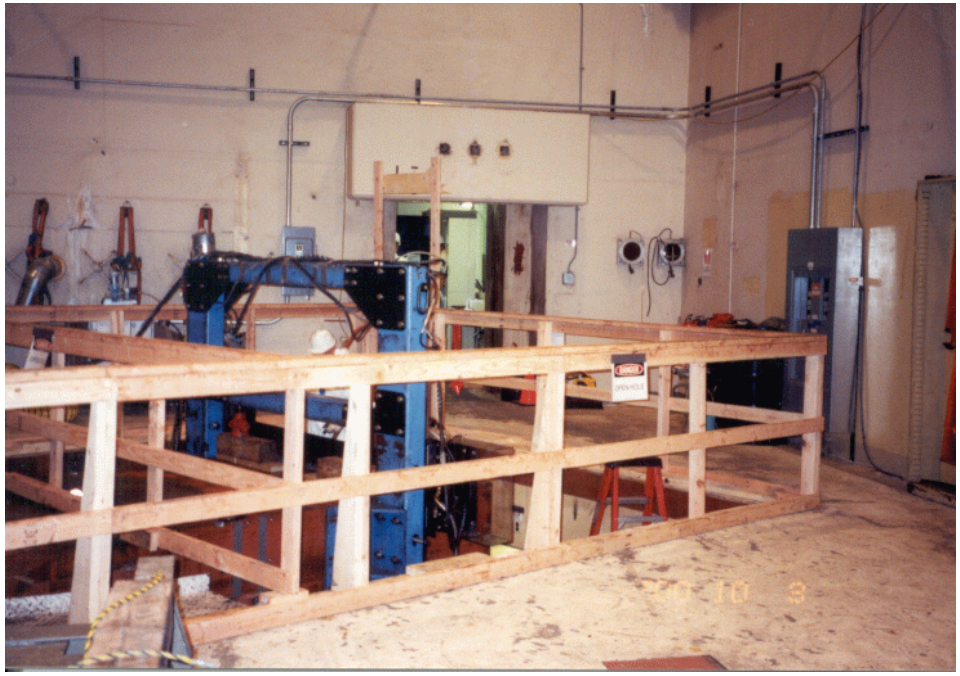
Another control utilized to prohibit binding was insertion of self-tapping bolts. The bolts were inserted at the 17- and 18-inch marks after a 28-inch depth was achieved. These bolts created a fulcrum point for the block and rocked it away from the blade during the end of the cut (ANL Neg. 26066K, Frame 11A).

60" Cyclotron D&D



This photograph shows a completed cut through a steel block. The blade did not always cut in a straight line, but an approximate block volume of 36 ft^3 and block weight of 18,000 lbs. was typical (ANL Neg. 26066K, Frame 7A).

60" Cyclotron D&D



After completing cutting operations on the upper and vertical sections of the yoke, floor deck plating and beam supports were removed to accommodate further saw operations. A handrail system was installed to alleviate fall hazards associated with the removal of the floor decking (ANL Neg. 26125K, Frame 13).

60" Cyclotron D&D

This photograph shows the crane operator lifting the first cut section of the bottom yoke and transporting it to a cart for degreasing and survey. The blocks are then painted, labeled, and surveyed before being transferred to the radiological yard storage area. Several of the blocks were transferred to the ATLAS (Argonne Tandem-Linear Accelerator System) Facility in Building 203 as reusable shielding material (ANL Neg. 26125K, Frame 22).

60" Cyclotron D&D

A steel transfer chute embedded in the Senior Cave wall required removal. This photograph shows a D&D technician grinding the tack welds from the interior cave wall for removal. Respiratory protection, burn protection, and hot-work controls were implemented for this task (ANL Neg. 26125K, Frame 17).

60" Cyclotron D&D

This photograph shows a D&D technician decontaminating the frame work of a shielded viewing window in the Senior Cave area. After using a needle gun to remove the painted outer surface, there was a small portion in the seam of the steel plates that required some extra decontamination effort (ANL Neg. 26125K, Frame 6).

Future Projects

Future D&D Projects at the ANL-E Site

During the remaining three fiscal years of the ANL-E D&D Program (FY 2001 - FY 2003), field work will be conducted at five projects:

- 60" Cyclotron (Bldg. 211) - An accelerator used for basic research, this facility met widely diversified operational requirements, producing beams of deuterons, helium ions, singly charged hydrogen molecules and neutrons of a broad energy spectrum. Field work began in January 2000, and FY 2000 activities are highlighted in the D&D Operations section of this Photobriefing book. This project is scheduled for completion in March 2001.

- Hot Cells (Bldg. 301) - The hot cell area, the first permanent cells constructed at ANL-E, contains eight caves that were used to perform a variety of radiological research activities. Field work is scheduled to begin the second quarter of FY 2001.

- Surplus Retention Tanks (Bldg. 310) - These tanks were placed into service more than 30 years ago and used for interim storage of radioactive liquids when the processing and holding tanks at an adjacent facility were full. ANL Plant Facilities and Services Waste Management Operations personnel began field work on September 25, 2000.

- Zero Power Reactors 6&9 (Bldg. 315) - This facility was used for fast reactor physics research. Field work is scheduled to begin in the third quarter of FY 2002.

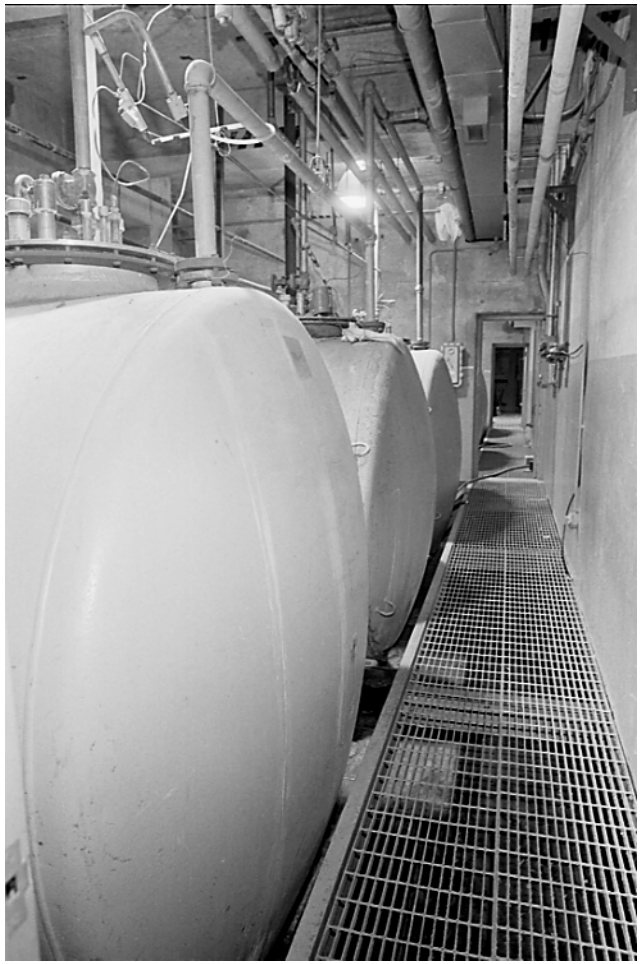
- Juggernaut Reactor (Bldg. 335) - A light-water moderated and cooled, graphite-reflected research reactor designed to conduct basic research. Field work is scheduled to begin in the first quarter of FY 2002.

The following pages contain photographs and brief project narratives for the Bldg. 301 Hot Cells, the Bldg. 310 Surplus Retention Tanks, the Zero Power Reactors 6 and 9, and the Juggernaut Reactor.

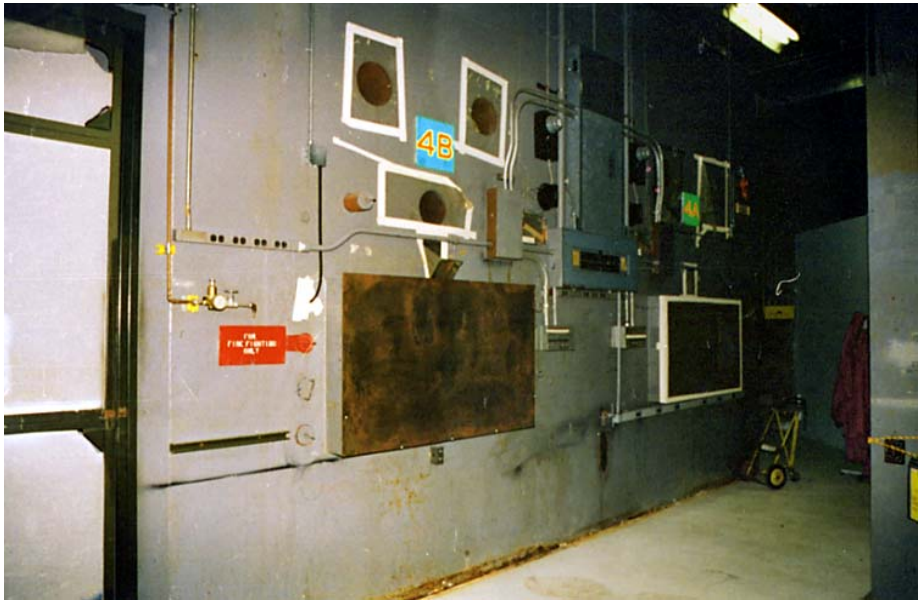
Building 310 Retention Tanks D&D Project

The ANL-E Building 310 service floor retention tank facility was originally installed more than 30 years ago. Even though the Building 310 tanks were installed for excess storage capacity for the adjacent Building 306 tanks, they were infrequently used for this purpose. The facility consists of three rooms containing three tanks each, and a larger room containing one tank, for a total of ten tanks. The tanks have not been used since 1975, when it was decided that the excess capacity was no longer required.

Project planning was completed in FY 1997. ANL Plant Facilities and Services Waste Management Operations personnel began D&D activities on September 25, 2000. Tasks include the removal of the ten retention tanks, removal of the fixtures and piping leading to the tanks, and decontamination of the retention tank area so that it can be released for unrestricted reuse. Work is scheduled to be completed in May 2002 (ANL Neg. 12379, Frame 15).



Building 301 Hot Cells D&D Project

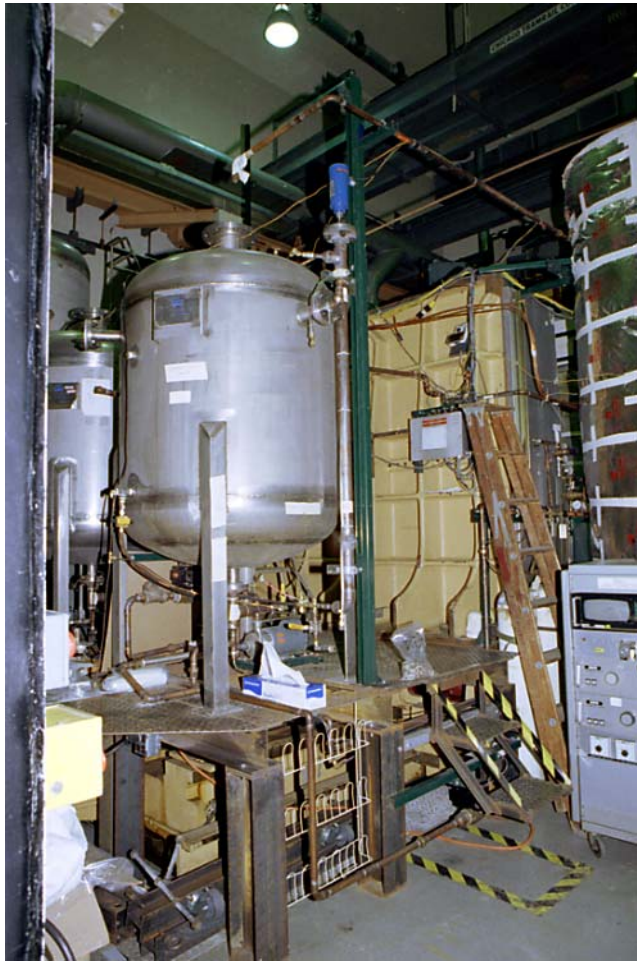


The hot-cell facility in Building 301 was placed into use in the early 1950s to perform a variety of radiological research and development experiments for the U.S. Department of Energy on nuclear reactor fuel components and materials. The eight caves contained within the hot cell facility were phased out in 1971 because they were obsolete and deteriorating. The interior of the caves received a preliminary cleanup. Characterization by ANL indicates that no activation is present and loose surface contamination is minimal. However, significant levels of contamination are fixed within the painted floor and walls. From 1971 until it was taken out of active use in 1992, the hot-cell facility was used for non-radiological experimentation.

The scope of this project includes cleaning or dismantling radioactively contaminated equipment and disposing of it properly. Project planning and documentation were completed during FY 1999. In FY 2000, a revision was made to the National Environmental Policy Act (NEPA) documentation. This revision resulted in approval by DOE of the Environmental Assessment (EA) for the Decontamination and Decommissioning of the Building 301 Hot Cell Facility and in issuance of a Finding of No Significant Impact (FONSI). Also in FY 2000, a process was set in place to select a D&D subcontractor to complete the project.

In the future, the hot-cell area and other contaminated areas will be decontaminated and removed to permit the area to be released for unrestricted reuse, and the cave structures, retention tanks, and ventilation systems will be demolished. The Laboratory has determined that this building is surplus to the Laboratory's needs and will be a candidate for demolition (ANL Neg. 24027K, Frame 12).

ZPR 6 & 9 D&D Project



The Zero Power Reactors (ZPR) 6 and 9 in Building 315 were low-power, experimental reactors utilized for fast reactor physics studies from the early 1960s until 1982. Uranium and plutonium fuels were used to study the neutronic properties of reactor assemblies. Each reactor is in an individual, blast-resistant, concrete cell. Shield walls separate the cells from their control rooms; between the cells is a separate work room used to load fuel drawers. The facility is no longer in use; it is contaminated and activated with low-level radioactivity.

The purpose of this project is to decommission ZPR-6 and ZPR-9 and permit the area's release for unrestricted reuse. To accomplish this, the reactors, process systems, and associated equipment will be cleaned or dismantled and disposed of properly. A characterization plan was prepared in FY 1999. Characterization of the facility, and project planning and documentation are scheduled for FY 2001. D&D activities are scheduled to be completed in FY 2003 (ANL Neg. 23663K, Frame 2A).

Juggernaut Reactor D&D Project

The Juggernaut Reactor in Building 335 was a light-water moderated and cooled, graphite-reflected research reactor with a rated thermal power of 250 kW. It operated from 1962 through 1970. The purpose of the facility was to provide neutron flux levels of medium intensity for research and development experiments for the fast reactor development program. At the time of reactor shutdown, the reactor fuel was removed and all systems were drained.

Only the high bay area of Building 335 that houses the Juggernaut Reactor, the pump room, and the rod-storage pits are covered by this project. The reactor remains radioactively contaminated and activated following many years of service. The scope of this project includes the disassembly, size-reduction, segregation, packaging, and disposal of all radioactive materials associated with the facility. After the removal of all radioactive materials, the facility will be decontaminated to levels that allow its release for unrestricted reuse.

Characterization of the facility, and project planning and documentation are scheduled for FY 2001. D&D activities are scheduled for completion in FY 2002 (ANL Neg. 122-510).