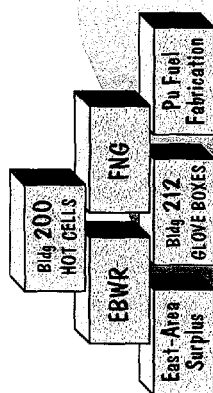


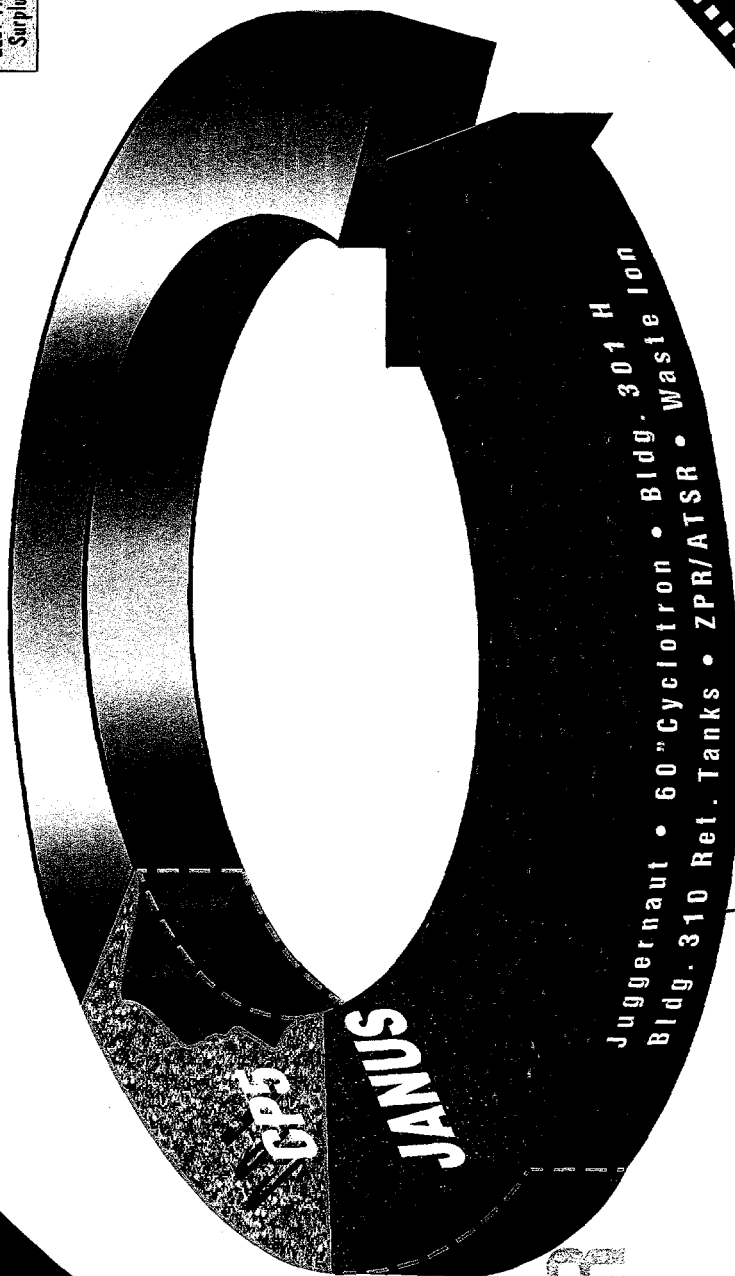
Decontamination & Decommissioning Activities Photobriefing Book

Closing The Circle^{ooo}

Fiscal Year '96

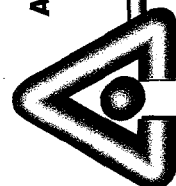


RECEIVED
SEP 29 1997
OSTI



MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED



Argonne National Laboratory-East Site
Technology Development Division
Decontamination & Decommissioning Program

Sponsored by the U.S. Department of Energy • Office of Environmental Management



**FISCAL YEAR 1996
DECONTAMINATION AND DECOMMISSIONING
ACTIVITIES PHOTOBRIEFING BOOK**

FOR THE

**ARGONNE NATIONAL LABORATORY-EAST SITE
TECHNOLOGY DEVELOPMENT DIVISION
WASTE MANAGEMENT PROGRAM
DECONTAMINATION AND DECOMMISSIONING PROJECTS
DEPARTMENT**

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

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, make 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.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Argonne National Laboratory

Argonne National Laboratory, with facilities in the states of Illinois and Idaho, is owned by the United States Government, and operated by the University of Chicago under the provisions of a contract with the Department of Energy.

This technical memo is a product of Argonne's Technology Development Division, Decontamination and Decommissioning Program. For information on the division's activities, contact:

Director, Technology Development Division
Argonne National Laboratory
Argonne, Illinois 60439-4815
Telephone (630) 252-6050

Presented in this technical memo are preliminary results of ongoing work or work that is more limited in scope and depth than that described in formal reports issued by the Technology Development Division.

Publishing support services were provided by Argonne's Information and Publishing Division (for more information, see IPD's home page: <http://www.ipd.anl.gov/>).

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.

Reproduced directly from the best available copy.

Available to DOE and DOE contractors from the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831; prices available from (423) 576-8401.

Available to the public from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161.

CONTENTS

Introduction	1
Purpose	1
The ANL-E D&D Program	1
 CP-5 Reactor	7
Chicago Pile-5 Reactor D&D Project	8
Description	8
FY 1996 Accomplishments	9
FY 1997 Goals	19
 Janus Reactor	20
JANUS Reactor D&D Project	21
Description	21
FY 1996 Accomplishments	21
FY 1997 Goals	27
 Completed Projects	28
Experimental Boiling Water Reactor D&D Project	29
Building 200 M-Wing Hot Cells D&D Project	31
Building 212 Plutonium Gloveboxes D&D Project	33
East Area Contaminated Surplus Facilities	35
Building 350 Plutonium Fabrication Facility D&D Project	36
Fast Neutron Generator D&D Project	37

CONTENTS (continued)

Future Projects	38
Building 310 Retention Tanks D&D Project	39
ZPR/ATSR D&D Project	40
60" Cyclotron Facility D&D Project	41
Building 301 Hot Cells D&D Project	42
Juggernaut Reactor D&D Project	43
Waste Ion Exchange Facility D&D Project	44
Technology Development for D&D	45
Description	45
CP-5 Large Scale Demonstration Project	46
Description	46
D&D Technology	52
Description	52
Summary	55

FIGURES

1	D&D Program	2
2	D&D Project Locator Map	3
3	Total Costs Incurred by Project in FY 1996	5
4	Total Fiscal Year Funding FY 1993-FY 1997	6
5	CP-5 Research Reactor Facility	10
6	Decontamination of the CP-5 Facility Hotcell	11
7	Preparation for the Removal of the Vertical Thimble Assembly	12
8	Wrapping the Vertical Thimble in Plastic After Size-Reduction	13
9	Transfer of the In-Core Instrumentation Thimble in a Shield Cask for Later Size-Reduction in the Hotcell	14
10	Robotics Orientation Session included Hands-On Operation of Prototype Unit	15
11	Training Session in Preparation for the CP-5 Robotics Demonstration	16
12	Preparation for Transfer of a NuPac 7-100 Shipping Cask Containing Drums of RH-LW for Burial at Hanford ...	17
13	Ventilation System is Lowered into 330 Basement to Provide HEPA Filtered Exhaust Airflow from D&D Work Areas	18

FIGURES (continued)

14	Building 202 - Location of JANUS Reactor	22
15	Model of JANUS Facility Showing Location of Work Rooms and Areas	23
16	JANUS Facility Orientation	24
17	Reactor Control Panel	25
18	JANUS Characterization - Preparation for Confined Space Entry	26
19	EBWR Under Construction	29
20	EBWR Facility and Outbuildings	30
21	EBWR Plant Perspective Before D&D	30
22	EBWR After D&D	30
23	Hot Cell Before D&D	31
24	D&D Operations in Hot Cell	31
25	Isolation Entry Room	32
26	Hot Cell After D&D	32
27	Gloveboxes Before D&D	33

FIGURES (continued)

28	Transfer of Glovebox to Another Facility	33
29	Bag-Out of Glovebox Contents	34
30	Glovebox Assay	34
31	Size-Reduction and Packaging of Glovebox	34
32	Facility After Glovebox D&D	34
33	Building 310 Retention Tanks	39
34	ZPR/ATSR Facility	40
35	60" Cyclotron Facility	41
36	Building 301 Hot Cells	42
37	Juggernaut Reactor	43
38	Waste Ion Exchange Facility	44
39	Dual-Arm Work Platform	46
40	MACS - Floor Radiation Survey	47
41	Rosie Mobile Work Platform	47

FIGURES (continued)

42	Field-Transportable Beta Counter	48
43	GammaCam - Gamma Radiation Field Imaging	48
44	Pipe Explorer - Pipe and Duct Characterization	49
45	ROTO-PEEN Scaler/Vac-PAC - Milling Decontamination	49
46	Pipe Crawler - Pipe Inspection, Decontamination, and Survey	50
47	Empore Membrane Separation Cartridge - High Capacity Water Treatment	50
48	SRA Surface Contamination Monitor - Automated Surface Survey	51
49	Portable X-Ray Fluorescence Detector - Nondestructive, Real-Time, Elemental Analysis	51
50	Fluid-Based Absorption	52
51	Associated Particle Sealed-Tube Neutron Generator	53
52	Chemical Decontamination	53
53	Particles from Cutting Operations	54

INTRODUCTION

PURPOSE

The Photobriefing Book describes the Decontamination and Decommissioning (D&D) Program at the Argonne National Laboratory-East Site (ANL-E) near Lemont, Illinois. This book summarizes current D&D projects, reviews fiscal year (FY) 1996 accomplishments, and outlines FY 1997 goals. A section on D&D Technology Development provides insight on new technologies for D&D developed or demonstrated at ANL-E. Past projects are recapped and upcoming projects are described as Argonne works to accomplish its commitment to, "Close the Circle on the Splitting of the Atom." Finally, a comprehensive review of the status and goals of the D&D Program is provided to give a snap-shot view of the program and the direction it's taking as it moves into FY 1997.

THE ANL-E D&D PROGRAM

The D&D Program supports the U.S. Department of Energy (DOE) and ANL-E missions by conducting D&D activities that promote compliance with applicable regulations and procedures and that will lead to reuse of facilities when practical. The D&D Program serves as the point of contact at ANL-E for coordination of the responsibilities and interrelationships among Laboratory departments with essential roles in the D&D program. This includes planning, scheduling, and directing D&D activities at ANL-E; planning and scheduling future D&D at ANL-E; and investigating new and innovative approaches to accomplishing D&D project work in a more timely and cost-effective manner. Concern for worker safety and health, public safety and health, and the environment are the first priority of the D&D program at the ANL-E site.

The D&D Program as part of the Technology Development Division also assists DOE in the development and demonstration of new technologies and the transfer of that information to the D&D community. Figure 1 graphically depicts how alliances and contacts within universities, corporations, utilities, and international organizations provide information that is transferred into D&D Operations planning and lessons learned. D&D Technology initiatives provide input and new technologies for D&D Operations. These technologies are demonstrated and the results are fed back for future D&D Operations, D&D Technology, and D&D Planning efforts. Projects report additional Lessons Learned that are communicated back to D&D Planning and D&D Technology to complete the circle. Figure 2 shows the location of D&D projects.

FIGURE 1
D&D PROGRAM

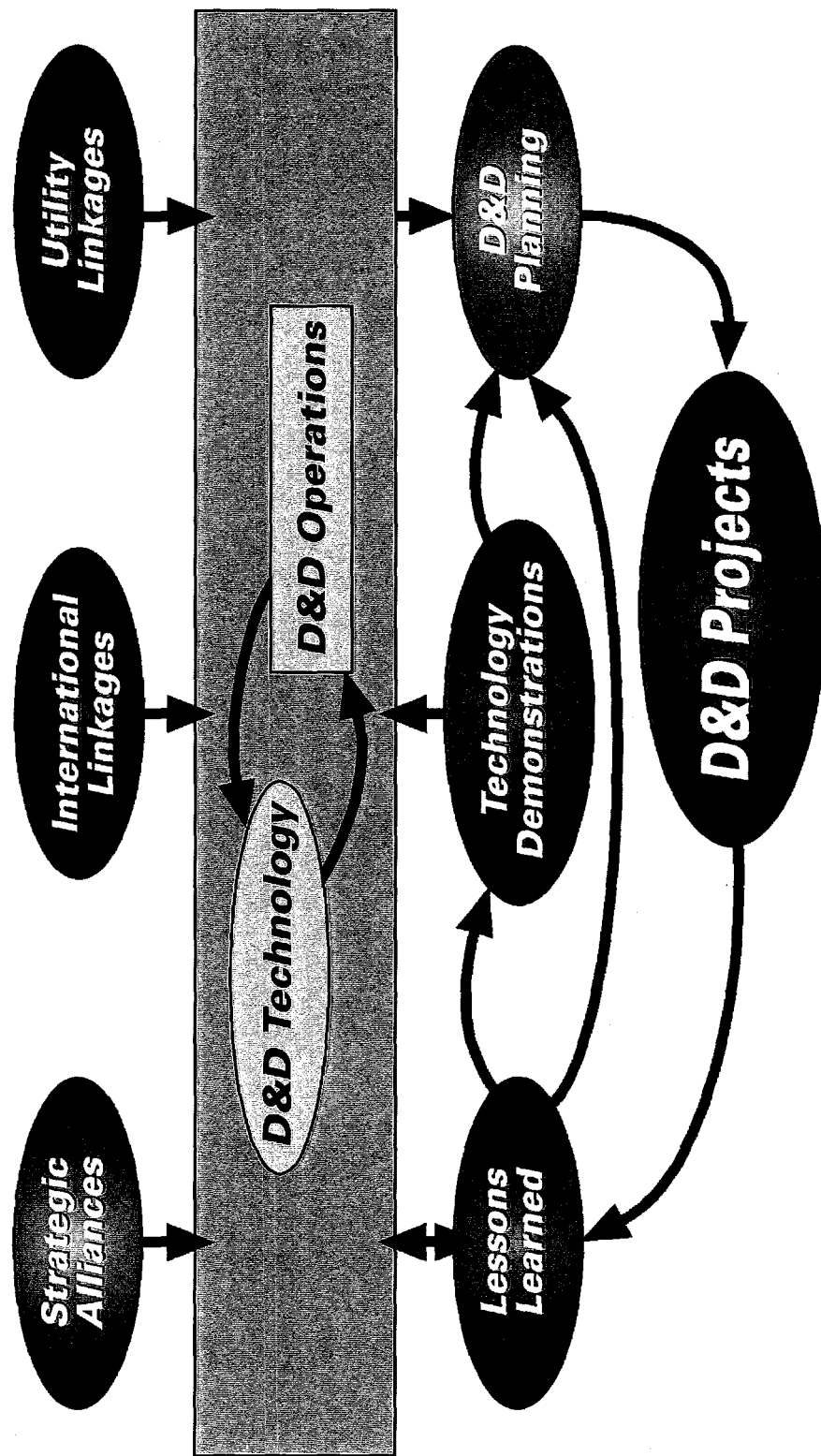
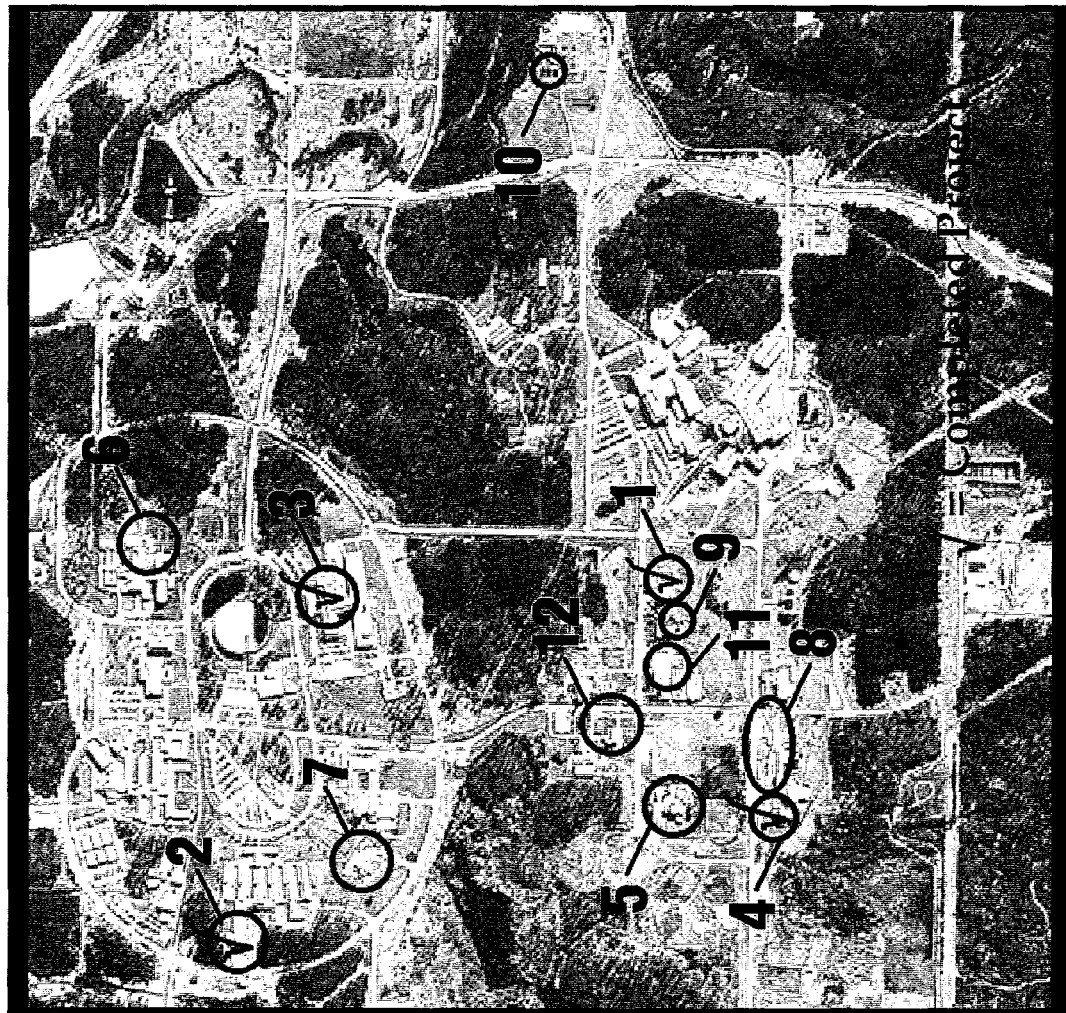


FIGURE 2
D&D PROJECT LOCATOR MAP



D&D Project Locator

- | | |
|-----|--------------------------------------|
| ✓ 1 | EBWR |
| ✓ 2 | Bldg. 200 Hot Cells |
| ✓ 3 | Bldg. 212 Gloveboxes |
| ✓ 4 | FNG |
| 5 | CP-5 Reactor Facility |
| 6 | JANUS Reactor |
| 7 | 60" Cyclotron |
| 8 | ZPR/ATSR |
| 9 | Juggernaut Reactor |
| 10 | Waste Ion Exchange |
| 11 | Bldg. 310 Surplus
Retention Tanks |
| 12 | Bldg. 301 Hot Cells |

During FY 1996 the physical D&D work continued at the CP-5 Reactor facility; the Fast Neutron Generator (FNG) D&D project was completed; D&D planning and characterization activities were initiated and completed for the JANUS D&D project. The total costs incurred by each of these projects in FY 1996 are presented in Figure 3.

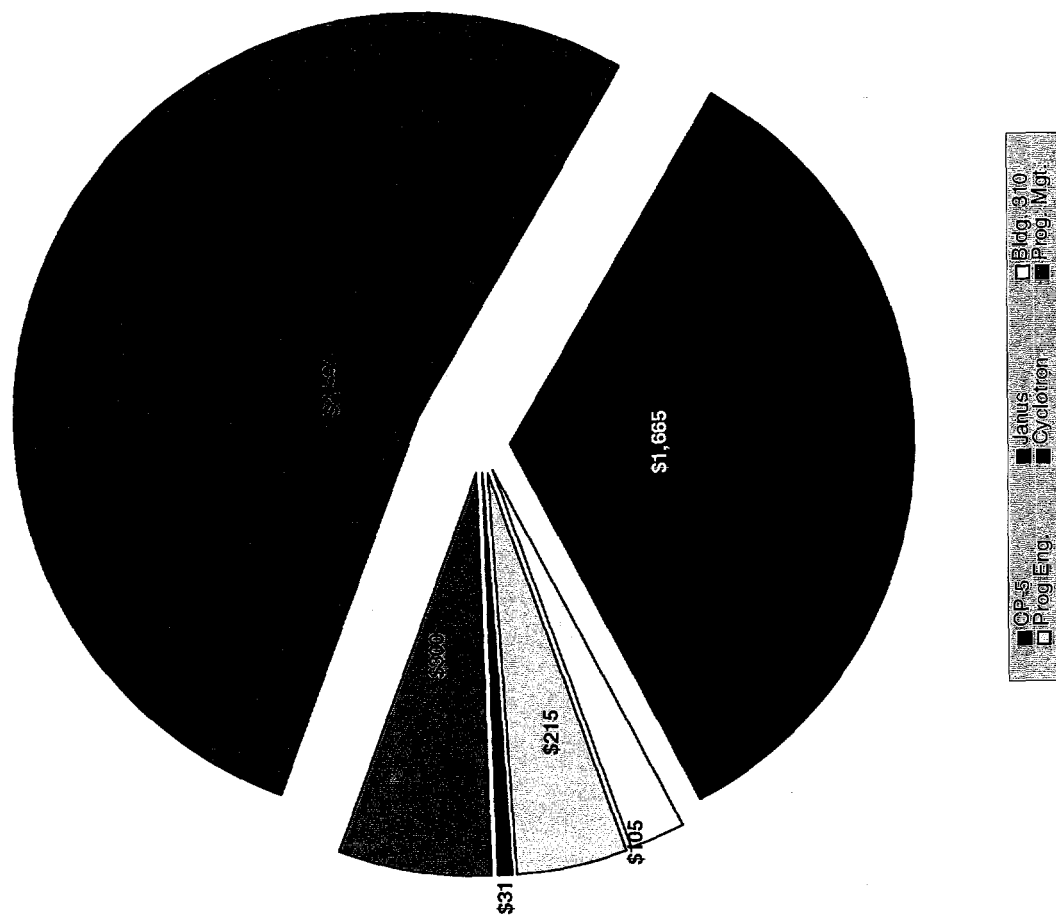
The D&D projects completed to date include:

	<u>Year Completed</u>
• Plutonium Fuel Fabrication Facility (Building 350)	1985
• East Area Surplus Facilities (Buildings 16, 17, 22, 34, 37, 38, 41, and 55)	1987
• Experimental Boiling Water Reactor (Building 331)	1996
• M-Wing Hot Cell Facilities (Building 200)	1996
• Plutonium Gloveboxes (61 gloveboxes in Building 212)	1996
• Fast Neutron Generator	1996

The following ANL-E facilities require future D&D since they are surplus to the mission of the Laboratory. Work on these projects is being planned. Other projects may be added as they are identified, or as research activities are shut down in individual facilities.

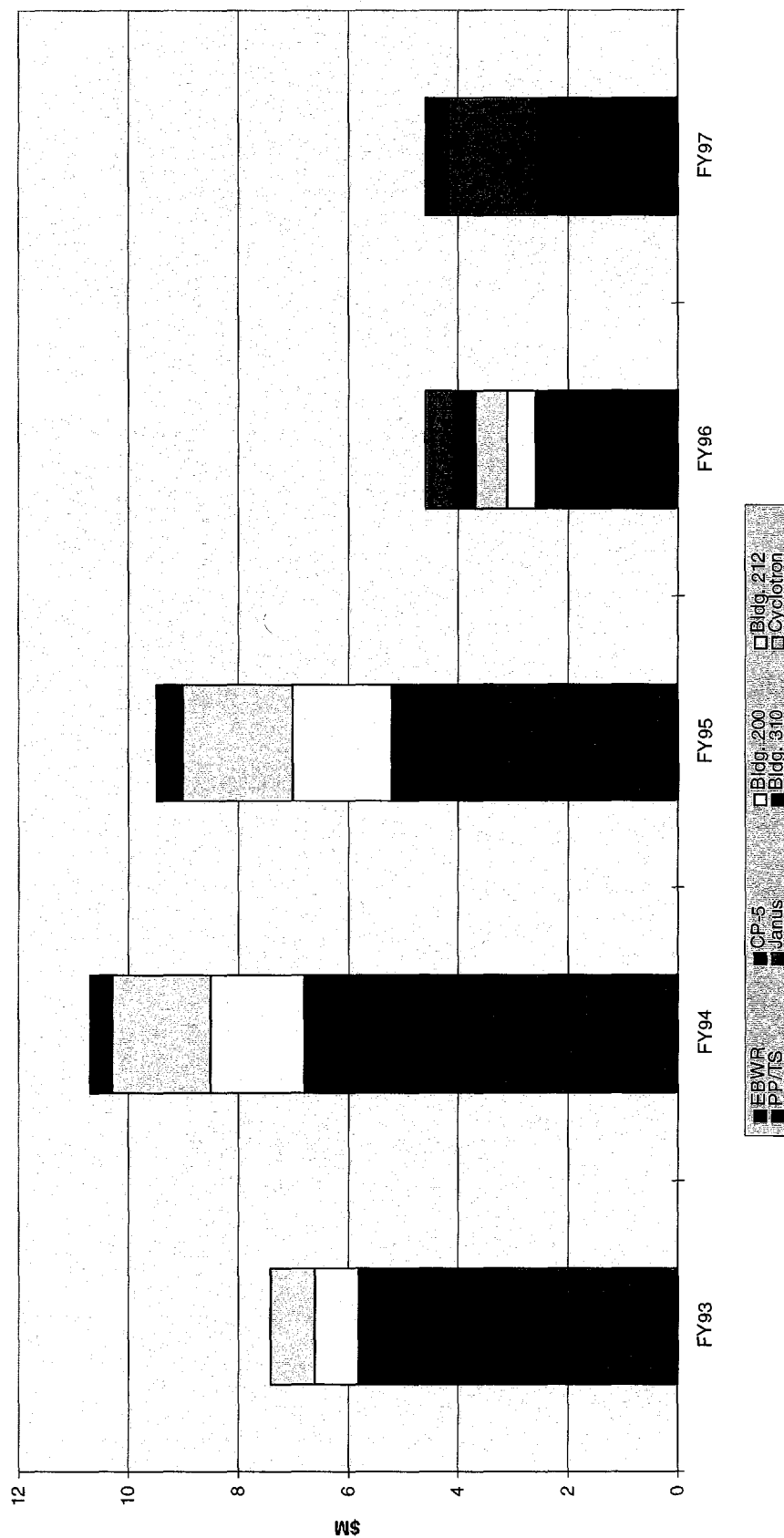
60" Cyclotron	Building 211
Zero Power Reactor (ZPR) Facilities	Building 315
Argonne Thermal Source Reactor (ATSR)	Building 316
Juggernaut Reactor	Building 335
Waste Ion Exchange Facility	Building 579
Surplus Retention Tanks	Building 310
Building 301 Hot Cells	Building 301

FIGURE 3
TOTAL COSTS (IN MILLIONS) INCURRED BY PROJECT IN FY 1996

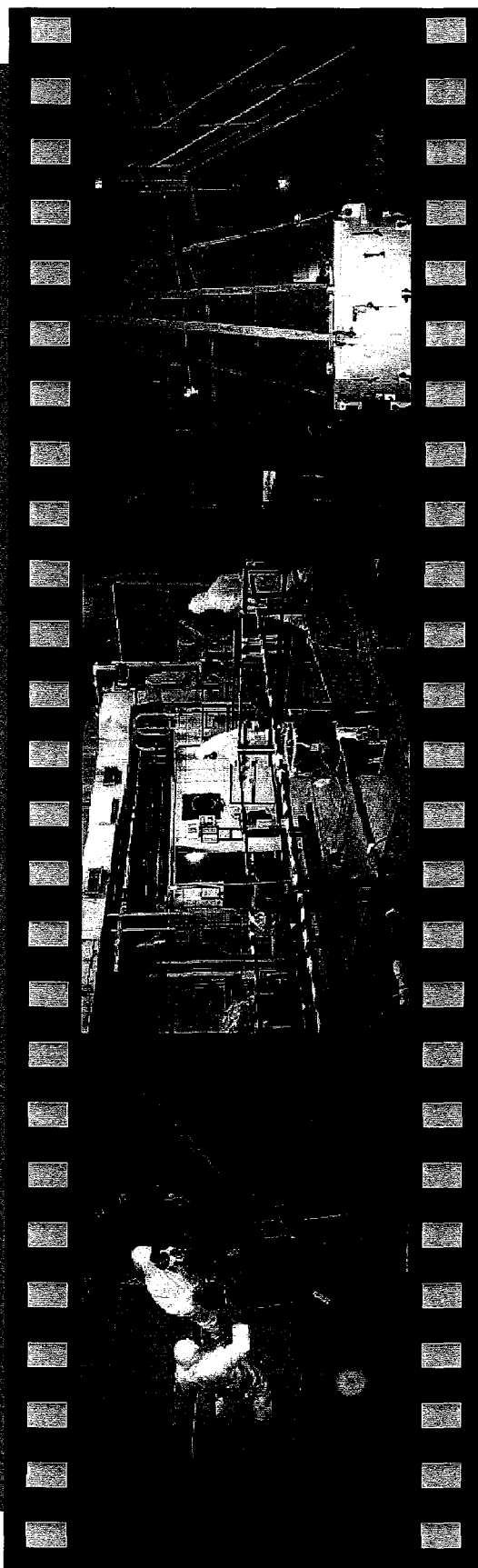


The following chart shows total fiscal year (FY) funding from 1993 to 1997 (projected) by project.

FIGURE 4
TOTAL FISCAL YEAR (FY) FUNDING FY 1993-FY 1997



CP-5 Reactor



CHICAGO PILE-5 (CP-5) REACTOR D&D PROJECT

DESCRIPTION

The Chicago Pile No. 5, or CP-5 Research Reactor Facility, was the principal reactor used to produce neutrons for scientific research at ANL-E from 1954 to 1979. It was a heavy water moderated, enriched-uranium-fueled reactor that operated for the last 19 of its 25-year history at a thermal power of 5 megawatts. During its lifetime, it irradiated more than 27,000 samples for research purposes.

The primary areas of concern associated with this facility include the storage of highly radioactive materials and components associated with reactor operations and the various experiments conducted at the facility over its lifetime. In 1996, the release of tritium from the biological shield was reduced to a level that required no further monitoring.

In September of 1979, the reactor was shut down for the final time. In 1980, all nuclear fuel and heavy water that could be drained were shipped to the DOE Savannah River Plant. In 1990, the partial decontamination and medium-term protective storage of the facility to alleviate the safety and environmental concerns associated with the deterioration of the building and its support systems began. In 1992, the decision was made to continue with the full D&D of CP-5. The scope of this project includes those tasks necessary to dispose of all radioactive materials and the unrestricted release of all areas associated with the facility. Removal of the reactor and its support systems, decontamination of the hot cell facility and fuel pool, and removal of associated radioactive wastes are a few examples of the tasks to be accomplished. These tasks require detailed planning to ensure proper handling of material and to minimize risk to workers. The decommissioning is expected to be complete in the year 2000.

In October 1995, the CP-5 Reactor facility was chosen as the site for the Large Scale Demonstration Project (LSDP). Additional information regarding the progress of the LSDP at CP-5 is provided in the Technology Development section of this document.

FY 1996 ACCOMPLISHMENTS

- Completed the SAFSTOR phase of the CP-5 D&D project.
- Complete the removal, size-reduction, and waste packaging of all 28 of the CP-5 vertical irradiation facilities.
- Completed the removal, size-reduction, and waste packaging of the four reactor shim control rods.
- Completed the removal of various piping, instrument lines and interfaces in preparation for the removal of the reactor upper center shield plug.
- Trained, and certified personnel to operate the two component systems for the CP-5 robotics demonstration.
- Characterized and physically removed two of the four Building 330 retention tanks.
- Participated in the DOE Necessary and Sufficient (N&S) Pilot Program.
- Supported several demonstrations for the Large Scale Demonstration Project (LSDP).

FIGURE 5
CP-5 RESEARCH REACTOR FACILITY (202-715K)

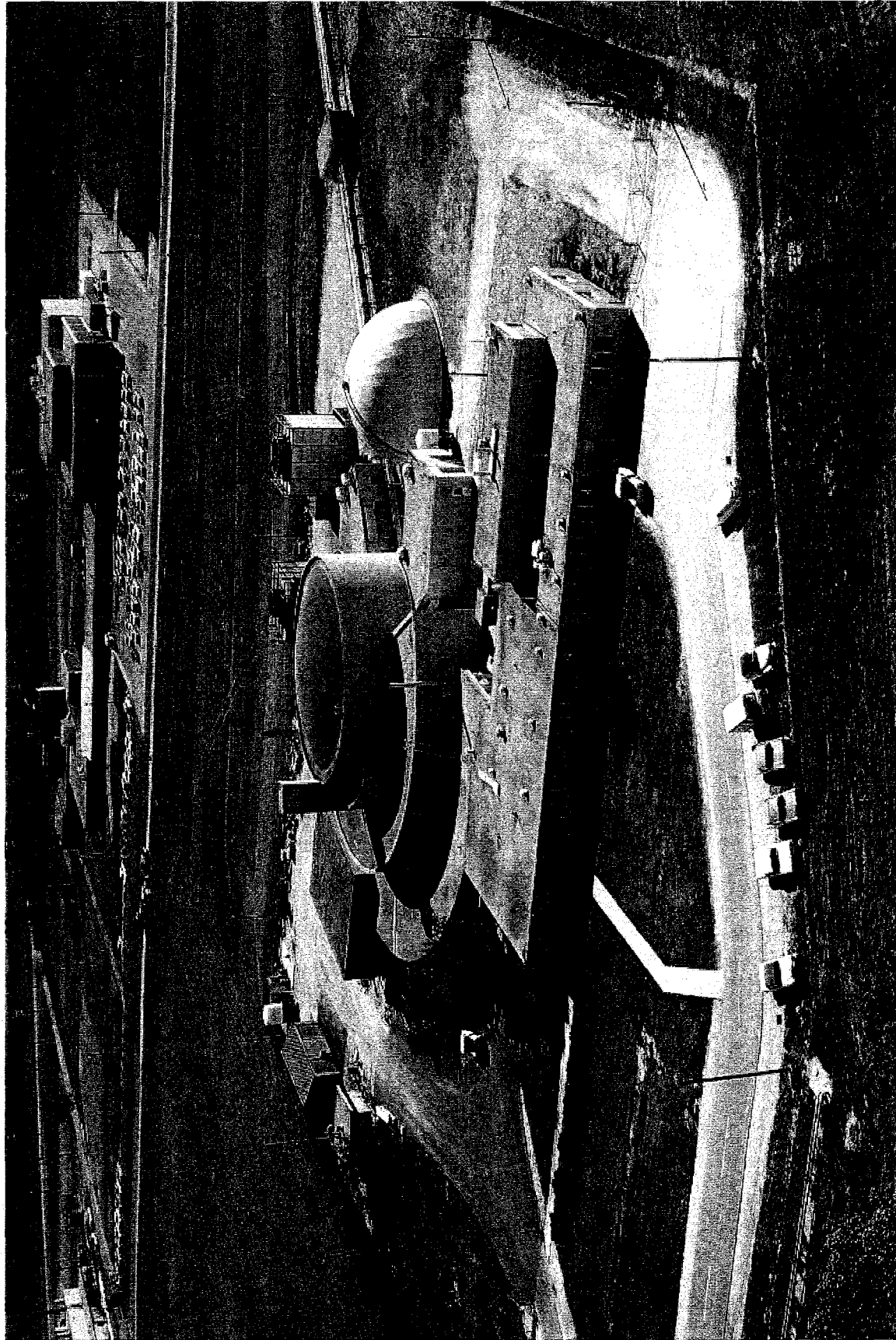


FIGURE 6
DECONTAMINATION OF THE CP-5 FACILITY HOTCELL

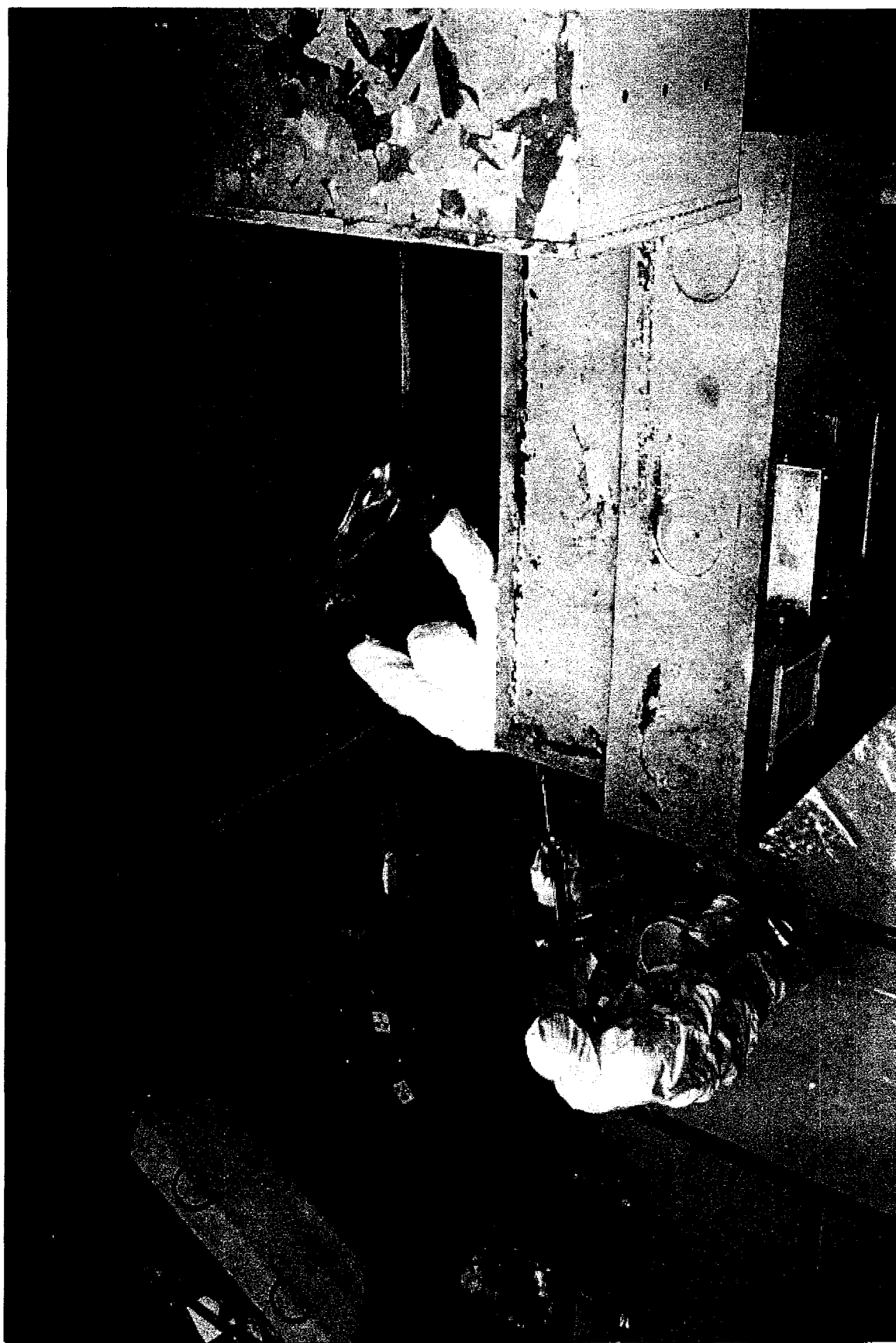


FIGURE 7
PREPARATION FOR THE REMOVAL OF THE VERTICAL THIMBLE ASSEMBLY

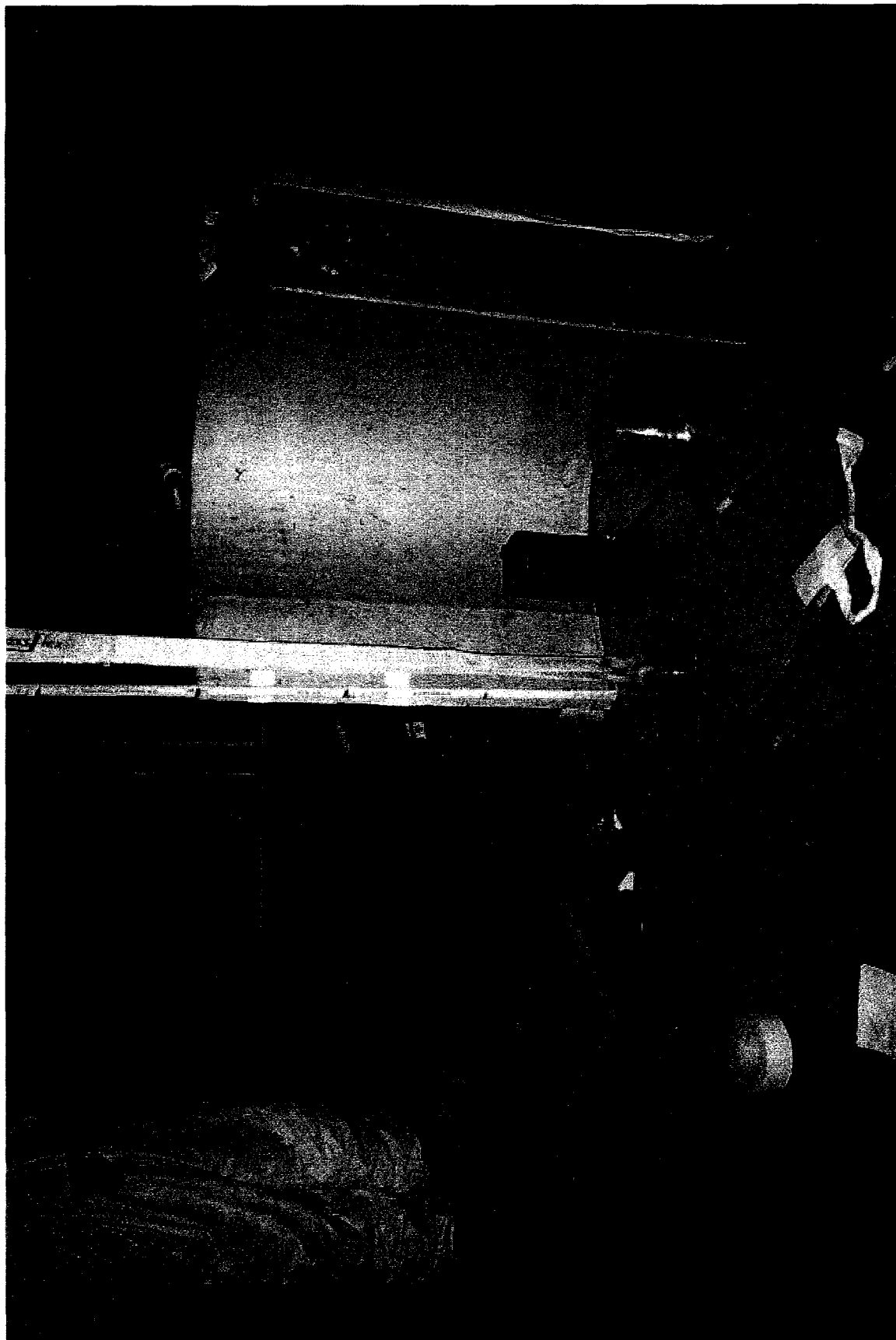


FIGURE 8

WRAPPING THE VERTICAL THIMBLE IN PLASTIC AFTER SIZE-REDUCTION



FIGURE 9
TRANSFER OF THE IN-CORE INSTRUMENTATION THIMBLE IN A SHIELD CASK FOR LATER SIZE-REDUCTION IN THE HOTCELL

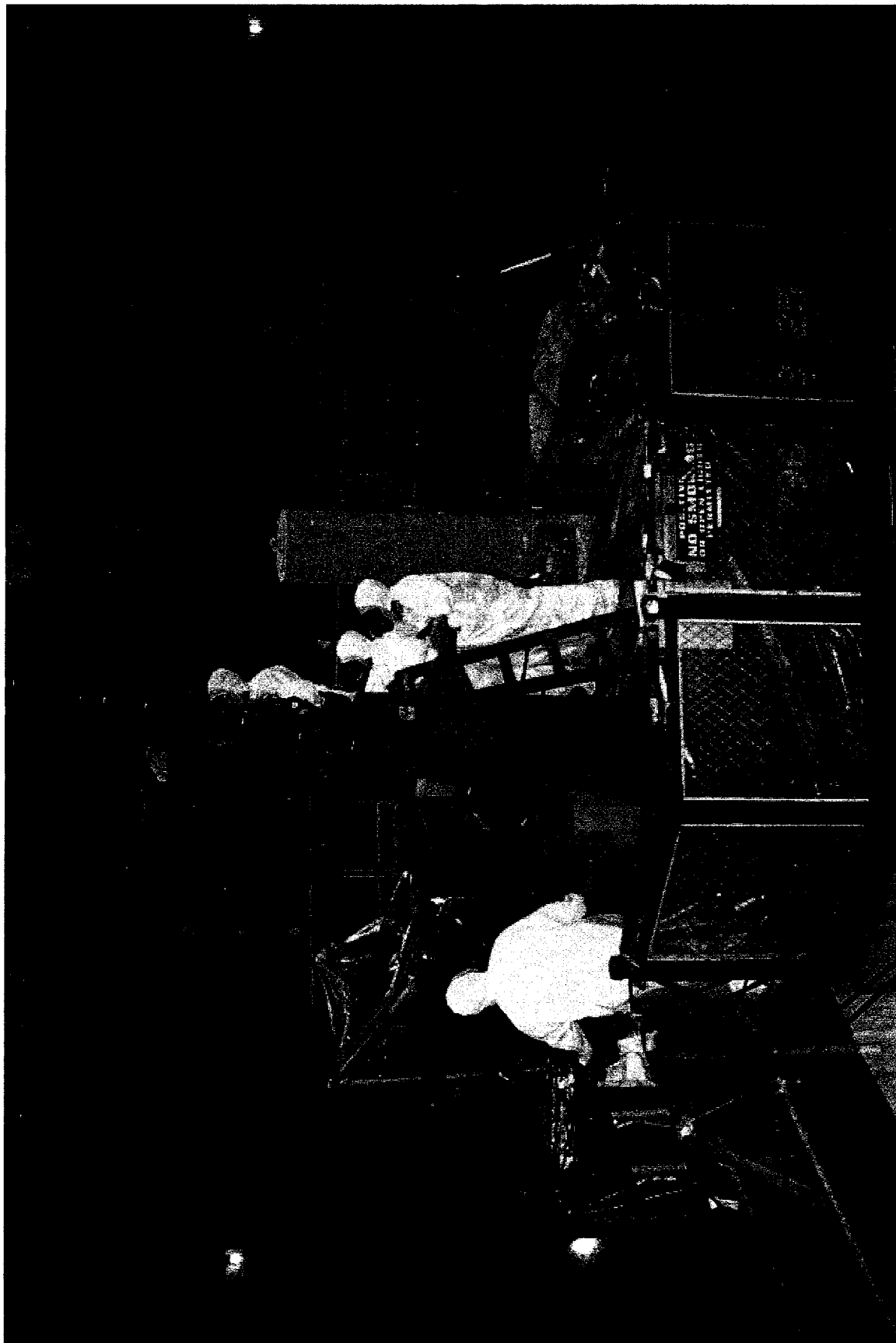


FIGURE 10
ROBOTICS ORIENTATION SESSION INCLUDED HANDS-ON OPERATION OF PROTOTYPE UNIT

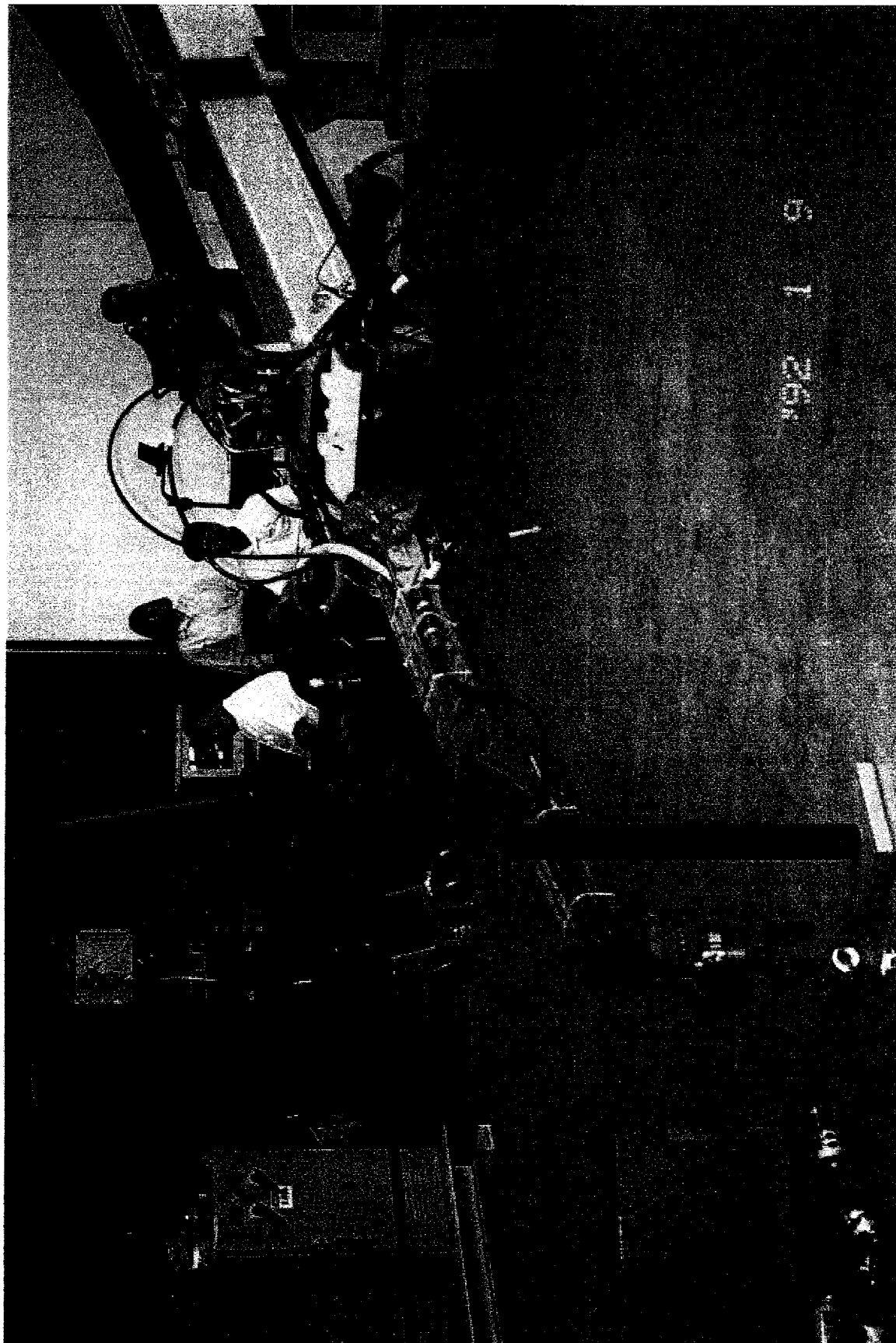


FIGURE 11
TRAINING SESSION IN PREPARATION FOR THE CP-5 ROBOTICS DEMONSTRATION

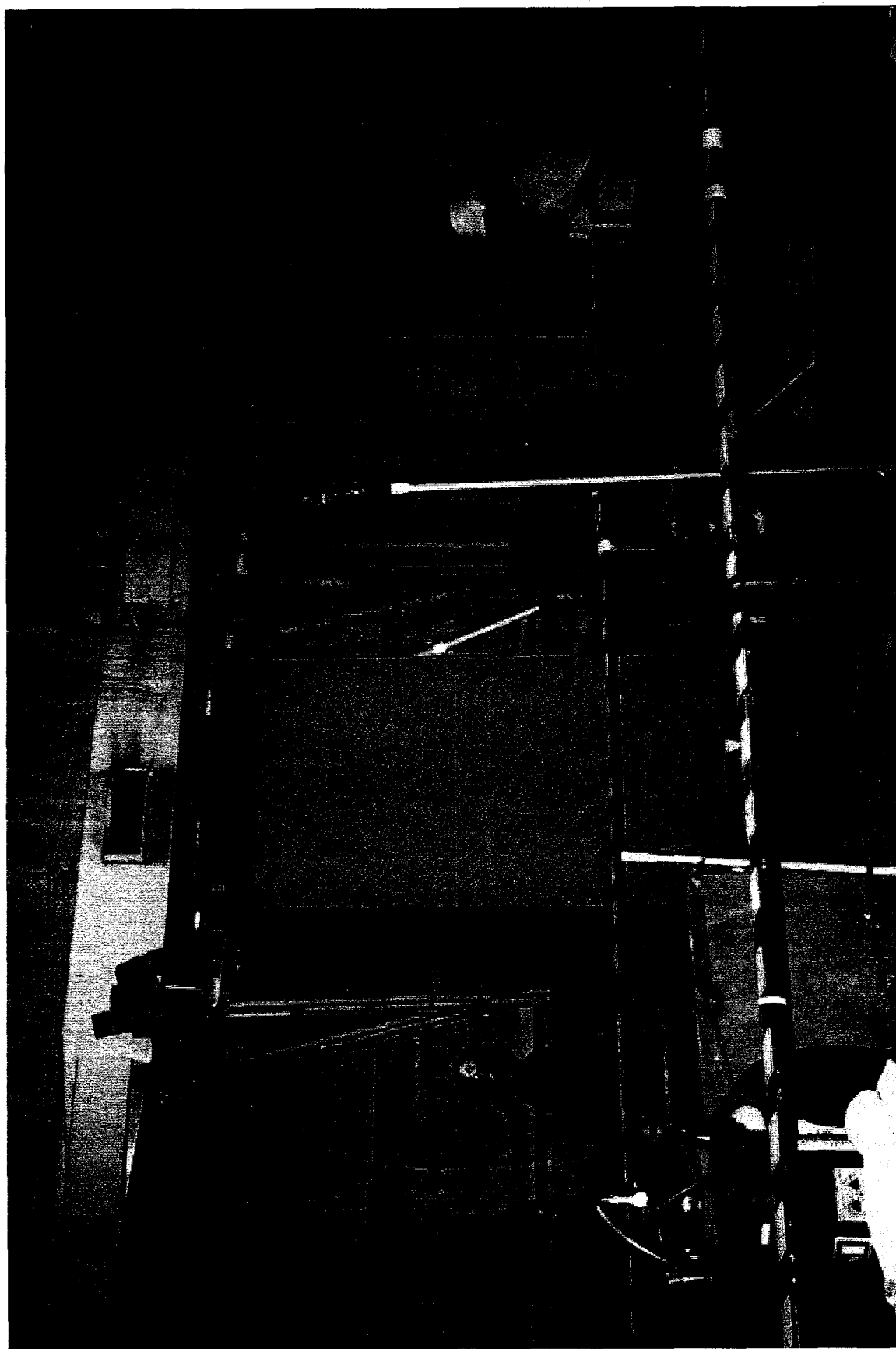


FIGURE 12

PREPARATION FOR TRANSFER OF A NUPAC 7-100 SHIPPING CASK CONTAINING DRUMS OF RH-LW FOR BURIAL AT HANFORD



FIGURE 13

VENTILATION SYSTEM IS LOWERED INTO 330 BASEMENT TO PROVIDE HEPA FILTERED EXHAUST AIRFLOW FROM D&D WORK AREAS



FY 1997 GOALS

- Remove the center and outer shield plugs.
- Complete removal of reactor vessel and internals.
- Provide support for the CP-5 Large-Scale Demonstration Project (LSDP).

JANUS Reactor



JANUS REACTOR D&D PROJECT

DESCRIPTION

The JANUS Reactor at Argonne National Laboratory is in Building 202 and was operational from August 1963 to March 1992. The reactor was used to test the biological effects of neutron exposure on dogs and mice. Nuclear fuel was removed from the reactor and shipped off-site in 1993. Residual radioactivity is present in the reactor vessel from neutron activation. Radioactivity levels in the reactor shielding have been measured at levels up to 175 mrem/hr.

The D&D efforts required for this project include the disassembly, size-reduction, packaging, and disposal of all radioactive materials associated with the facility. Upon completion of the component removal, the rest of the facility will be decontaminated to levels that will allow its release for unrestricted use by other Laboratory programs.

FY 1996 ACCOMPLISHMENTS

- Completed JANUS characterization and report.
- Drafted NEPA Scoping document.
- Received approval for Auditable Safety Analysis document.
- Environmental Assessment approved by DOE. Finding of No Significant Impact (FONSI) was issued.
- Completed Project Management and Surveillance and Maintenance (S&M) plans.
- Issued Request for Proposal (RFP) and held prebid meeting with tour of the facility.

FIGURE 14
BUILDING 202 - LOCATION OF JANUS REACTOR



FIGURE 15
MODEL OF JANUS FACILITY SHOWING LOCATION OF WORK ROOMS AND AREAS (22163K #26A)

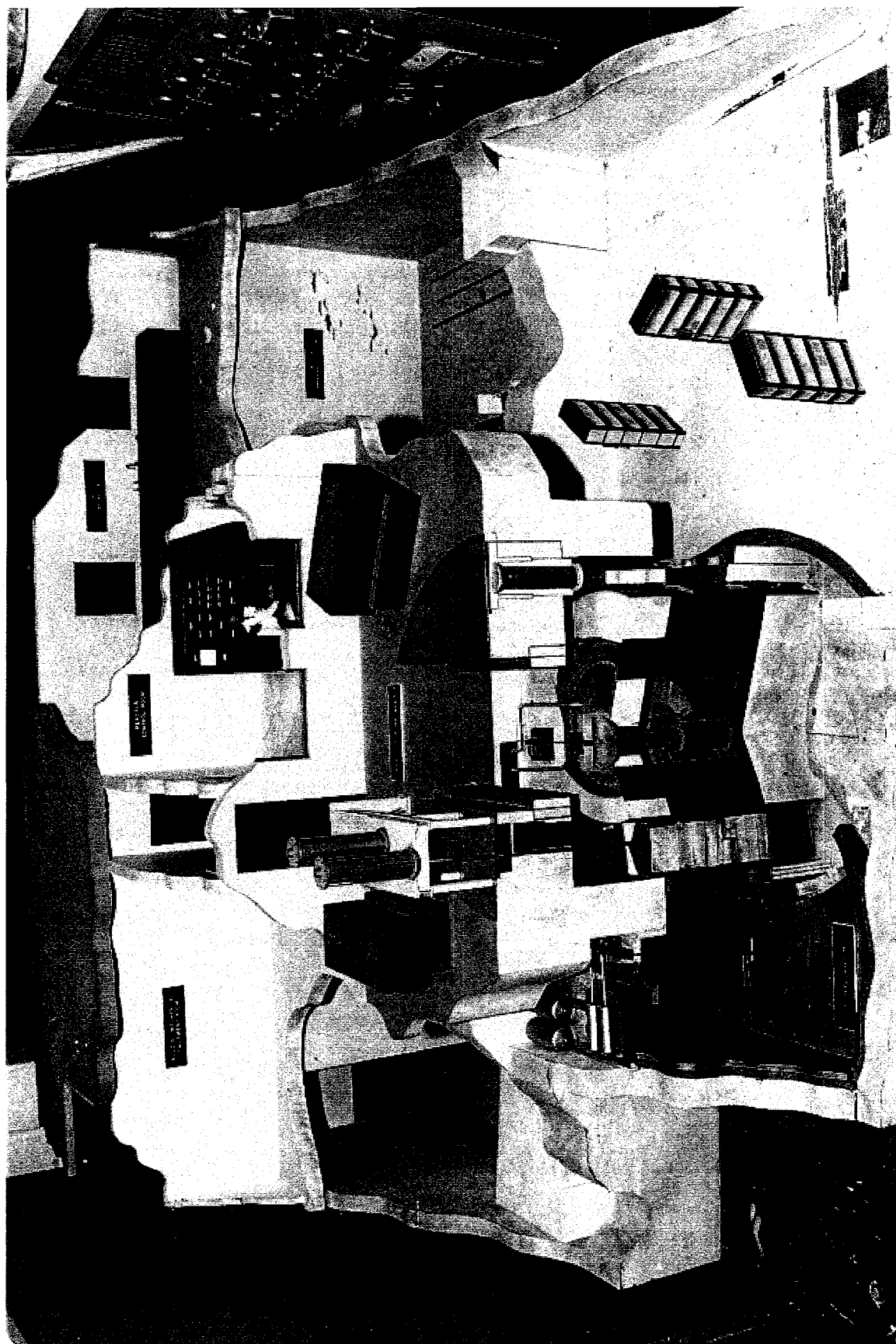


FIGURE 16
JANUS FACILITY ORIENTATION

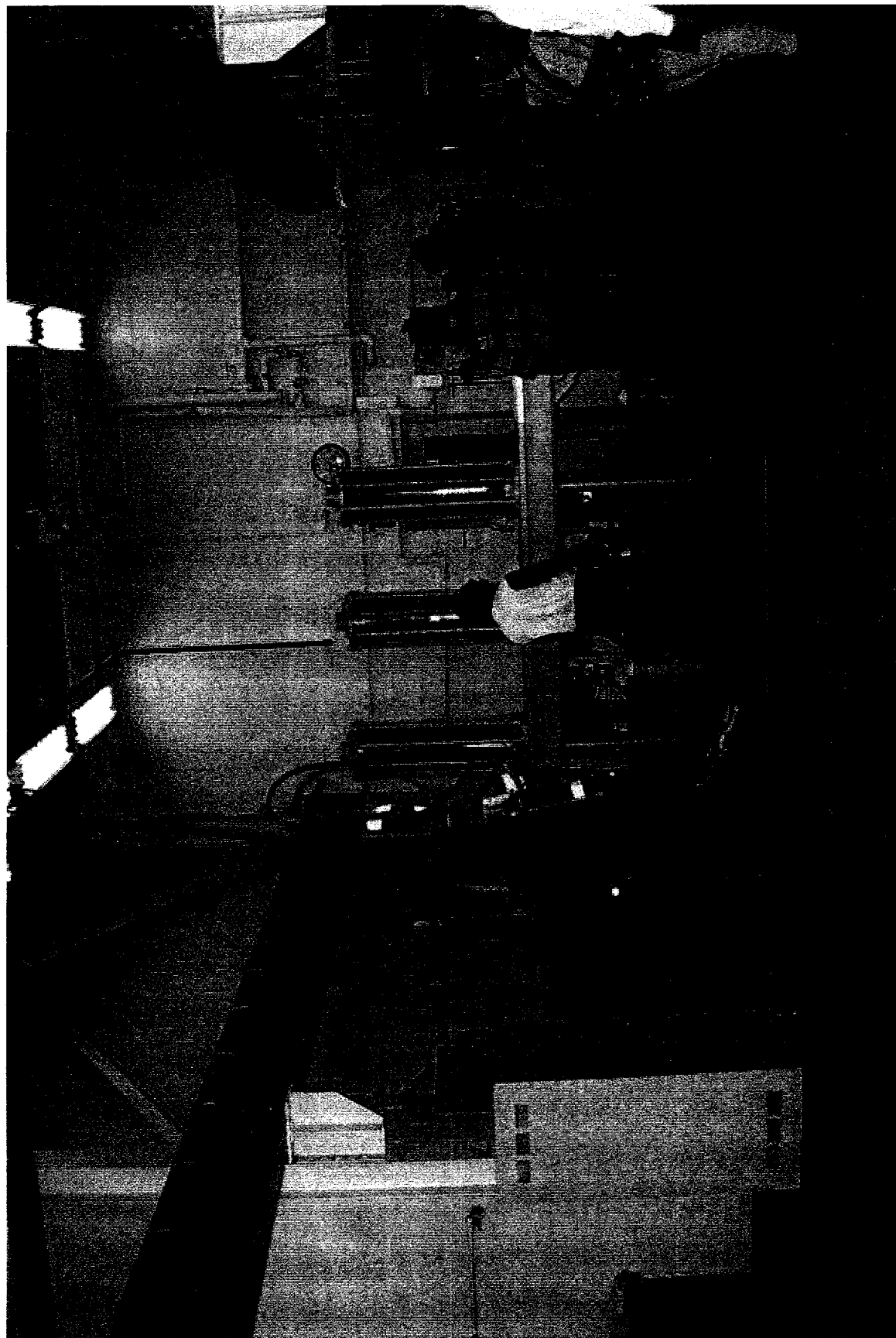


FIGURE 17
REACTOR CONTROL PANEL (20476K #7A)

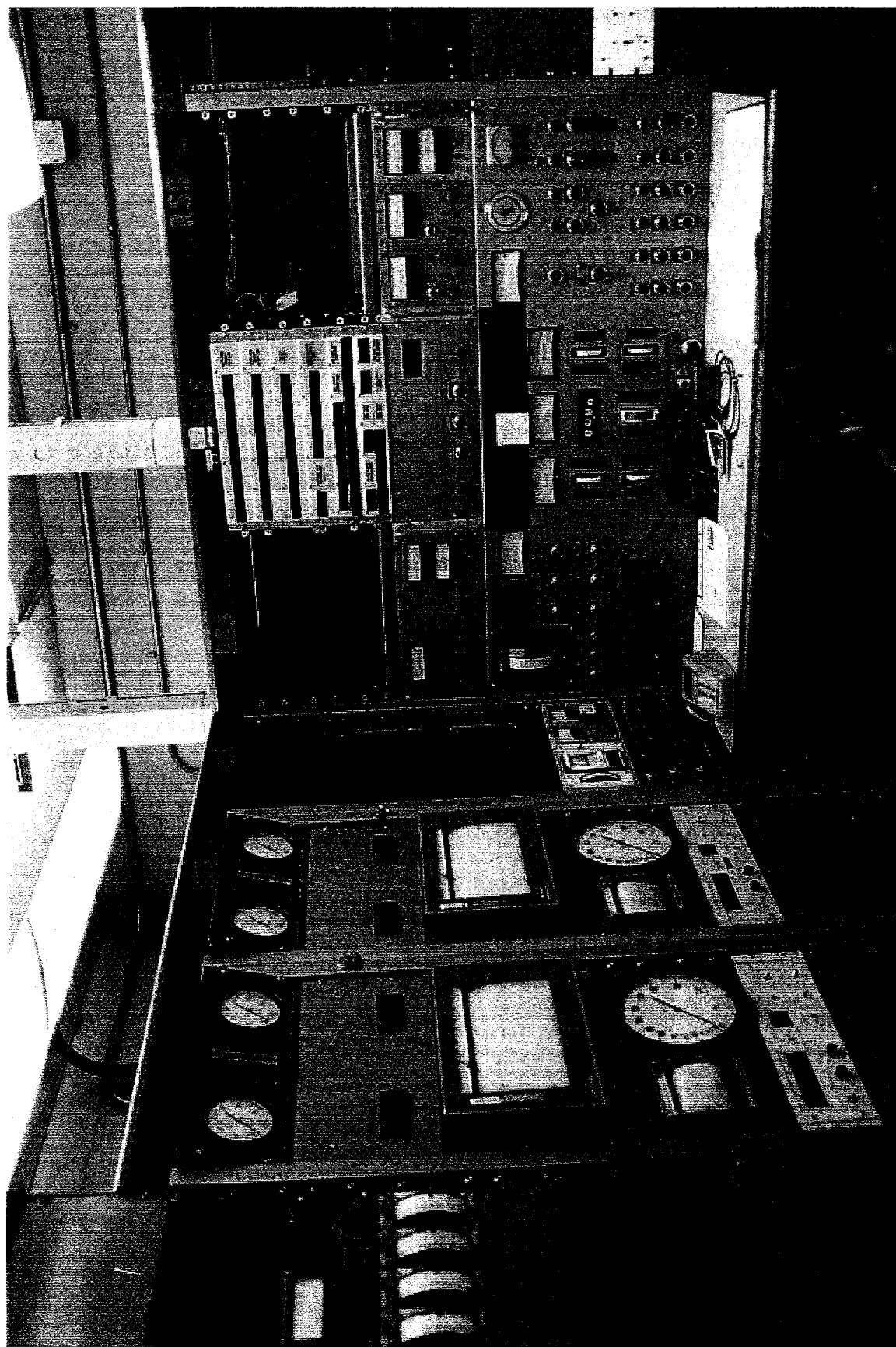


FIGURE 18

JANUS CHARACTERIZATION - PREPARATION FOR CONFINED SPACE ENTRY



FY 1997 GOALS

- Secure contractor for decommissioning.
- Complete decommissioning.
- Issue Final Report.
- Turn Facility over.

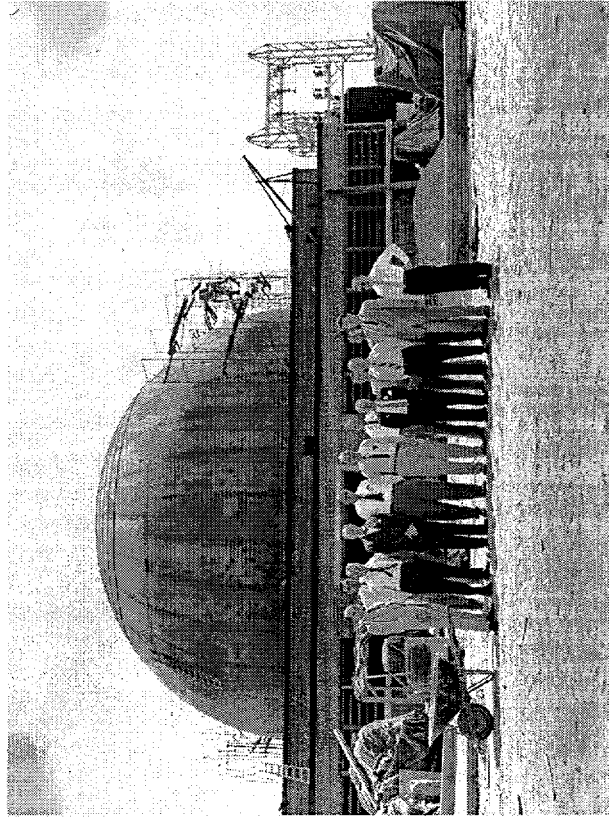
Completed Projects



EXPERIMENTAL BOILING WATER REACTOR (EBWR)

D&D PROJECT

FIGURE 19
EBWR UNDER CONSTRUCTION (201-1523)



The Experimental Boiling Water Reactor, or EBWR, was operated from 1956 to 1967 to demonstrate the use of a boiling water reactor as a heat source to generate electricity. The unique structure that housed the power plant was a huge steel shell, half underground, giving complete protection against the escape of radiation.

The EBWR facility was shut down and placed in a dry lay-up condition in 1967. Although EBWR had been shut down, radioactive contaminants were still present in the reactor vessel and the bioshield. As part of the dry lay-up, all reactor fuel was removed, reactor systems were flushed and drained, and water was treated for disposal. Several of the outbuildings were either demolished or converted for reuse prior to 1980.

The EBWR D&D project was initiated in 1986. The primary areas of concern associated with the facility were the induced radioactivity of the reactor internals, the reactor vessel, and the biological shield. This project represented one of the few high-power reactor D&D projects in the world.

The final D&D operational stage began in June 1994. The remaining contamination was cleaned up and all contaminated materials were removed from the facility. It was completed February 1996.

FIGURE 20
EBWR FACILITY AND OUTBUILDINGS (202-312)

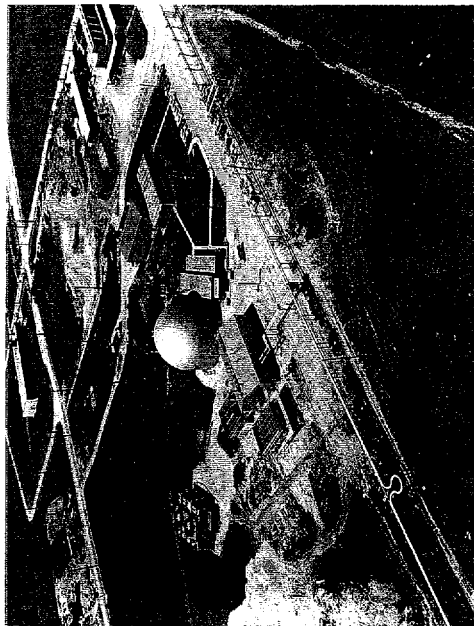


FIGURE 21

EBWR PLANT PERSPECTIVE BEFORE D&D (700-88)

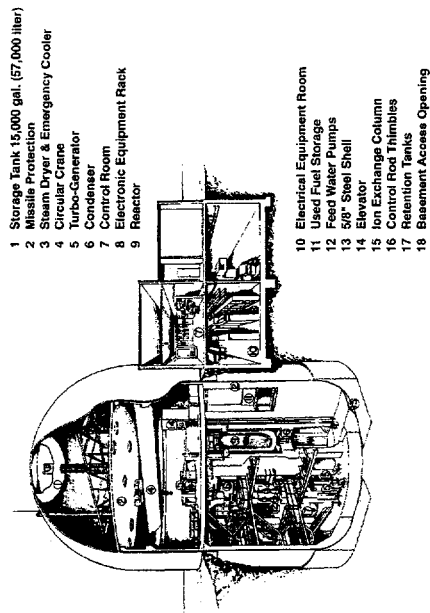
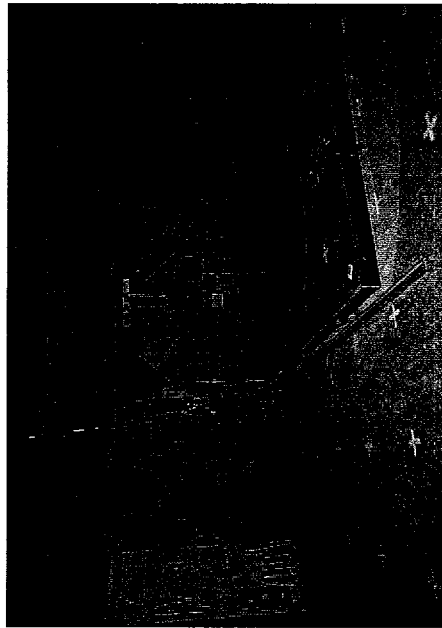


FIGURE 22
EBWR AFTER D&D (21023K #4)



BUILDING 200 M-WING HOT CELLS D&D PROJECT

The Building 200 M-Wing hot cells decontaminated and decommissioned include A-1, K-1, K-3, M-1, and M-3. Hot cells K-1, K-3, M-1, and M-3 were used for a U.S. Navy/ANL Proof-of-Breeding (POB) research program that was part of a national DOE effort to develop technology for breeding Uranium-233 (U-233) from Thorium-232 (Th-232) in light-water reactors.

Hot Cell K-1 was used as a waste processing cell; Hot Cell K-3, as an analytical cell; Hot Cell M-1, as a dissolver cell; and M-3, as a fuel shearing cell.

FIGURE 23

HOT CELL BEFORE D&D (17411 #5)



The research work with irradiated blanket fuel pins from the Shippingport Reactor was completed in 1985. Hot Cell A-1 was used for examination of irradiated reactor fuel specimens from the Commonwealth Edison Zion Nuclear Power Station. The fuel specimens were sheared, pulverized, dissolved, and analyzed to learn their isotopic composition. After completion of the research work, neutralized/cemented waste from the POB project was packaged and shipped to the DOE Idaho disposal site, and the contaminated equipment and structures in the hot cells were left in place.

FIGURE 24

D&D OPERATIONS IN HOT CELL (20536K #16)



The objective of the project was to reduce the emission of 2,600 curies of radioactivity from radon-220 substantially (Rn-220) each year, thereby removing the major source of radioactive air emissions at ANL-E. The hot cells were remotely decontaminated using manipulator arms before workers were permitted to enter. The manipulators and bridge cranes in hot cells K-1, M-1, and M-3 were used to bag equipment for loading into waste containers in the cave corridors. Manipulators in hot cells A-1 and K-3 were used to move equipment for loading into waste containers in the cave corridors.

After all small equipment was removed from a hot cell, a plastic sheet isolation entry room was built at the doorway. Alpha shields, false floors, false ceiling panels, framework, large equipment was removed by workers. The project was completed in April 1996.

FIGURE 25
ISOLATION ENTRY ROOM (19242K #6A)

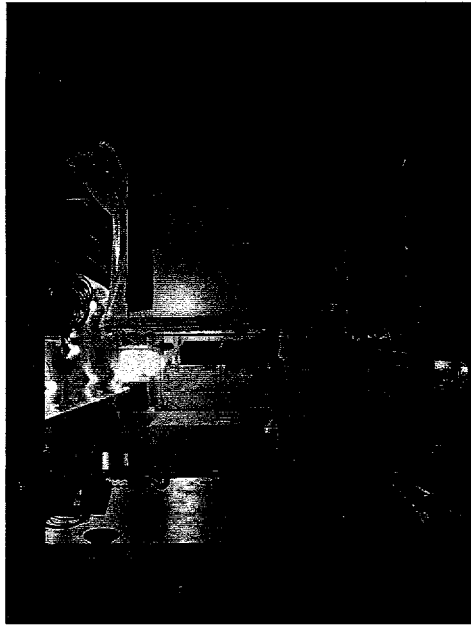
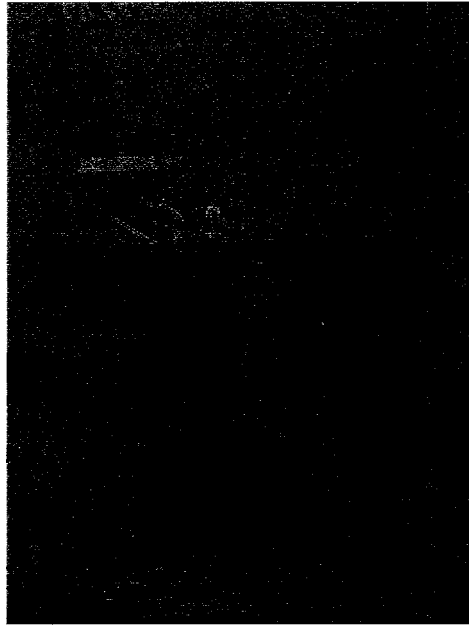


FIGURE 26
HOT CELL AFTER D&D (21249K #14)



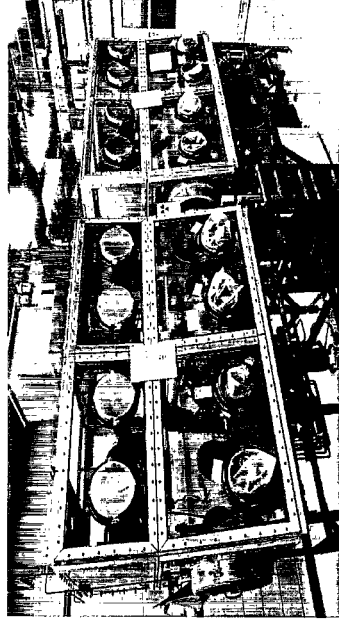
BUILDING 212 PLUTONIUM GLOVEBOXES D&D PROJECT

A total of 61 plutonium gloveboxes in Building 212 D-Wing were used in various DOE energy research programs to support unirradiated reactor fuel composition research and basic studies on TRU metals. The programs were phased out, and the gloveboxes were decommissioned. The primary contaminants in the gloveboxes were plutonium, americium, and uranium.

The D&D of the gloveboxes included removal and packaging of the glovebox contents; decontamination, size reduction, and packaging of the glovebox; and removal of contaminated external glovebox support systems.

The nine laboratories in Building 212 were to be left in a clean, unrestricted use condition for subsequent programmatic research use. The objective of this project was to remove the risk associated with the surplus plutonium-contaminated gloveboxes in these laboratories and to allow the use of the facilities for future DOE programmatic research. The project was completed in January 1996.

**FIGURE 27
GLOVEBOXES BEFORE D&D (6594K #30)**



**FIGURE 28
TRANSFER OF GLOVEBOX TO ANOTHER FACILITY**

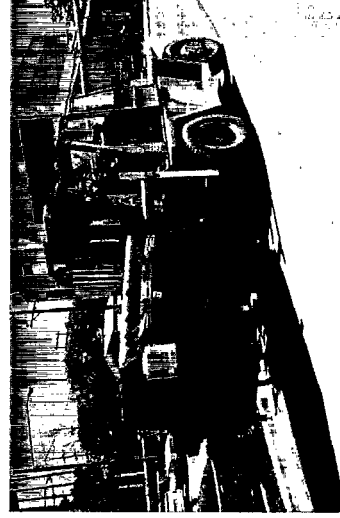


FIGURE 29

BAG-OUT OF GLOVEBOX CONTENTS (15494K #35)

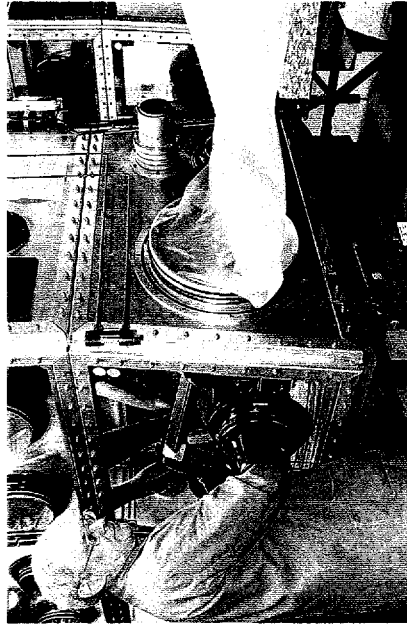


FIGURE 31

SIZE-REDUCTION AND PACKAGING OF GLOVEBOX (19241 #32)



FIGURE 30

GLOVEBOX ASSAY

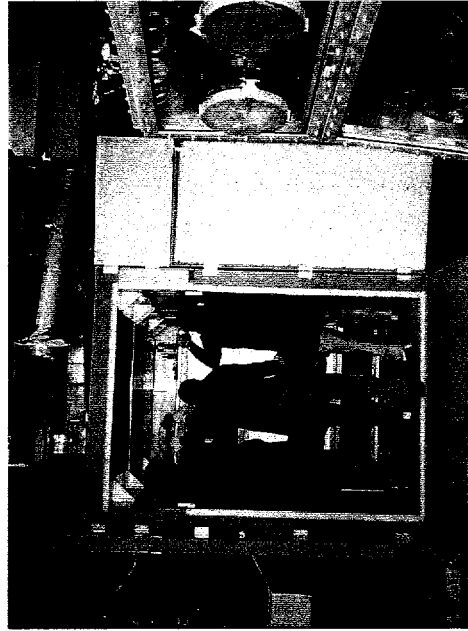
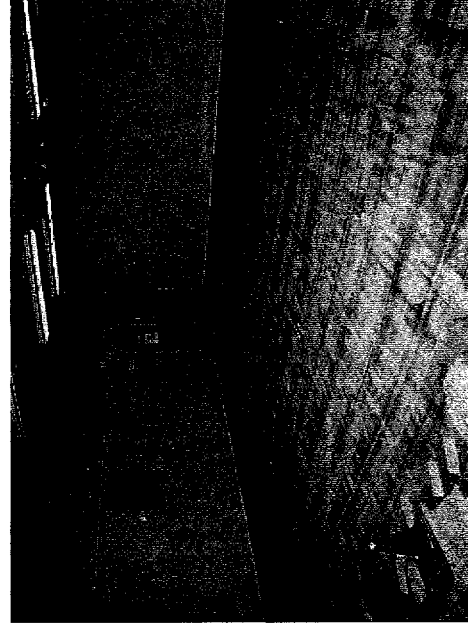


FIGURE 32

FACILITY AFTER GLOVEBOX D&D (20930K)



EAST AREA CONTAMINATED SURPLUS FACILITIES

The "East Area" at Argonne National Laboratory was built in the late 1940s and early 1950s to provide temporary quarters until permanent buildings were available for the ANL staff that had been on the University of Chicago campus. The structures were mostly "Quonset huts" but some were made of sheet metal or concrete blocks. The facilities were only expected to last a few years, but due to the constant space shortage at the Laboratory, many remained in use until the 1980s.

The overall purpose of this project was to eliminate seven unneeded radioactively contaminated surplus facilities from the Argonne site in a way that allowed the buildings to be released for conventional demolition and the land returned to unrestricted use. The seven facilities included in the project are listed below in the order the D&D work was carried out.

- Building 37 - Fan House # 1
- Building 16F - Nuclear Materials Storage Vault
- Building 41 - Pangborn Dust Collector
- Building 38 - Fan House # 2
- Building 17 - "Hot" Machine Shop
- Building 34 - Industrial Waste Treatment Plant
- Building 22 - Nuclear Research Laboratory

The seven facilities had been used with operations involving radioactive materials, which resulted in their becoming contaminated with low levels of uranium and thorium. Because each was 30 to 35 years old and in a deteriorated condition, no beneficial reuse appeared economical. The buildings were declared surplus and were accepted into the Department of Energy's Surplus Facilities Management Program (SFMP).

Initially only six facilities were identified. They consisted of a machine shop that fabricated materials that were radioactive or were components of radioactive systems, three air filtration buildings, and a small industrial waste treatment plant that treated radioactive exhaust air and contaminated liquids, and a nuclear storage vault. A vacated nuclear research facility was later added to the program without extending the original schedule or requiring any additional funding. For additional information refer to ANL-87-18, "*Decontamination and Decommissioning of the Argonne National Laboratory East Area Radioactively Contaminated Surplus Facilities Final Report.*"

BUILDING 350 PLUTONIUM FABRICATION FACILITY D&D PROJECT

Building 350, located in the 300 Area at Argonne National Laboratory housed the Plutonium Fabrication Facility that became operational in 1959. Hundreds of kilograms of plutonium in metallic form and other fissile materials were processed in this facility used extensively during its fifteen-year operating span for developing methods for alloying, casting, machining, cladding, and assembling fuel elements. To accomplish this purpose the facility contained a variety of equipment, from small scale laboratory instruments to full-sized rolling mills, machine tools, hydraulic presses and a variety of furnaces all of which were inside various sized gloveboxes.

In 1973, ANL began consolidating and upgrading its plutonium-handling operations with the result that a research fuel-fabrication facility was determined to be unnecessary for further programmatic work. The facility was shut down and declared surplus. The building was later designated as the new location of the New Brunswick Laboratory, moved to ANL-East from its New Brunswick, New Jersey site.

The objective of the decommissioning project was to safely D&D all unusable radioactive components, including those in controlled storage, and send them offsite to a DOE transuranic (TRU) retrievable storage facility or dispose of materials as low-level waste as applicable. The overall purpose of the project was to eliminate a surplus facility from the ANL site and provide additional space to house the New Brunswick Laboratory.

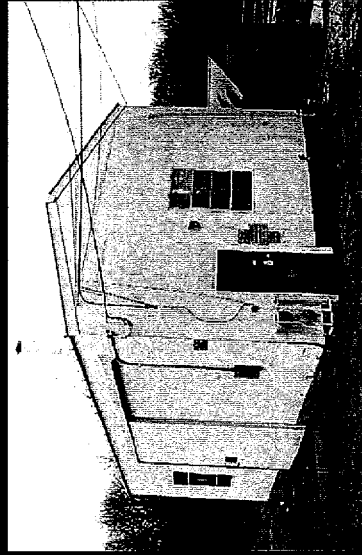
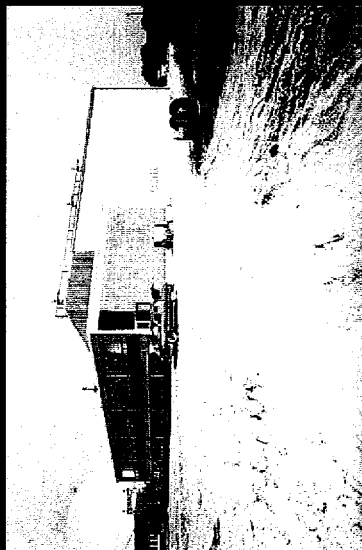
For additional information refer to ANL-85-37, "Decontamination and Decommissioning of the Argonne National Laboratory Building 350 Plutonium Fabrication Facility Final Report."

FAST NEUTRON GENERATOR D&D PROJECT

The Fast Neutron Generator (FNG) was a high-intensity, tandem, negative-ion accelerator operating on the Dynamitron principle. The accelerator was situated in a shielded vault and operated in both pulsed and steady-state modes. This facility was used for the production of various types of neutron sources. The mission of the FNG was the determination of nuclear-reaction cross sections and investigation of microscopic nuclear properties of materials. The materials studied were used in applications of nuclear energy in defense, space, commercial power production, mineral exploration, and other nuclear applications.

The FNG facility occupied Building 314 which is at the west end of the Building 316 complex. An annex to Building 314 was used as a service area for the facility. The facility became operational in 1969 and was in operation until its shutdown in 1992. From 1992 to early 1996, ANL personnel conducted remedial activities at the facility. Characterization efforts were completed in January 1995. Major components were removed from the facility for use by other ANL organizations. D&D Project efforts were completed and the facility was released for unrestricted use in October 1996, two months ahead of schedule.

Future Projects

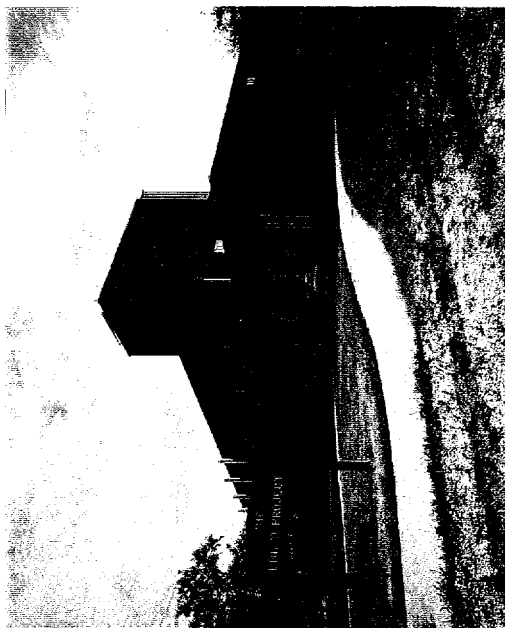


BUILDING 310 RETENTION TANKS D&D PROJECT

Ten surplus retention tanks on the service floor of Building 310 were formerly used to store liquid low-level waste. The tanks have not been used since 1975. However, the tanks remain contaminated with low-level radioactivity. Fixtures and pipes leading to the tanks must also be removed and disposed of along with the tanks.

The ten surplus tanks will be emptied of any remaining liquids or sludge. The tanks, interconnecting pipes, drain pipes, pipe supports, and drain fixtures will be size reduced, segregated, packaged, and shipped for disposal. The area where the tanks were will be decontaminated to levels that will allow the area to be released for unrestricted use.

FIGURE 33
BUILDING 310 RETENTION TANKS (#104-76-204)



ZPR/ATSR D&D PROJECT

The purpose of this project is to decommission Zero Power Reactors (ZPR) 6 and 9 and the Argonne Thermal Source Reactor (ATSR), including associated equipment and process systems. This will permit release of cells 4 and 5 in Building 315, and the ATSR area in Building 316, for unrestricted use.

The ZPR-6 and ZPR-9 facilities were low power experimental reactors used from the early 1960s until 1982 for reactor physics measurements and studies. Uranium and plutonium fuels were used to learn 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, and a separate work room used to load fuel drawers is between the cells.

The ATSR, a highly enriched, light water-moderated thermal reactor, operated from 1953 to 1988 and served as a source of neutrons for ANL experimental research programs. The main components of the facility are the reactor, the control console, instrumentation, personnel shielding, and the reactor experiment room.

FIGURE 34
ZPR/ATSR FACILITY (134-584K)

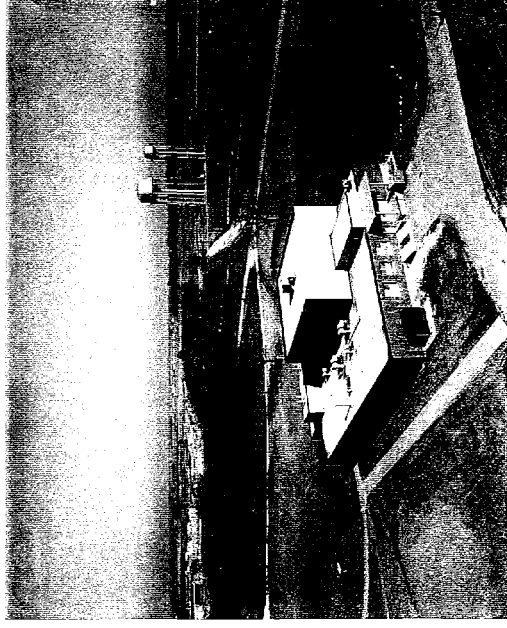


60" CYCLOTRON FACILITY D&D PROJECT

The purpose of this project is to decommission the 60" Cyclotron and permit the release of space in Building 211, for unrestricted use. The constant-frequency cyclotron, built in 1952, was used to aid basic research and met widely diversified requirements, producing deflected beams of deuterons, helium ions, singly-charged hydrogen molecules, and neutrons of a broad energy spectrum. The cyclotron was used for research in the fields of heavy element chemistry, nuclear activation activities, nuclear scattering, solid state physics, radiation chemistry, isotope production, and radiation biology.

The scope of the project includes the disassembly, size-reduction, segregation, packaging, and disposal of all radioactive materials associated with the facility. Upon completion, the facility will be decontaminated to levels that will allow the release of the facility for unrestricted use.

FIGURE 35
60" CYCLOTRON FACILITY (#120-1835)



BUILDING 301 HOT CELLS D&D PROJECT

The hot cell area in Building 301 contains eight caves used to perform a variety of early radiological research experiments for the DOE. The hot cells were placed into use in the early 1950s and were phased out in 1971 because they were outmoded and had begun to deteriorate. The cells received a preliminary cleanup, but fixed low-level contamination remains.

Radioactively contaminated equipment will be cleaned or dismantled and disposed of. The area will be decontaminated to permit the site to be released for unrestricted use. The cave structure will be demolished upon completion of decontamination.

FIGURE 36
BUILDING 301 HOT CELLS (#206-57)

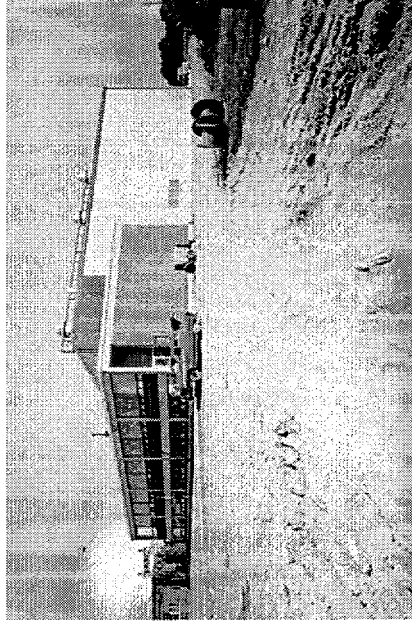


JUGGERNAUT REACTOR D&D PROJECT

The Juggernaut Reactor was a light-water moderated and cooled, graphite reflected research reactor with a rated thermal power of 250 kW. It was designed to provide experimental facilities for the conduct of basic research and operated from 1962 through 1970. The reactor fuel was removed and all systems were drained at the time of reactor shutdown. Only the high bay area of Building 335 housing the Juggernaut Reactor, the pump room, and the pit are within the scope of this project.

The scope of this project includes the disassembly, size-reduction, segregation, packaging, and disposal of all radioactive materials associated with the facility. Upon completion of the removal of all radioactive materials, the facility will be decontaminated to levels that allow the release of the facility for unrestricted use by other Laboratory programs.

FIGURE 37
JUGGERNAUT REACTOR (111-9457)

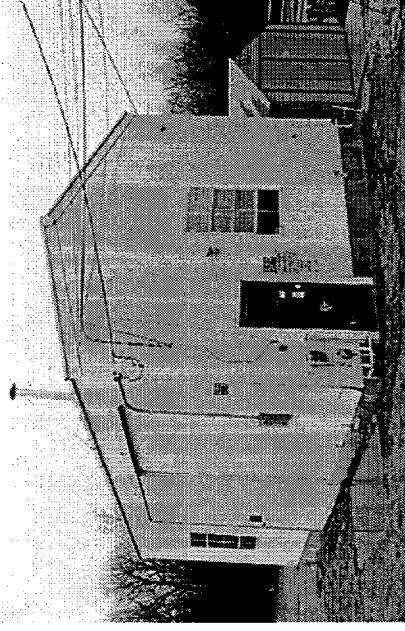


WASTE ION EXCHANGE FACILITY D&D PROJECT

The Waste Ion Exchange Facility (Building 579), was used to process slightly contaminated waste water. The unit consists of a cation exchange column, mixed bed column, and associated regeneration and operating equipment. The ion exchange equipment is connected to the laboratory tanks and equalization tanks by underground piping. The facility is no longer in use but remains contaminated with low-level radioactive material.

This project will decommission the equipment and drainage systems in the Waste Ion Exchange Facility to permit demolition of the facility.

FIGURE 38
WASTE ION EXCHANGE FACILITY (12260)



TECHNOLOGY DEVELOPMENT FOR D&D

DESCRIPTION

The technology development program for D&D at Argonne focuses on research and promising new technologies to improve worker health and safety and solve the problems of the high cost of decontamination and decommissioning at DOE sites. The department strives to improve bottom-line performance of its decommissioning work by developing and/or demonstrating new technologies and providing the results of those efforts to D&D problem holders such as DOE, and the commercial nuclear industry. The Technology Development community work and share information with other D&D technology providers such as universities and technology companies. Strategic alliances and international information exchange vehicles are used to help determine current problems and future needs; they also help disseminate information on new and more cost-effective technologies to decision makers.

CP-5 LARGE SCALE DEMONSTRATION PROJECT

DESCRIPTION

The purpose of the CP-5 Large Scale Demonstration Project (LSDP) is to select currently available, innovative D&D technologies, demonstrate those technologies in a large-scale environment, and compare the results against existing commercial technologies. The intent is to show that significant benefits can be achieved through the use of enhanced technologies or verify that the existing technologies are the most cost-effective to date. The LSDP is being performed by a consortium of industry, commercial nuclear industry, university, and national laboratory team members sponsored by the DOE. This consortia, the Strategic Alliance, includes Argonne National Laboratory, Commonwealth Edison, Duke Engineering and Services, Florida International University, ICF Inc., and 3M. The following photographs depict the various technologies demonstrated to date. Contact the Strategic Alliance on the internet at <http://www.strategic-alliance.org> for additional information.

FIGURE 39
DUAL-ARM WORK PLATFORM (22808K #15A)

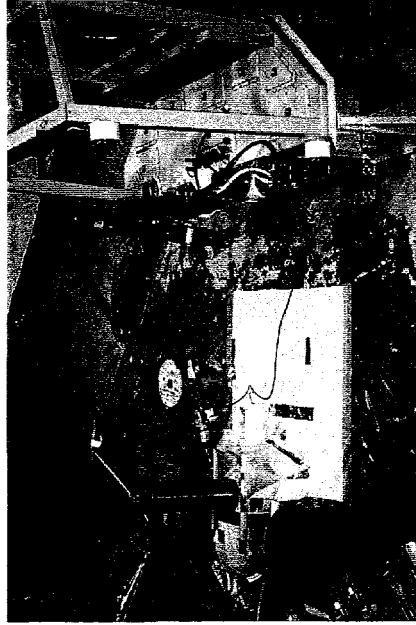


FIGURE 40

MACS - FLOOR RADIATION SURVEY (22010 #4A)

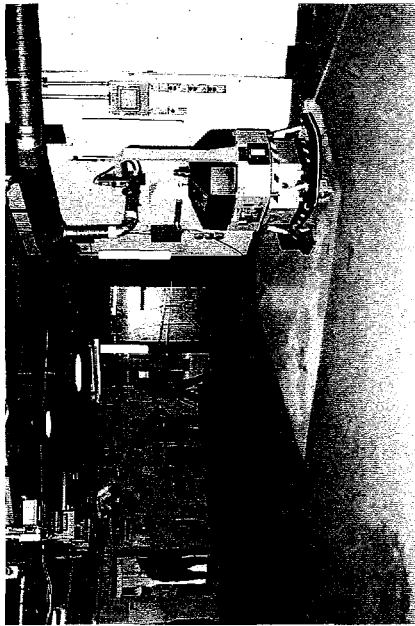


FIGURE 41

ROSIE MOBILE WORK PLATFORM (22740K #10A)

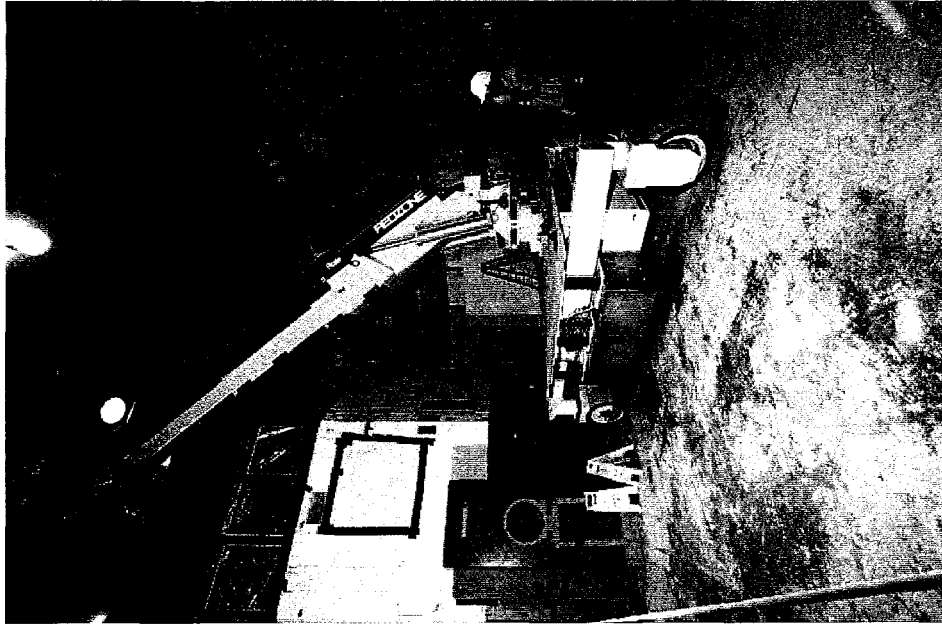


FIGURE 42
FIELD-TRANSPORTABLE BETA COUNTER



FIGURE 43
GAMMACAM - GAMMA RADIATION FIELD IMAGING
(22597K #13A)

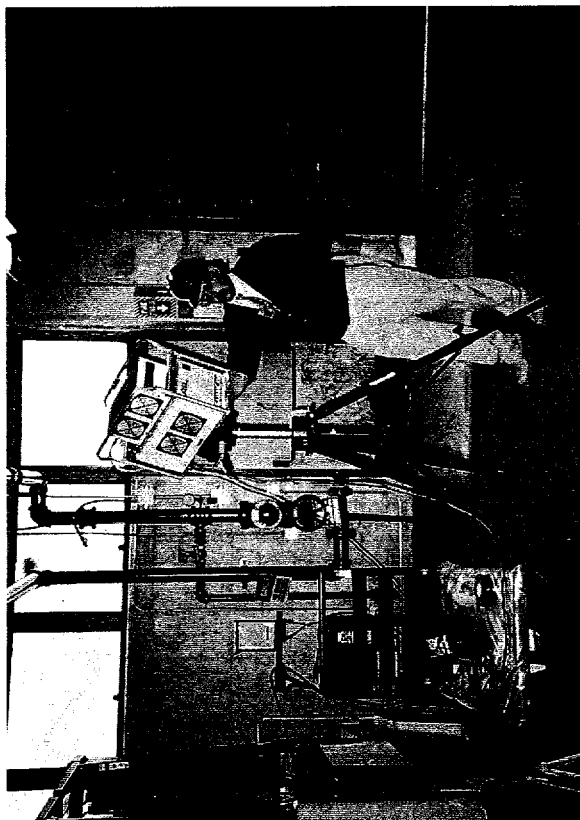


FIGURE 44

**PIPE EXPLORER - PIPE AND DUCT CHARACTERIZATION
(21974K #10A)**

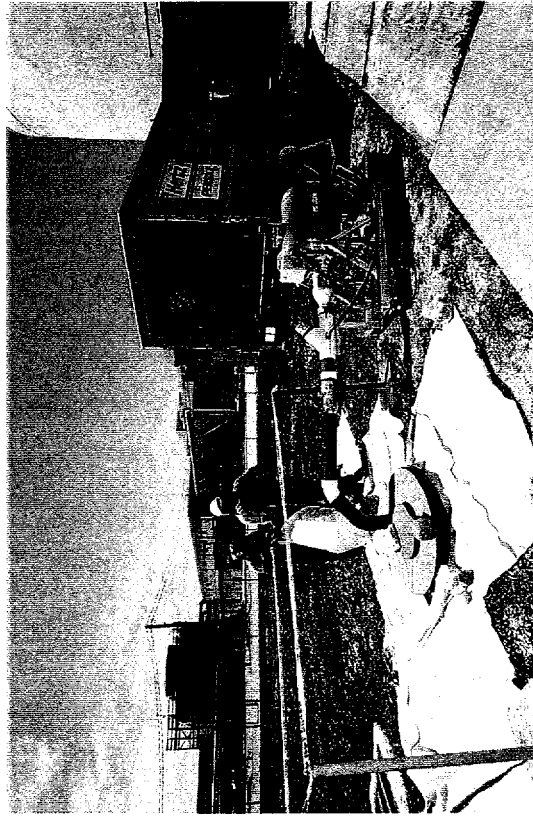


FIGURE 45

**ROTO-PEEN SCALER/VAC-PAC - MILLING
DECONTAMINATION (22877K #9)**

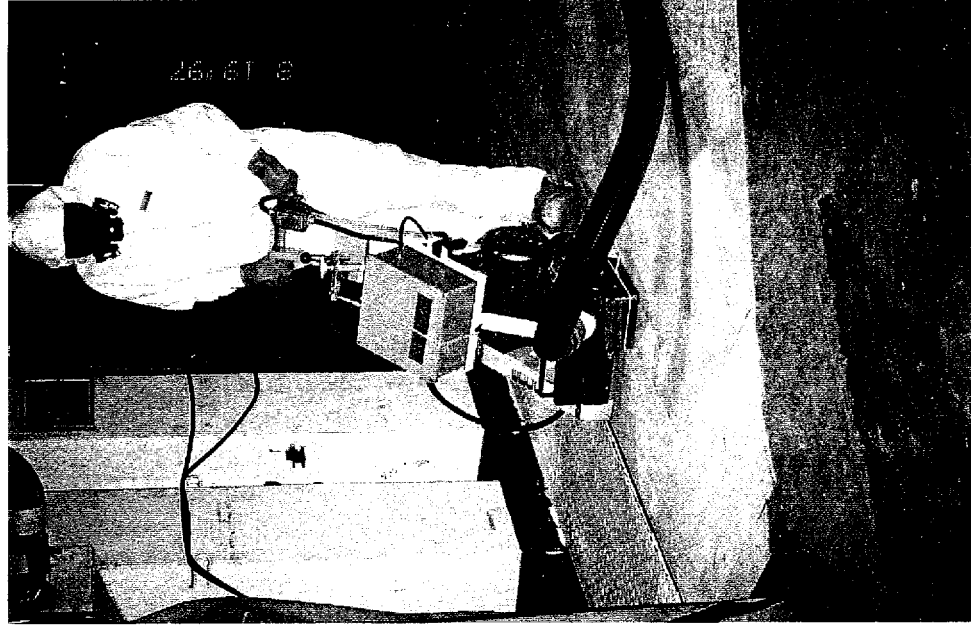


FIGURE 46

PIPE CRAWLER - PIPE INSPECTION, DECONTAMINATION, AND SURVEY (22613K #16A)



FIGURE 47

EMPORE MEMBRANE SEPARATION CARTRIDGE - HIGH CAPACITY WATER TREATMENT (22313K #14A)

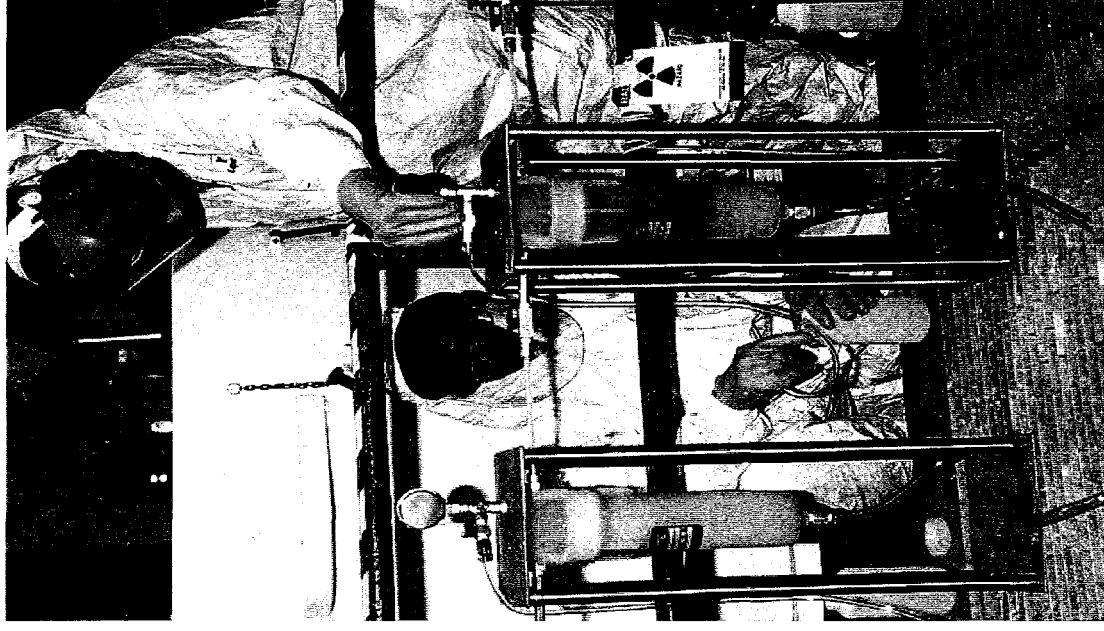


FIGURE 48

**SRA SURFACE CONTAMINATION MONITOR - AUTOMATED
SURFACE SURVEY (22613K #20A)**

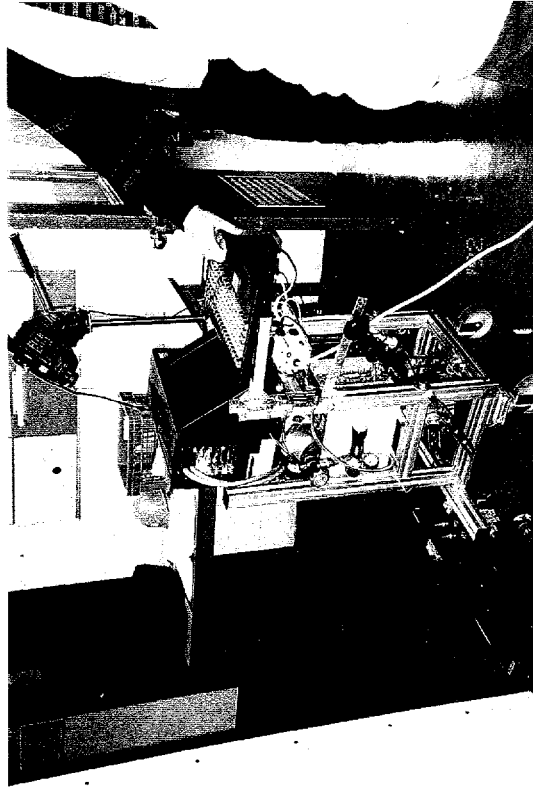
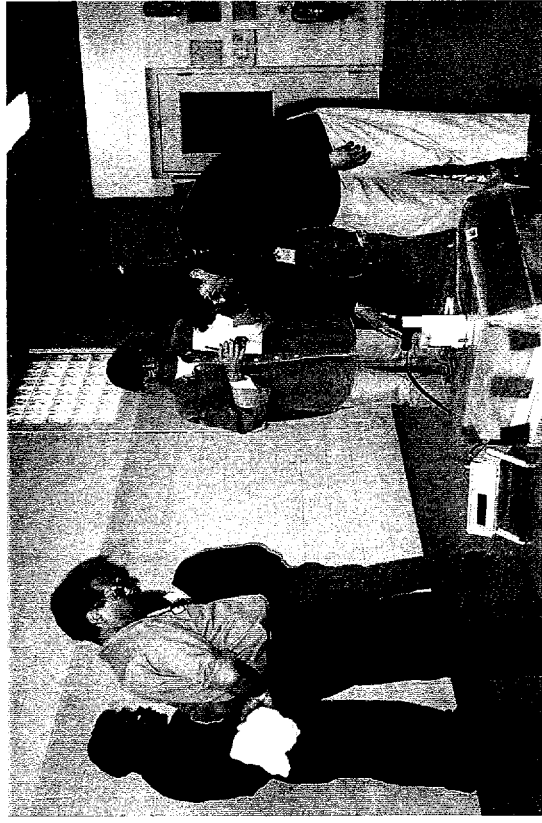


FIGURE 49

**PORTABLE X-RAY FLUORESCENCE DETECTOR -
NONDESTRUCTIVE, REAL-TIME, ELEMENTAL ANALYSIS**



D&D TECHNOLOGY

DESCRIPTION

The Technology Development Division has an ongoing research and development effort to establish improved methods of performing decontamination and decommissioning. As an example of improved methodologies developed to support D&D activities, computer codes have been written which are used to characterize radiation sources in structural materials. These codes are used to predict the effects of activation and characterize the distribution of radiation sources in order to support the planning of D&D activities. Other D&D technologies are pictured and described in the following figures.

It is desirable to hold radioactive gases in order to allow the radioactivity to decay before the gases are released to the environment. Figure 50 shows fluid-based absorption equipment, developed at Argonne National Laboratory, that offers the possibility of high-efficiency recovery of gases such as radon, xenon, or krypton. This led to the design of a simple and inexpensive apparatus for radon removal technology based on this fluid absorption process.

FIGURE 50
FLUID-BASED ABSORPTION (22389K #7)

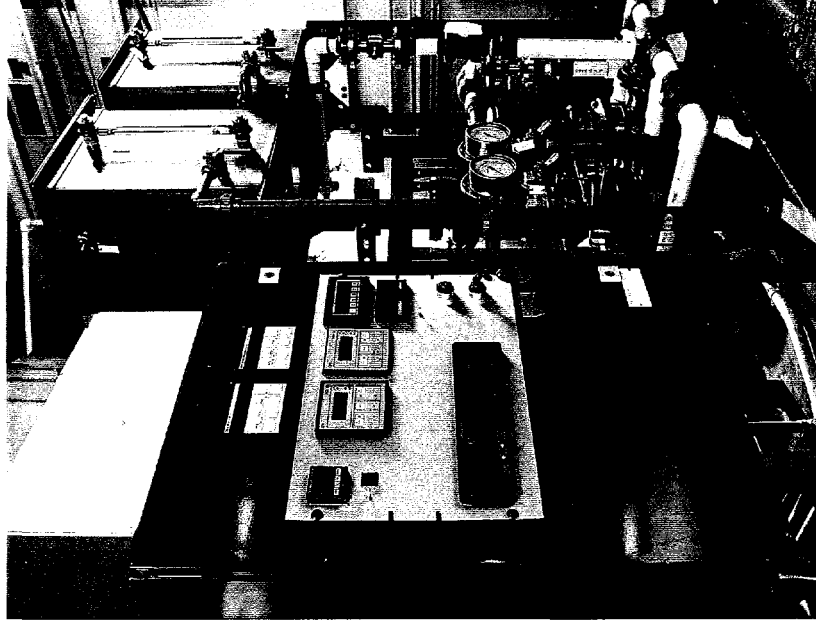
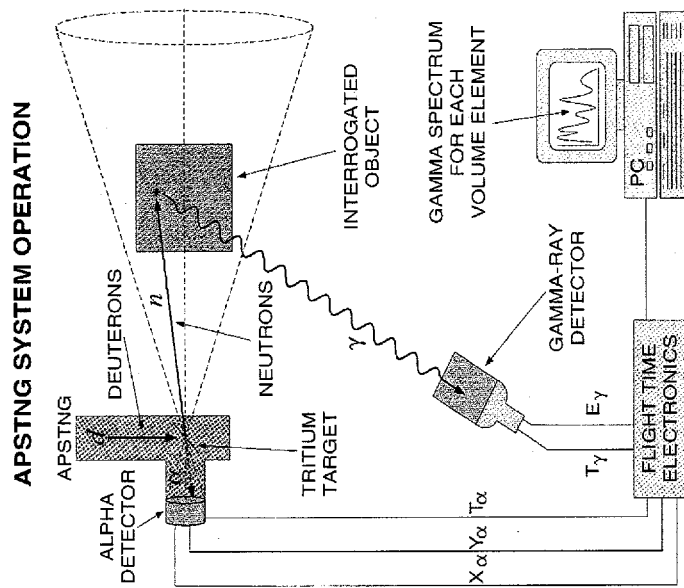


FIGURE 51
ASSOCIATED PARTICLE SEALED-TUBE NEUTRON GENERATOR
(APSTNG)



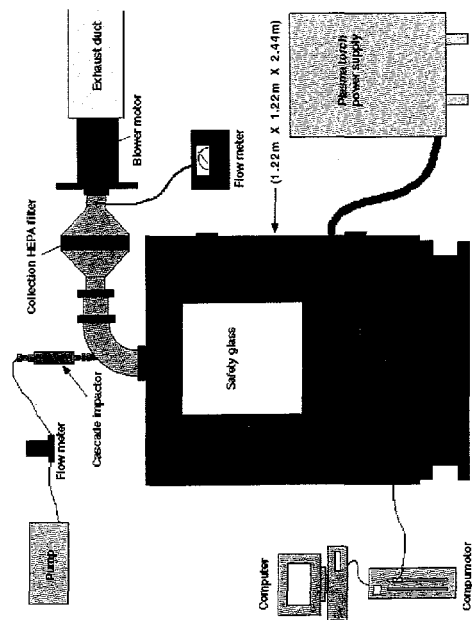
It is sometimes necessary to package radioactive waste without being able to measure the amount of radioactive material in the container as it is being packaged. The associated particle sealed-tube neutron generator, referred to as APSTNG, is a system that can be used to determine the amount of uranium, plutonium, or hazardous materials inside containers. The system uses neutrons and alpha particles generated by a fusion reaction to survey the containers.

FIGURE 52
CHEMICAL DECONTAMINATION



The objective of this work is to develop and demonstrate new chemicals for cost-effective removal of surface contamination of pipes which can be disposed of in an environmentally acceptable manner. Laboratory scale demonstrations of decontamination by aqueous chemical agents have been performed using a formulation developed at Argonne National Laboratory. The basic principle behind this technique is the removal of the contaminated surface oxide or crud layer without affecting the metal alloy of the pipe wall.

FIGURE 53
PARTICLES FROM CUTTING OPERATIONS



Radioactive particles generated during D&D cutting operations need to be controlled and contained. This experimental setup schematic shows the system used at Argonne for characterizing small particles which are releasing during cutting operations. Plasma-arc, oxyacetylene, and laser cutting operations have been characterized thus far. Other cutting technologies will also be characterized with this setup.

SUMMARY

The D&D Program at ANL-E provides DOE with a top-quality D&D program by maintaining D&D projects under control managerially and financially. The D&D Program has had a very successful FY 1996. The establishment of a strong D&D program at ANL-E is a noteworthy accomplishment that ensures timely, coordinated, and efficient D&D of surplus radioactive-contaminated facilities at the Laboratory.

The current D&D projects underway at ANL-E provide examples of an effective program able to clean up facilities that are radioactively contaminated from past research activities. Approximately 7,000 buildings in the DOE complex need to be decommissioned during the next 50 years. Due to the scale of planned D&D, it is imperative that significant cost reduction technologies are demonstrated and replicated across the Complex. Regulatory acceptance and routine use of these technologies by industry can only be assured by scientifically sound demonstrations in realistically contaminated environments. Nuclear production and research facilities represent the most significant and unique D&D challenges.

The D&D Program has an outstanding operational and safety record and has developed a strong infrastructure necessary to support the D&D program. In FY 1997 and beyond, continued support will be provided to establish fully and maintain the program. The continued funding and support for all these activities, and the initiation and completion of D&D activities at all other surplus facilities/areas at ANL-E, will indeed prove our pledge to maintain Argonne's commitment to clean up our site.

T. J. Yule
T.J. Yule, WM Program Manager