ANL/D&D/98-3

Decontamination and Dismantlement of the Building 594 Waste Ion Exchange Facility at Argonne National Laboratory-East Project Final Report

Decontamination and Decommissioning Program

Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

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1.0 EXECUTIVE SUMMARY

The decontamination and dismantlement (D&D) of the Building 594 Waste Ion Exchange Facility at Argonne National Laboratory-East (ANL-E) was completed in September 1998. Descriptions and evaluations of the activities performed and analyses of the results obtained during the Building 594 D&D Project are provided in this Final Report. The following information is included:

- Descriptions of the ANL-E site and the Building 594 Waste Ion Exchange Facility
- History of the Building 594 Waste Ion Exchange Facility
- Description of the D&D activities performed
- Summary of the final status of the Building 594 Waste Ion Exchange Facility based upon the final survey results
- Summaries of the waste minimization techniques utilized and total waste generated by the project
- Descriptions of the health and safety aspects of the project, including personnel exposure and OSHA reporting
- Summary of the final cost and schedule for the Building 594 Waste Ion Exchange D&D project

In 1997, as part of an area-wide numbering change, the building number was changed from Building 579 to Building 594 and new building signs were posted. Earlier project documents refer to the building as Building 579.

The decontamination and dismantlement of this facility was funded by the DOE Office of the Assistant Secretary for Environmental Management, specifically EM-40 (Environmental Restoration).

This final report was written in accordance with requirements outlined in the ANL-E D&D Project Planning Guidance Manual and the ANL-E D&D Program Management Plan. It covers the entire Building 594 Waste Ion Exchange Facility D&D Project, from initiation of planning and characterization activities to final project closeout. The final survey was completed in August 1998, and the building was demolished in September 1998.

All accessible areas of the Building 594 Waste Ion Exchange Facility were surveyed to meet free-release requirements as specified in the ANL-E Environment, Safety and Health Manual. Contaminated resin was removed and packaged for disposal. Radiologically clean building components, equipment, wiring and piping, and radiologically clean concrete were removed for recycle or reuse by ANL-E. The building was demolished, and the area graded and seeded.

There was no exposure to project personnel recorded compared to the original "As Low As Reasonably Achievable" (ALARA) estimate of 2.856 person-mrem (0.02856 mSv). The total cost of the project was approximately $182,000, compared to the Baseline estimate of $478,597. A total of 70 ft^3 (2 m^3) of low-level radioactive waste was packaged for off-site disposal at a DOE-approved low-level waste repository.

2.0 PROJECT OBJECTIVE

The Building 594 D&D Project was directed toward the following goals:

- Removal of any radioactive and hazardous materials associated with the Waste Ion Exchange Facility
- Decontamination of the Waste Ion Exchange Facility to unrestricted use levels
- Demolition of Building 594
- Documentation of all project activities affecting quality (i.e., waste packaging, instrument calibration, audit results, and personnel exposure)

These goals had been set in order to eliminate the radiological and hazardous safety concerns inherent in the Waste Ion Exchange Facility and to allow, upon completion of the project, unescorted and unmonitored access to the area. The ion exchange system and the resin contained in the system were the primary areas of concern, while the condition of the building which housed the system was of secondary concern. ANL-E health physics technicians characterized the Building 594 Waste Ion Exchange Facility in September 1996. The characterization identified a total of three radionuclides present in the Waste Ion Exchange Facility with a total activity of less than 5 μCi (175 kBq). The radionuclides of concern were Co^{60}, Cs^{137}, and Am^{241}. The highest dose rates observed during the project were associated with the resin in the exchange vessels. DOE Order 5480.2A establishes the maximum whole body exposure for occupational workers at 5 rem (50 mSv)/yr; the administrative limit at ANL-E is 1 rem/yr (10 mSv/yr).

3.0 FACILITY HISTORY AND DESCRIPTION

3.1 Building 594 Waste Ion Exchange Facility History

The Waste Ion Exchange Facility was constructed in the 1950's. Non-functional for over 30 years, the facility had been used to process waste fluids from a collecting lagoon. The ion exchange equipment was connected to the collecting lagoon, equalization tanks, and a distribution pit located in Building 592 by underground piping. There was also a concrete pad and influent lines on the south side of the building and another concrete pad and effluent lines on the north side of the building.

The Building 594 Waste Ion Exchange Facility operated for only a short period of time. No records were available to indicate when the Waste Ion Exchange Facility was shut down. After the characterization was done in 1996, the ion exchange equipment was posted as a radiologically controlled area. In recent years, the non-controlled portion of the building had been used for outdoor equipment storage.

The original building number was 579; in 1997, the number was changed to 594 and new signs were posted.

3.2 Site Description

The Building 594 Waste Ion Exchange Facility was located in the East Area on the ANL-E site, a 1,275 acre (5.16 km^2) reservation in DuPage County, Illinois, operated by the University of Chicago under contract with the Department of Energy. Approximately 4,000 people work at the ANL-E site. The majority of the reservation is forested and landscaped with only 200 acres (0.81 km^2) currently dedicated to operational facilities. The Laboratory is approximately 22 miles (35.4 km) southwest of Chicago and 25 miles (40.3 km) west of Lake Michigan at the closest point. Access is available from State Highway 83, county roads, Northgate Road, and Cass Avenue, all of which have access to Interstate 55 (see Figure 3.1). The reservation is surrounded by the 2,040 acre (8.26 km^2) Waterfall Glen Forest Preserve, a greenbelt forest preserve managed by the DuPage County Forest Preserve District. The areas south and west of the site are primarily rural, with more heavily populated areas to the north and east. The Des Plaines River, Illinois Waterway, and the Chicago Sanitary and Ship Canal are all located about 1 mile (1.6 km) from the southern boundary of the site. Figure 3.2 shows the location of Building 594 on an ANL-E site map.

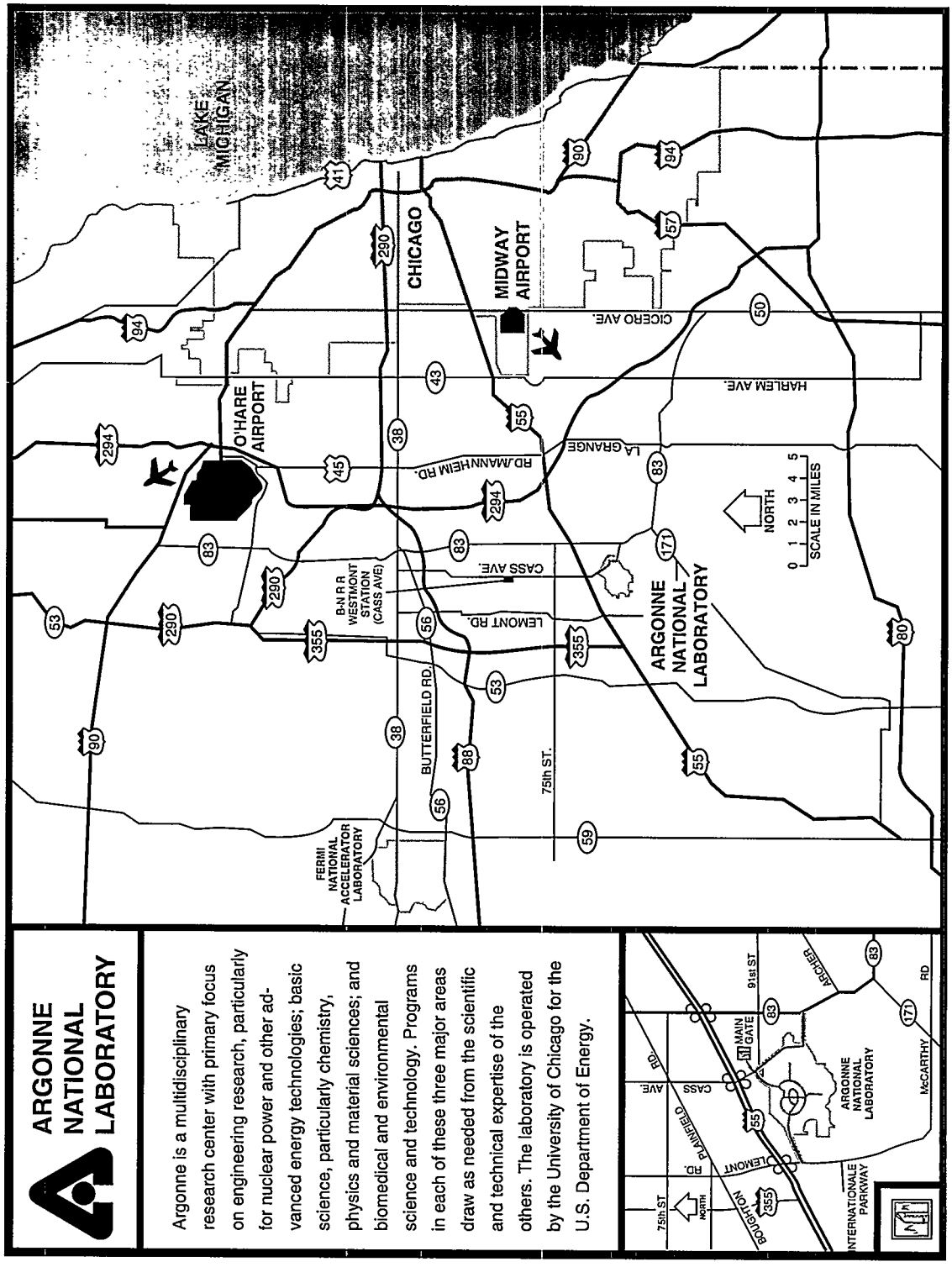

Figure 3.1 Chicago Area Map

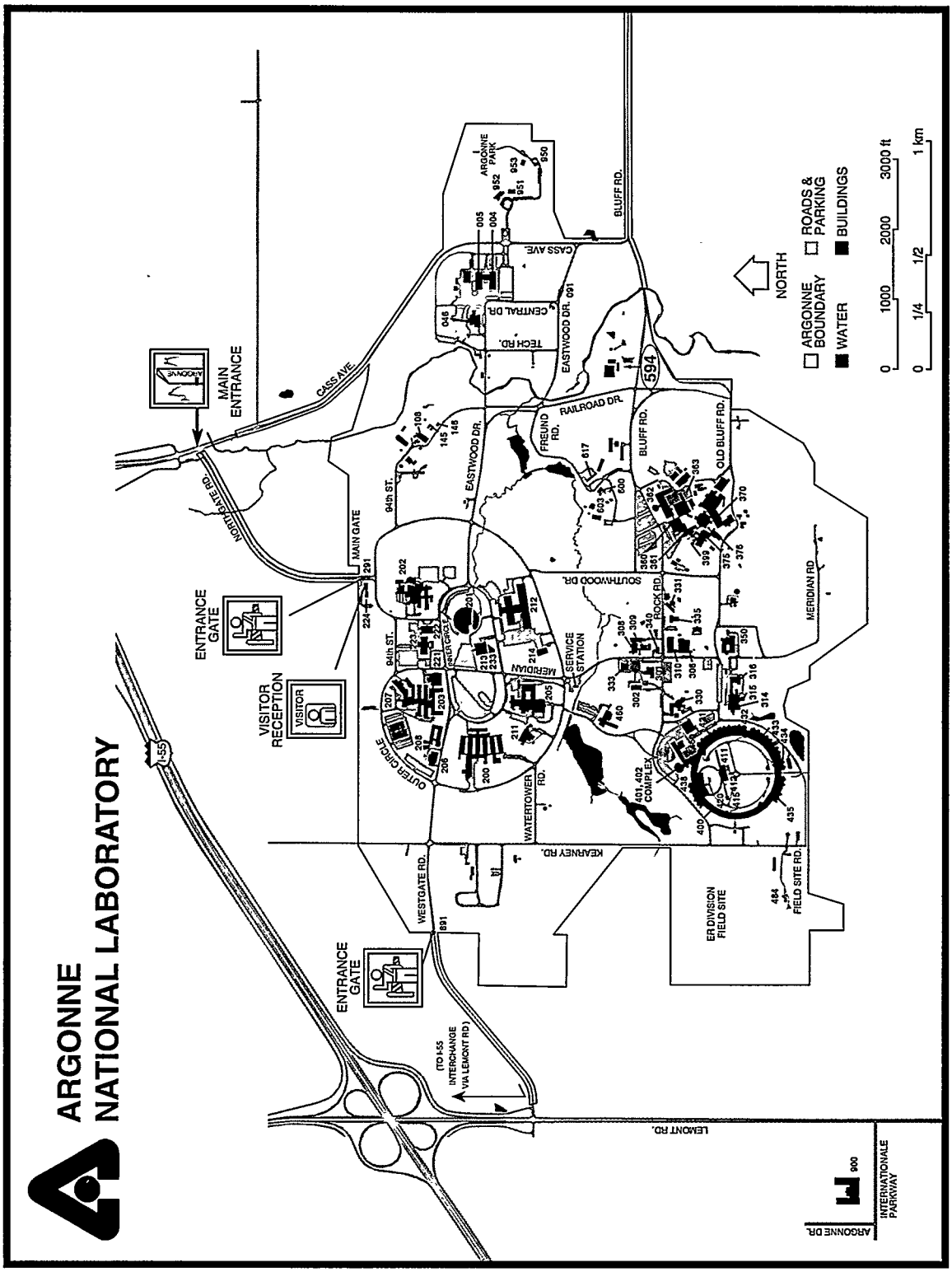

Figure 3.2 ANL-E Site Map

3.3 Facility Description

3.3.1 General

Building 594 was a pre-engineered metal building with a concrete foundation and floor (see Figure 3.3). The building measured 20-ft (6.09-m) wide, 32-ft (9.75-m) long, and 14-ft (4.27-m) high. There were two personnel doors, one located on the north side and the other on the south side. Both doors were at the west ends of the walls. An 8-ft (2.44-m) wide by 14-ft (4.27-m) high sliding door was located in the center of the west wall. The floor had a 1-ft (0.3-m) wide, 1-ft (0.3-m) deep, and 14-ft (4.27-m) long trench that ran through the center of the building and drained into a pit that was located in the northeast corner. The concrete pit measured 6-ft (1.83-m) wide, 8-ft (2.44-m) long, and 5-ft (1.52-m) deep.

The waste ion exchange equipment was located on the east side of Building 594 (see Figure 3.4). The equipment occupied approximately one half of the floor space.

3.3.2 The Ion Exchange Equipment

The ion exchange process used two resin tanks, a cation exchange vessel and a mixed bed exchange vessel, each measuring 2.5 ft (0.76 m) in diameter and 8.5 ft (2.59 m) high. The tanks were made of carbon steel and had an asphaltic liner. Connected to the exchange vessels were a caustic regenerant tank and an acid regenerant tank along with miscellaneous piping, valves, gauges, and pumps. The whole system drained into a 200-gal (757-liter) stainless steel tank that could be pumped out to an outside tank or through a drain line to a lagoon.

4.0 OVERVIEW OF THE BUILDING 594 D&D PROJECT

4.1 General

Partial funding was authorized for the Building 594 Waste Ion Exchange Facility D&D Project in FY 1996. Commencing in August 1995, a Characterization Plan was prepared together with a cost and schedule plan. Characterization of the facility was performed by the ANL-E Environment, Safety and Health/Health Physics (ESH/HP) group in September 1996. A Characterization Report was issued in March 1997. Funding to complete the project was authorized in FY 1998. Project planning and document preparation began in February 1998. This scope of work consisted of development of the Project Management Plan, Quality Assurance Plan, Auditable Safety Analysis, Environmental Evaluation Notification Form, Illinois Historical Preservation Agency Review, Waste Management Plan, and appropriate procurement documents. All documentation was completed in May 1998. A Readiness Assessment (RA) was conducted in June 1998. With the RA complete, the project field work was ready to begin.

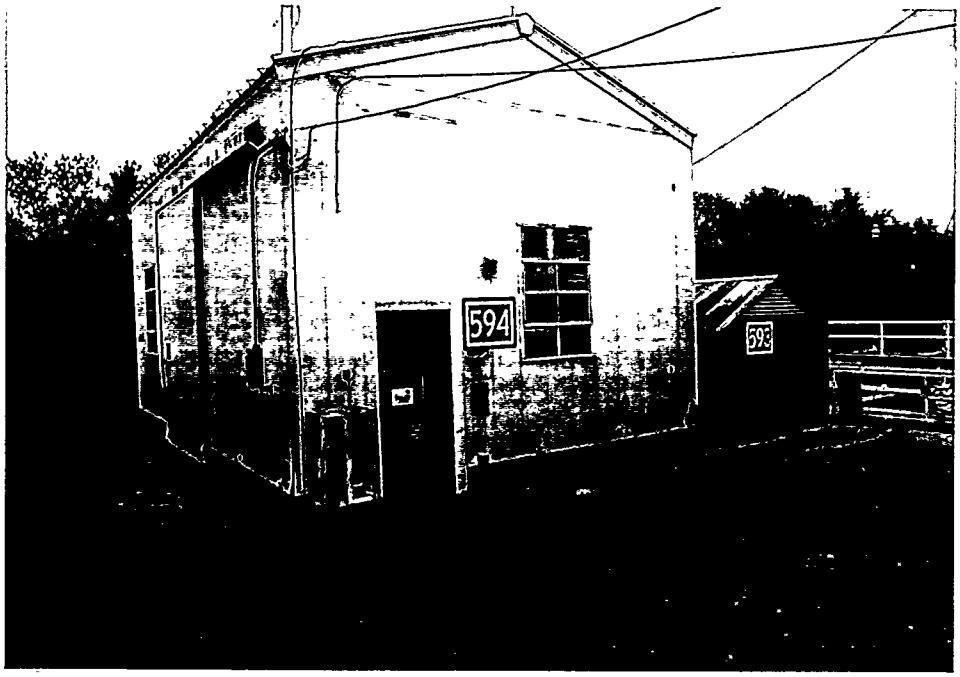

Figure 3.3 Building 594 Prior to Start of D&D
(ANL Neg. # 24191K, Frame 12)

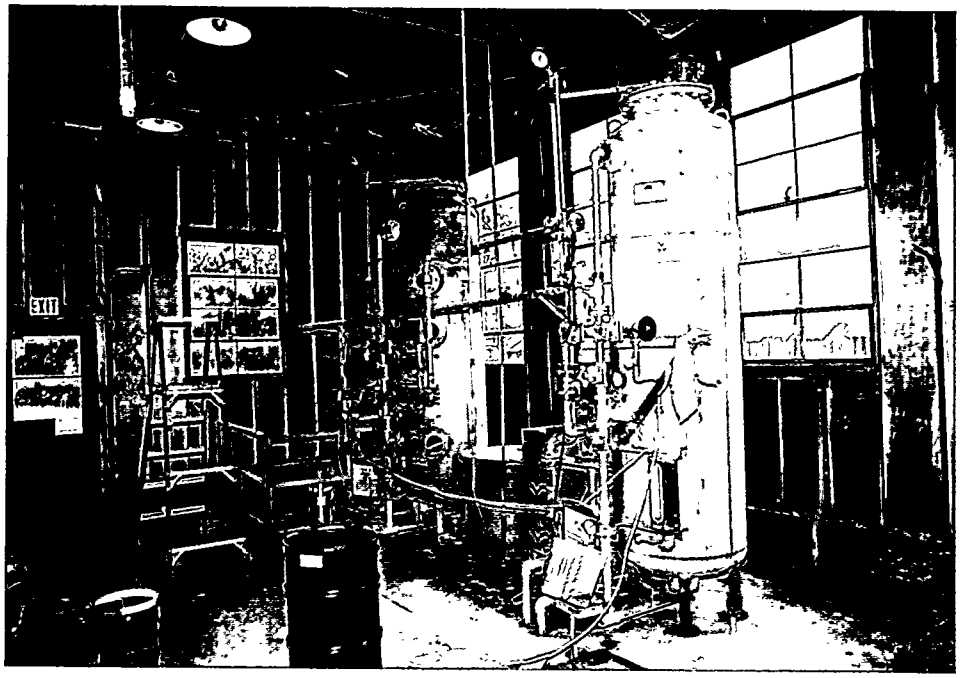

Figure 3.4 Waste Ion Exchange Equipment During D&D
(ANL Neg. # 24344K, Frame 4)

A service request (or work order) was issued to ANL-E Waste Management Operations (WMO) to perform the D&D work. All D&D activities were conducted during June 1998. A final survey of the building was done by ESH/HP in July 1998, and the building was free released for demolition. In August 1998, a contract was awarded to Action Wrecking Company of Darien, Illinois, to demolish Building 594 and other buildings on site. On-site mobilization took place in September 1998, and building demolition and removal of the concrete pads were completed in September 1998. A final survey of underground piping, which had been left buried in place, was completed by ESH/HP in September 1998.

4.2 Major Tasks

The following major tasks were performed during the D&D of the Building 594 Waste Ion Exchange Facility. Each is described in Section 6.0.

- Performance of Routine Surveillance and Maintenance Tasks
- Removal of Miscellaneous Building Components
- Demolition of the Waste Ion Exchange Equipment
- Area Decontamination and Survey
- Building Demolition and Site Restoration
- Project Closeout Activities

5.0 BUILDING 594 D&D PROJECT PLANNING AND ENGINEERING

5.1 Project Organization

The Building 594 D&D project had a specific management structure in which the administrative, programmatic, and technical responsibilities, including management controls and reporting systems for the performance of the project, were well defined. The various organizations involved in this project and their responsibilities are described below.

5.1.1 Department of Energy

Overall responsibility for accomplishment of the Building 594 Waste Ion Exchange Facility D&D Project resided with the Secretary of Energy. Responsibility flowed from the Secretary through the Office of the Assistant Secretary for Environmental Management (DOE-EM) to DOE Chicago Operations (DOE-CH) and to the DOE Argonne Group (DOE-ARG).

5.1.2 Argonne National Laboratory-East

The Decontamination and Decommissioning (D&D) Program of the Technology Development (TD) Division Environmental Remediation Program was assigned the lead for the D&D of the Building 594 Waste Ion Exchange Facility which included direction, management, and control of

all phases of work. A project manager was assigned and given full line authority and responsibility for the hands-on management of the project. The project manager was responsible for the consistent application of project controls, developed through a risk assessment, to ensure acceptable performance and successful completion of the Building 594 Waste Ion Exchange Facility D&D.

5.2 Project Engineering

5.2.1 Quality Assurance

The project Quality Assurance (QA) Plan prescribed the requirements for achieving a satisfactory level of quality in the performance of project activities. These requirements were based upon existing codes, standards, and practices found in the current issues of ANSI/ASME NQA-1, DOE Order 5700.6C, the ANL-E QA Implementation Guide, and the ANL-E QA Planning Guide. The following project D&D activities were covered by the project QA Plan:

- Segregating of radioactive and nonradioactive waste
- Packaging of radioactive waste
- Determining curie and radionuclide content of waste packages
- Calibrating instruments to NIST traceable standards
- Inspecting waste packages
- Maintaining sample chain-of-custody compliance
- Auditing of the QA Plan

Quality assurance responsibilities for all project management personnel were defined by the project QA Plan. The project manager was assigned overall responsibility for the execution of the project QA Plan. Assistance in carrying out specific QA requirements was provided by the Quality Assurance Representatives (QARs) from TD, Environment, Safety and Health (ESH), and the Environmental Management Operations (EMO) divisions, and by personnel from the ESH and EMO divisions. The Office of ESH/QA Oversight provided an audit and verification function. Specific requirements carried out by each office are discussed below.

The ESH/Health Physics Manager was responsible for oversight of the sampling, sample analysis, standards, instrument calibration, radiation safety, radiation monitoring, and final radiation survey of the facility.

The ESH Manager was responsible for providing project oversight of subcontractor safety and health practices during performance of the demolition work and for reviewing and approving the subcontractor's plans and procedures to ensure compliance with federal, state, and laboratory rules and regulations.

The WMO Manager was responsible for providing training and oversight of the D&D field work and waste packaging activities and for providing disposal of the radioactive waste generated during project D&D activities.

The QARs for EMO, ESH, and TD had joint responsibility for review and approval of the project QA Plan. They assisted the project manager in implementing the QA Plan and served as an interface with the Office of ESH/QA Oversight.

ESH/QA Oversight was responsible for auditing the project to verify compliance with the QA Plan and to determine the Plan's effectiveness. The Office reviewed the QA Plan prior to issuance and provided guidance and consultation to Divisional QARs. The Office also served as third party independent review of all project QA-related issues.

5.2.2 Project Control

The Building 594 D&D project manager had prime control and overall responsibility for the project. Progress was reported to DOE through weekly and monthly progress reports. All reports and records were reviewed by the project manager to identify any deficiencies. Meetings were held with project personnel to discuss work performed and the upcoming work schedule, and to identify any issues or problems. Periodic project status review meetings were held with TD management and with DOE representatives.

5.2.3 Project Data

Data generated by D&D activities, e.g., survey results, instrument calibrations, sample analyses, personnel radiation, and toxic material exposures, have been retained as a permanent record of the project. ANL-E management staff reviewed the data to assure that all operations were in compliance with QA Plan specifications.

5.2.4 Training

All project personnel involved with the Building 594 D&D project were required by ANL-E policy to meet minimum training requirements, as identified below:

For all personnel requiring unescorted access during D&D field work:

- ANL-E Radiological Worker II
- OSHA 40-hour Hazardous Waste Site Operations
- Building 594 Facility Orientation

For personnel assigned as Health and Safety Manager:

- OSHA Hazard Recognition for Construction

For personnel who perform Health Physics-related functions:

- Previously qualified as a Radiological Controls Technician at a DOE site

For personnel who performed radioactive waste packaging, inspection, or labeling functions:

- Complete ANL-E Radioactive Waste Generator Training

Additional job specific training requirements for individuals involved in those operations:

- Confined space training
- Specialized training for various equipment and tools

5.2.5 Health and Safety

The project manager was responsible for implementing the ANL-E Health and Safety requirements for the project to ensure compliance with existing directives on environment, safety, and health issues. The actions implemented are discussed below.

5.2.5.1 ES&H Policy

All project activities were performed in a manner which ensured protection of the environment and the health and safety of the general public and workers. All project personnel had the authority and responsibility to stop work if an unsafe condition or activity was observed. The project manager was the only individual at the project level with authority to restart work after an unsafe condition or activity had been identified and corrected. All work was performed in accordance with the ANL-E ESH Manual, the Building 594 D&D Auditable Safety Analysis, and the project-specific Health and Safety Plan.

5.2.5.2 Radiation Safety

Radiation safety at the Building 594 D&D Project was the responsibility of ESH/HP personnel. The ANL-E ESH Manual served as a guide for implementing the project's Radiation Safety Program. Health physics coverage of the project was provided by ESH/HP personnel. All project plans and procedures were developed and implemented using the ALARA principle.

5.2.5.3 Industrial Hygiene

ESH Industrial Hygiene (IH) furnished technical guidance on materials handling and reviewed sample results.

5.2.5.4 Industrial Safety

All industrial safety aspects of the project were required to comply with rules and regulations as stated by OSHA and in the ANL-E ESH Manual and the project-specific Health and Safety Plan. ESH safety engineering personnel, and the project manager and staff continuously observed all operations. Daily project meetings and safety meetings were used to keep project personnel aware of potential or existing personnel hazards and accident prevention techniques.

5.2.5.5 Fire Protection and Security

Project fire protection services and safety guidance were provided by the ANL-E Fire Department. Physical security was provided by the ANL-E security force.

5.3 Conduct of Operations

The Building 594 D&D Project was performed in accordance with guidelines established in the TD/D&D Conduct of Operations Manual. The eight elements utilized by the project are:

- Operations organization and administration
- Communications
- Investigation of abnormal event(s)
- Control of systems and equipment status
- Log-keeping
- Postings
- Labeling
- Operations essential to ensure safe and timely progress of the D&D project

5.4 Site Characterization

During September 1996, ESH/HP performed a detailed characterization of the Building 594 Waste Ion Exchange Facility. The characterization revealed the presence of three different radionuclides and equipment coated with lead-based paint. No additional radionuclides, hazardous materials, asbestos or mixed waste were identified during the performance of D&D operations.

5.4.1 Radiological Contaminants

Table 5.1 identifies nuclides found during the characterization and performance of D&D operations at the Building 594 Waste Ion Exchange Facility.

Table 5.1 Radioactive Contamination Found During Characterization and Performance of D&D Operations

Contaminant	Maximum Concentration	Area Found	Remarks
Co^{60}	4.3 pCi/g (0.16 Bq/g)	Cation Exchange Vessel	Resin sample
Cs^{157}	2.6 pCi/g (0.01Bq/g)	Cation Exchange Vessel	Resin sample
Am^{241}	24.1 pCi/g (0.9 Bq/g)	Cation Exchange Vessel	Resin sample
Gross α	19.2 pCi/g (0.7 Bq/g)	Cation Exchange Vessel	Gross area smear
Gross β	4.3 pCi/g (0.16 Bq/g)	Cation Exchange Vessel	Gross area smear

5.4.2 Hazardous Materials

Table 5.2 identifies the types and locations of hazardous materials found during the characterization and performance of D&D operations.

Table 5.2. Types and Locations of Hazardous Materials

Hazardous Substance	Location(s) Found	Remarks
Asbestos	Building insulation and pipe insulation were analyzed	None found
Lead-Based Paint	Outside of exchange vessels, piping, and valves	Areas were stripped before cutting
Cadmium	Resin in the Cation Exchange Vessel	Removed with the resin
Chromium	Resin in the Cation Exchange Vessel	Removed with the resin
Selenium	Resin in the Cation Exchange Vessel	Removed with the resin
Silver	Resin in the Cation Exchange Vessel	Removed with the resin
Mercury	Resin in the Cation Exchange Vessel	Removed with the resin

5.4.3 Mixed Waste

There was no mixed waste identified in the characterization report, and none was found during D&D operations. Although there were RCRA metals on the resin in the Cation Exchange Vessel, it was determined that the amount removed during a leaching analysis was below the toxicity Characteristic level. Therefore, the resin was categorized as a radioactive waste, not a mixed waste.

6.0 BUILDING 594 D&D OPERATIONS

6.1 General

The Building 594 D&D Project Work Breakdown Structure (WBS) was built around three facilities (DOE Field Codes DD73, DD74, and DD75), and each facility was divided into major subtasks. The Building 594 D&D Project Work Breakdown Structure (WBS) is provided in detail below.

17.1.2.1 ANL-E Decontamination and Decommissioning Program
17.1.2.1.6 Building 579 D&D Project
17.1.2.1.6.00 Planning and Documentation

A Characterization Plan, cost and schedule plan, and characterization of the Waste Ion Exchange Facility were completed in FY 1996. The Characterization Report formed the basis for hazards analysis and final planning. In FY 1998, the safety and technical reviews required by DOE Orders and EM guidance manuals were performed and incorporated into the requisite reports, plans, and procedures. Each report or document that was unique to the Waste Ion Exchange Facility and required for project initiation was identified as a discrete task. These tasks were:

- Prepare an Auditable Safety Analysis
- Complete NEPA documentation
- Complete the Project ESH Baseline Survey
- Finalize the Technical Scope required to meet the project objective
- Prepare and/or revise air and/or water discharge permits
- Prepare the Project Surveillance & Maintenance Plan
- Prepare and/or revise the Building 579 Emergency Plan to incorporate D&D-specific hazards
- Prepare the Project Training Plan
- Prepare the Project Waste Management Plan
- Prepare the Project Quality Assurance Plan
- Prepare the Project Health and Safety Plan
- Prepare the Project Management Plan
- Prepare the Project Decommissioning Plan

17.1.2.1.6.01 Bldg. 579 Engineering/Management

The Engineering/Management element consisted of the resources required to provide technical and administrative management; to coordinate and provide liaison with other ANL organizations; and to provide technical, cost, and schedule performance data for the project.

17.1.2.1.6.02 Bldg 579 Surveillance and Maintenance

The Surveillance and Maintenance element consisted of those activities that are required to be in compliance with DOE Orders, ANL requirements, and programmatic direction for the management of surplus facilities.

17.1.2.1.6.03 Bldg. 579 Ion Exchange Equipment

The following WBS tasks completed facility field code DD73:

- The interior piping was cut and removed
- The ion exchange vessels were cut and removed
- All interior surfaces were decontaminated
- A final radiological survey was conducted

17.1.2.1.6.04 Bldg. 579 Underground Piping and Soil

The following WBS tasks completed facility field code DD74:

- Temporary fencing was installed around areas to be excavated
- Underground piping and soil around the piping was surveyed and excavated
- Backfill and grading of the area was done

17.1.2.1.6.05 Bldg. 579

The following WBS tasks completed facility field code DD75:

- The building's electrical wiring was de-energized
- Building 579 roof, walls, and foundation were demolished
- The area was backfilled, graded, and seeded

17.1.2.1.6.06 Bldg. 579 Project Closeout

Demobilization was completed in FY 1998. Preparation of the project closeout package and the final report was completed in FY 1999.

During project planning, the following assumptions were made:

1. DOE will receive a favorable response from Housing and Urban Development (HUD) and will authorize demolition of the building by August 18, 1998.

2. Soil will not be contaminated.

6.2 Project Preparation and Characterization

6.2.1 Project Preparations

The first activities associated with the Building 594 Waste Ion Exchange Facility D&D Project began in August 1995. These consisted of preparing a facility characterization plan, and a detailed cost and schedule plan. The project resumed again in February 1998 with preparation of required plans and procedures, including an Environmental Evaluation Notification Form for the D&D activities. All planning documentation was completed by the end of May 1998, and a Readiness Assessment (RA) was conducted by the project manager on June 3, 1998.

6.2.2 Facility Characterization

In September 1996, ESH/HP performed a radiological and hazardous materials characterization of the Building 594 Waste Ion Exchange Facility. The results of this characterization were utilized in the preparation of the project's Health and Safety Plan and Auditable Safety Analysis. The characterization identified three radioisotopes (Co^{60}, Am^{241}, and Cs^{137}), equipment and piping items coated with lead-based paint and approximately 600 gal (2,271 liters) of RCRA metal-contaminated resin. In addition to the above items characterized prior to the start of D&D operations, additional analyses were performed for asbestos and mixed waste.

6.3 Decommissioning Activities

On-site D&D activities commenced on June 8, 1998. The activities were not necessarily performed in the sequence or time frames of the original schedule due to procedure conflicts, receipt of required equipment and supplies, or availability of personnel to perform the work when scheduled. The following narrative is based on the original project schedule sequence for ease of presentation.

6.3.1 Routine Surveillance and Maintenance Tasks

The surveillance and maintenance tasks were performed by the designated person according to the Surveillance and Maintenance Plan for Building 594. The tasks included safety inspections, inspection of fire extinguishers, equipment inspections, review of training requirements, and verification that work was being performed per specifications.

6.3.2 Electrical System Isolation

Electrical system isolation consisted of performing lockout/tagout (LO/TO) of circuits feeding Building 594. Project personnel identified the circuits that required disconnecting and requested ANL-E building maintenance personnel to de-energize and disconnect the circuits. After the circuits to Building 594 were disconnected, building maintenance personnel verified the circuits were de-energized.

6.3.3 Removal of Miscellaneous Building Components

Miscellaneous components were removed from the building before the ion exchange system was dismantled. This created a clear work space for the removal of the ion exchange equipment. The miscellaneous components included items such as electrical panels, switches, conduit, tables, storage lockers, and water lines. All of the components were surveyed and released to the clean scrap pile for recycling.

6.3.4 Waste Ion Exchange Demolition

Demolition of the Waste Ion Exchange encompassed all equipment and components that were part of the system. Containers were placed under drain lines and the valves opened to drain fluid from the system and tanks (see Figure 6.1). The piping and valves were then removed, starting at the drain end of the system and working back through to the input side of the system. Small catch cans or containers were used to capture any liquid that might have been trapped in low areas or valves. After each piece was removed, it was surveyed and released to the clean scrap pile for recycling. Once all of the piping and valves were removed back to the resin tanks, the top of the tanks were opened to gain access to the resin. The workers used a HEPA vacuum connected to a 55-gal (208-liter) drum to remove the resin from the tanks. The resin was vacuumed out of the tanks directly into the drums. Pieces of the removed piping were attached to the vacuum hose to allow the workers to reach the bottom of the tanks and remove all of the resin. The tanks were then lowered to the floor and cut in half with a mechanical saw. The inside of the tanks were wiped clean, surveyed, and released to the clean scrap pile. A sample of the resin was taken to the on-site laboratory for analysis and waste disposition.

6.3.5 Area Decontamination and Survey

At the completion of all D&D activities and prior to starting the final status survey, suspect areas of the facility were wiped down with damp rags. All loose items were removed from the building. The areas were then surveyed for contamination by ESH/HP (see Figure 6.2). After the ion exchange area was determined to be clean, the remainder of the building was surveyed. There was no contamination found, and the building was free-released for demolition.

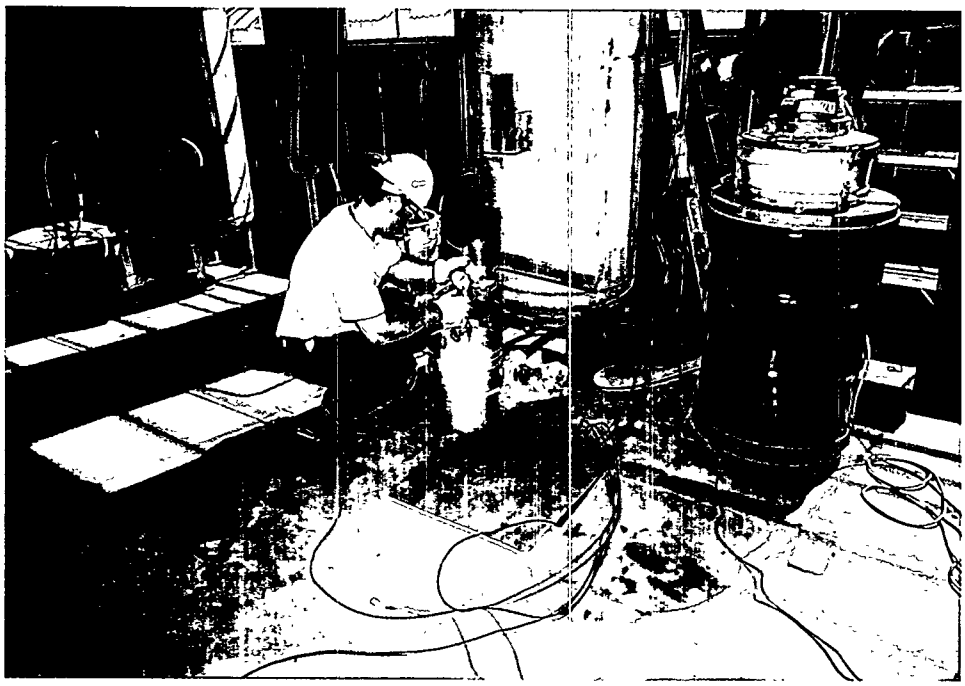

Figure 6.1 WMO Technician Draining a Waste Ion Exchange Tank
(ANL Neg. # 24344K, Frame 11)

Figure 6.2 HP Technician Taking Smear Sample
(ANL Neg. # 24344K, Frame 9)

6.3.6 D&D Demobilization

Upon completion of the final survey, WMO personnel demobilized from the building. Demobilization consisted of removing all equipment and supplies, and leaving the building ready for demolition.

6.4 Building Demolition

6.4.1 Contract Award

The demolition of Building 594 was included in a ANL-E Plant Facilities and Services (PFS) Division procurement package for the demolition of other various buildings on the ANL-E site. This was determined to be most cost-effective. To segregate costs, Building 594 was included as Option 1 of the package.

Contract documents were finalized by the project manager and an ANL-E procurement specialist, and a contract was awarded to Action Wrecking Company. Prior to the start of demolition, the subcontractor submitted performance bonds and provided plans and procedures, which were reviewed and approved by ANL-E. A Preconstruction Safety Meeting was held at ANL-E on August 26, 1998. This meeting provided Action Wrecking management personnel the opportunity to meet with representatives from the various groups at ANL-E who would be involved in the demolition operations. Personnel from Industrial Hygiene, Safety Engineering, Fire Protection, and Building Maintenance reviewed with the contractor the various notifications, permits, and inspections that were required for the various tasks that were to be performed. ESH/HP discussed their oversight role and various over checks. Security personnel reviewed the procedures for site access, deliveries, visitors, and ANL-E traffic regulations. Plant, Facilities and Services discussed the method for obtaining assistance from groups outside of the subcontractor's scope of work with regard to systems and structures inside the contractor's work area. An ANL-E Procurement Official reviewed the procedure for submitting change orders to the contract.

6.4.2 Mobilization and Demolition

Action Wrecking personnel arrived at ANL-E on September 9, 1998 for the start of on-site training and orientation. All subcontractor personnel completed the required ANL-E Contractor Safety Orientation. Equipment was mobilized to the work area, and safety inspections were performed. A work area around the building was clearly marked with yellow "Caution Tape" to warn personnel in the area that demolition work would soon start.

The contractor commenced demolition operations of Building 594 on September 10, 1998. The building was first knocked down (see Figure 6.3) and the metal segregated for recycle. Then the concrete floor and foundation were demolished and the concrete removed for disposal at an off-site facility (see Figure 6.4). The piping that was under the concrete floor was removed, surveyed, and

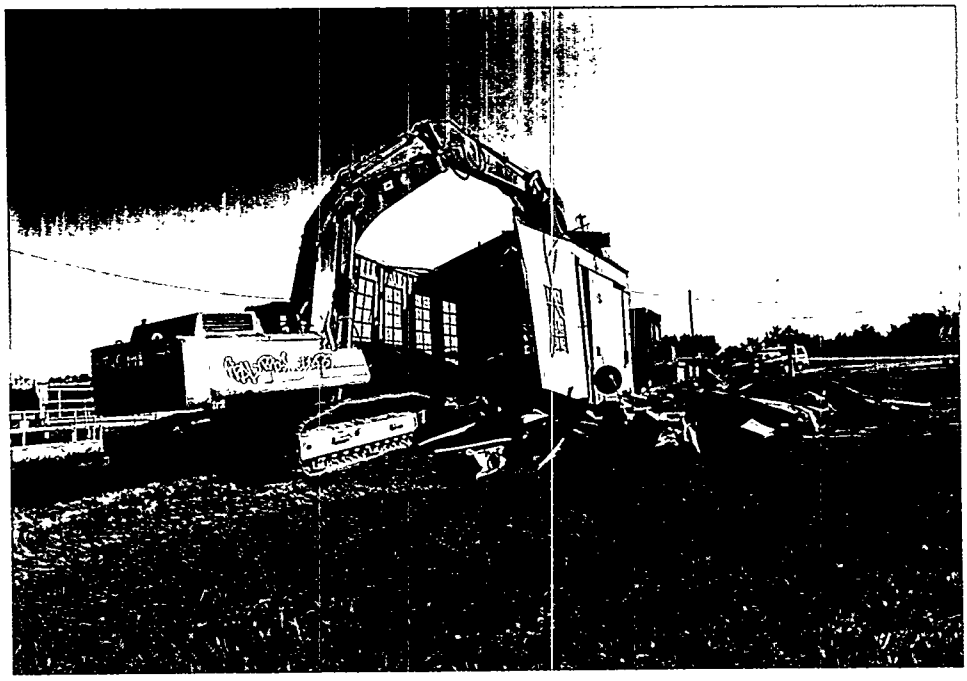

Figure 6.3 Demolition of Building 594
(ANL Neg. # 24692, Frame 8)

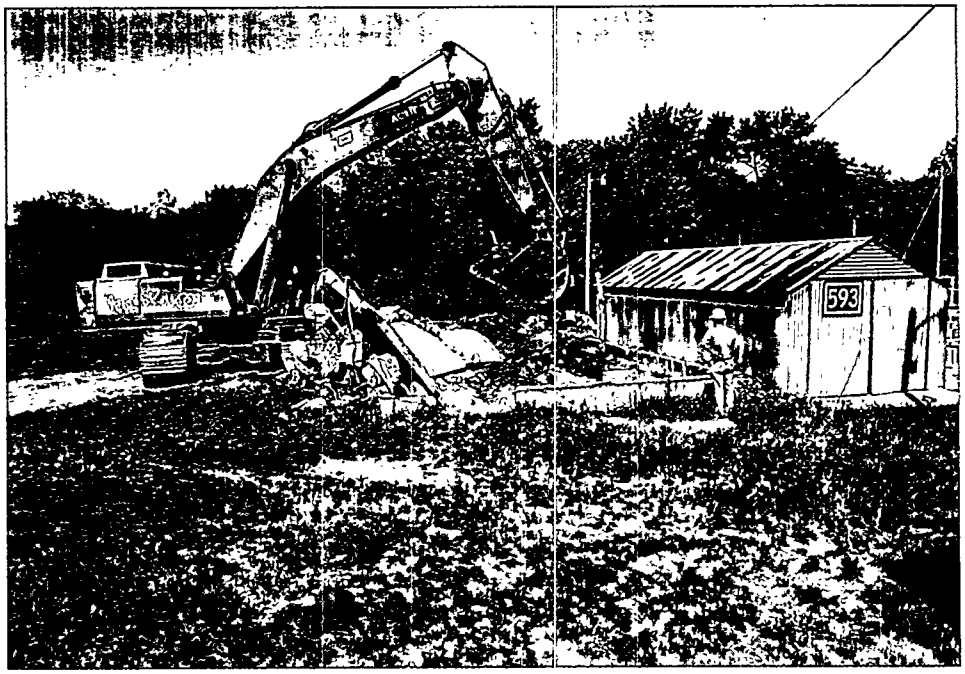

Figure 6.4 Removal of Concrete Pad
(ANL Neg. # 24693, Frame 2)

released to the clean scrap pile for recycling. The site was then backfilled with dirt, graded, and seeded.

6.5 Close-Out Operations

The final project activity consisted of preparation of this final report. This report utilized the information and data from several documents including the Building 594 Characterization Report dated March 1997 and the Final Survey Report.

7.0 POST-DECOMMISSIONING RADIOLOGICAL SURVEY

7.1 Final Survey Objectives

The purpose of the final status survey was to demonstrate that the radiological conditions at Building 594 satisfied the unrestricted release guidelines of the "ANL-E Environment, Safety and Health Manual" and ANL-E Health Physics Procedure HPP-610 "Surface Contamination Surveys for Unrestricted Release of Equipment and Materials."

Based on the contaminants present at Building 594 Waste Ion Exchange Facility, the release criteria specified for the project were as follows:

Beta-Gamma Contamination

- 5,000 dpm (83 Bq)/100 cm^2, beta-gamma fixed and removable (total) contamination, averaged over 1 m^2;
- 15,000 dpm (250 Bq)/100 cm^2, maximum beta-gamma fixed and removable (total) contamination over 100 cm^2; and
- 1,000 dpm (17 Bq)/100 cm^2, removable beta-gamma contamination.

Alpha Contamination

- 100 dpm (1.67 Bq)/100 cm^2, alpha fixed and removable (total) contamination, averaged over 1 m^2;
- 300 dpm (5 Bq)/100 cm^2, maximum alpha fixed and removable (total) contamination over 100 cm^2; and
- 20 dpm (0.3 Bq)/100 cm^2, removable alpha contamination.

7.2 Survey Instrumentation

7.2.1 Instrument Selection

Instruments were chosen to assure that the Minimum Detectable Activity (MDA) for the selected instrument/technique was less than the release criteria. Surface contamination was measured with an NE Technology Model Electra with a 100 cm^2 detector for measuring α, β, and γ, and an Eberline PRM-5-3 with PG-2 scintillation detector [2" (5.08 cm) x 2 mm thick NaI detector]. Surface smears were counted using a Tennelec APC MII Smear Counting System.

7.2.2 Daily Instrument Function Test and Quality Assurance

All survey instruments were function tested daily. Calibrations for each instrument were checked on a regular basis. Instrument calibration records and daily instrument check records are included in the Final Survey Report for Building 594.

7.3 Final Survey Results

The final survey of the building found no contamination on any surface in the building. The building was free released for demolition. During demolition, sections of the underground piping were removed and surveyed. No contamination was detected. All of the contamination was contained in the resin, and the resin was disposed of as low-level waste. Final survey results determined that no further action would be required in the area formally occupied by Building 594.

8.0 COST AND SCHEDULE

8.1 Building 594 D&D Project Cost

The estimated total cost of the project was $182,000.

8.2 Building 594 D&D Project Schedule

The project was completed in two segments. The first began in August 1995 and completed in September 1996. The second began in February 1998 and completed in November 1998. The project lasted a total of 14 months. First segment activities included characterization planning, characterization field work, and the characterization report. Second segment activities included project planning and scheduling, document preparation, D&D activities, waste handling, and building demolition. A Gantt Chart graphically showing the project schedule is provided in Figure 8.1.

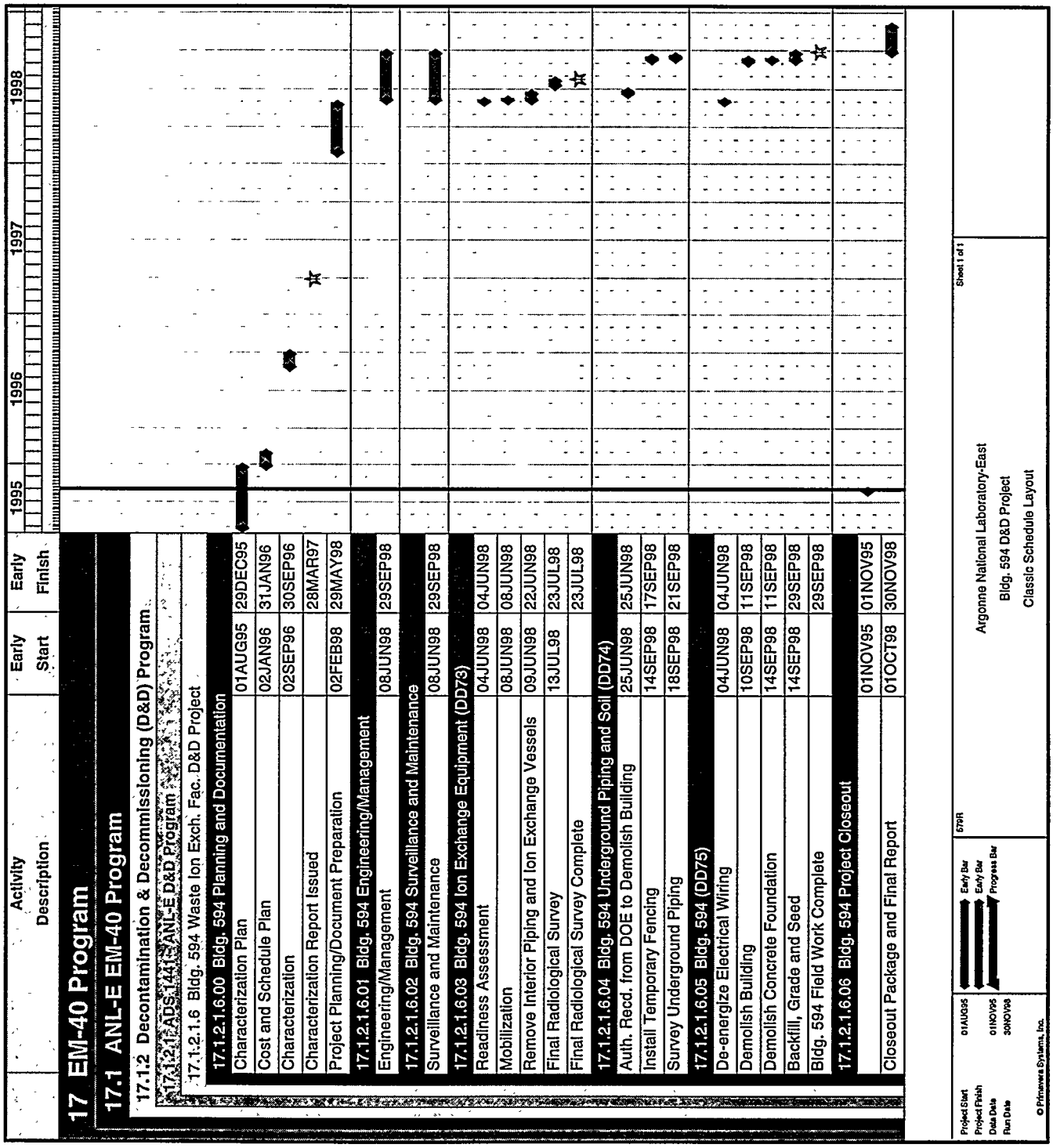

Figure 8.1 Building 594 D&D Project Gantt Chart

9.0 WASTE MANAGEMENT

9.1 Waste Types

Two types of waste were generated during the Building 594 D&D Project: radiological waste and clean waste.

9.2 Waste Volume

9.2.1 Radiological Waste

The radiological waste generated from this project consisted of the resin material from the two exchange vessels, water from the exchange vessels and piping, dirt from the bottom of the catch basin, and personal protection equipment (PPE) used during the D&D operations.

The resin was vacuumed out of the vessels and put into nine 55-gal (208-liter) drums. The nine drums of resin material had an approximate volume of 60 ft^3 (1.68 m^3). Water was drained from the vessels and piping into a closed drain tank. The water was then pumped out of the closed drain tank into a special tank (used for transporting contaminated water) and taken to the ANL-E evaporator for disposal. There was approximately 100 gal (378.5 liters) of water collected. The dirt was removed from the bottom of the catch basin with small hand shovels and placed into a 5-gal (18.93-liter) pail. There was less than 1 ft^3 (0.028 m^3) of material collected.

9.2.2 Clean Waste

There was approximately 10 ft^3 (0.28 m^3) of clean waste generated during the D&D of Building 594. This waste was primarily plastic piping and valves. During the building demolition, there was approximately 800 ft^3 (22.4 m^3) of fiberglass insulation and concrete removed from the building and foundation. This material was sent to a land fill for disposal.

9.3 Recycled Materials

There was approximately 400 ft^3 (11.2 m^3) of recycled material generated during the D&D of the Building 594 Waste Ion Exchange Facility. The material consisted of tanks, valves, and miscellaneous metal. All material was surveyed for radiological contamination, but none was found. The material was then segregated and placed in separate areas for recycle.

During the building demolition, there was approximately 960 ft^3 (26.88 m^3) of metal from the building walls and roof that was sent to be recycled.

9.4 Waste Packaging

Waste packaging operations conformed with U.S. Department of Transportation (DOT) regulations and with the requirements of the designated disposal site. Standard 17-H 55-gal (208-liter) drums were loaded with low-level radioactive waste, sealed and turned over to ANL-WMO for final disposition. The 17-H 55-gal (208-liter) drums were used for packaging the resin from the ion exchange vessels. Liquid radioactive waste generated during D&D operations was processed on site by WMO. Approximately 100 gal (378.5 liters) of liquid were generated during the project as a result of draining the ion exchange vessels and associated piping. The water was placed in a large tank for transport to the on-site treatment facility.

10.0 HEALTH AND SAFETY

10.1 Industrial Health and Safety

It was (and continues to be) the policy of ANL-E and its subcontractors to execute all reasonable precaution in the performance of work during the Building 594 D&D Project in order to protect the safety and health of employees, members of the general public, and the environment. Strict compliance with all applicable environmental safety and health regulations and requirements, including reporting requirements of the DOE, was essential. Safety took precedence over production goals for the duration of the project. It was ANL-E's objective to complete the project in a timely manner while maintaining the highest standards of safety and health for the project. The Building 594 D&D Project Health and Safety Plan provided the guidance necessary to perform the work in a safe manner.

A pre-job hazard evaluation was performed to identify as many of the potential hazards expected to be present at the job site as possible. Some of the hazards identified included heavy equipment operation, lifting and rigging, noise, falling objects, eye hazards, radiation exposure, pinch points, confined space entry work, fire hazards, electrical shocks, heat stress, and exposure to hazardous chemicals. A hazard communication program was implemented to keep employees informed and aware of the hazards present. Frequent inspections by ANL-E management were performed to ensure employee awareness and compliance with established safety regulations.

10.2 Radiation Protection

In addition to the industrial hazards associated with the decommissioning of Building 594, the presence of radioactive materials also presented a radiological hazard for the workers, general public, and environment. The Building 594 D&D Project Radiological Control Plan provided the guidance necessary to perform the work in a radiologically safe manner. The ALARA philosophy was used throughout the project. Only trained essential personnel were utilized in the performance of work. ALARA reviews were performed prior to the start of on-site work and before each segment of work involving personnel exposure.

Personal Protection Equipment was utilized to limit worker exposures to loose and airborne contamination. Signs and barriers were used to keep unauthorized personnel from entering radiation and/or contamination areas and to post entry requirements and radiological conditions inside the area. To prevent the spread of contamination, all equipment, tools, and personnel leaving controlled areas were monitored for radioactive contamination at the exit point.

Radiological Work Permits were utilized for all phases of work. They specified the safety and protective equipment, radiological conditions in the area, type of personnel monitoring equipment, and sampling requirements required for the work. Each individual working in the area was required to read, understand, and sign the specific RWP under which they were working. Radiation exposure was monitored by ANL-E with thermoluminiscent dosimeters (TLDs).

Continuous air monitors (CAMs) were utilized near the work areas to sample and alarm if high airborne radioactivity existed. Grab samplers and lapel samplers were utilized in the workers' breathing zones to track personnel exposure to airborne activity. Respiratory protection was required to be worn when any individual was expected to be exposed to airborne levels of 10% derived airborne concentration (DAC) or higher.

11.0 FINAL FACILITY CONDITION

Building 594 was demolished on September 10, 1998; and the concrete floor and foundation was removed on September 11, 1998. The area was backfilled with dirt, graded and seeded. No further work will be done on the site of Building 594 as part of this project.

12.0 CONCLUSIONS, RECOMMENDATIONS, AND LESSONS LEARNED

12.1 General Problems Encountered

There were two minor electrical problems addressed during the D&D project. The first problem was the discovery that power for Building 593 (directly east of Building 594) was connected to one of the circuits within Building 594. It was necessary to disconnect the circuit and install a new overhead service in Building 593. The second problem dealt with an unidentified circuit that ran through Building 594. The circuit was traced back to a panel in Building 592 (located to the southeast of Building 594) that was used to feed one of the pit scrubbers at the sewage treatment plant. It was determined that the circuit was no longer required, and it was disconnected and removed.

12.2 Management Issues

There was some concern about contaminates and contamination levels at the Waste Ion Exchange Facility prior to the start of characterization. Limited historical information was available on the system, how long it operated or what type of material had been run through the system. A

conservative approach was taken during the planning of this project. During all phases, the unexpected was planned for but, fortunately, never encountered.

12.3 Lessons Learned

Following proper procedures during the electrical disconnect portion of the D&D work prevented a possible electrical hazard to the workers: After the main power panel in Building 594 was disconnected, all circuits and external conduits were checked prior to the start of D&D work. The check identified an energized circuit to an adjacent scrubber. The circuit was traced back to a panel in Building 592. The circuit was then disconnected from its power source and verified that it was dead. The scrubber was no longer in service, and no additional work was required.

13.0 ACRONYM AND ABBREVIATION LISTING

ALARA	As Low As Reasonably Achievable
α	alpha
Am	Americium
ANL-E	Argonne National Laboratory-East (located in Argonne, Illinois USA)
ANSI	American National Standards Institute
ASME	American Association of Mechanical Engineers
Bq	Becquerel
β	beta
CAM	continuous air monitor
cm	centimeters
Co	Cobalt
Cs	Cesium
D&D	Decontamination and Decommissioning; Decontamination and Dismantlement
DAC	derived airborne concentration
DOE	United States Department of Energy
DOE-ARG	United States Department of Energy Argonne Group
DOE-CH	United States Department of Energy Chicago Operations
DOE-EM	United States Department of Energy Environmental Management
DOT	United States Department of Transportation
dpm	disintegrations per minute
EMO	ANL-E Environmental Management Operations Division
ESH	ANL-E Environment, Safety, and Health Division
ESH/HP	Environment, Safety and Health/Health Physics Group
ESH/QA	Office of Environment, Safety and Health/Quality Assurance Oversight
ft	foot (feet)
g	grams
gal	gallon
γ	gamma
HEPA	high efficiency particulate air
hr	hour
HUD	United States Department of Housing and Urban Development
IH	Industrial Hygiene

km	kilometer
LO/TO	lock out/tag out
m	meter or milli
μ	micro
MDA	Minimum Detectable Activity
min	minute
mm	millimeter
mrem	millirem
mSv	milli Sievert
NEPA	National Environmental Policy Act
NaI	sodium iodine
NIST	National Institute for Science and Technology
NQA	Nuclear Quality Assurance
OSHA	Occupational Safety and Health Administration
PFS	ANL-E Plant Facilities and Services Division
p	pico
PPE	personal protection equipment
QA	Quality Assurance
QAR	Quality Assurance Representative
R	Roengtens
RA	Readiness Assessment
RCRA	Resource Conservation and Recovery Act
rem	Roentgen equivalent man
RWP	Radiological Work Permit
TD	Technology Development Division
TLD	Thermoluminescent Dosimeter
WMO	ANL-E Waste Management Operations Group