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ORNL Isotopes Facilities Shutdown Program Plan

S. M. Gibson
B. D. Patton
M. B. Sears

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ORNL/TM-11689

Chemical Technology Division

ORNL ISOTOPES FACILITIES SHUTDOWN PROGRAM PLAN

S. M. Gibson
B. D. Patton
M. B. Sears

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EXECUTIVE SUMMARY

This plan presents the results of a technical and economic assessment for shutdown of the Oak Ridge National Laboratory (ORNL) isotopes production and distribution facilities.

On December 11, 1989, the Department of Energy (DOE), Headquarters, in a memorandum addressed to DOE Oak Ridge Operations Office (DOE-ORO), gave instructions to prepare the ORNL isotopes production and distribution facilities, with the exception of immediate facility needs for krypton-85, tritium, and yttrium-90, for safe shutdown. In response to the memorandum, ORNL identified 17 facilities for shutdown, as indicated in Table 1.1. Each of these facilities is located within the ORNL complex with the exception of Building 9204-3, which is located at the Y-12 Weapons Production Plant. These facilities have been used extensively for the production of radioactive materials by the DOE Isotopes Program. They currently house a large inventory of radioactive materials (Table 1.2). Over the years, these aging facilities have inherited the problems associated with storing and processing highly radioactive materials (i.e., facilities' materials degradation and contamination).

During FY 1990, ORNL is addressing the requirements for placing these facilities into safe shutdown while maintaining the facilities under the existing maintenance and surveillance plan. The surveillance and maintenance plan requires that each of the facilities be maintained in a safe manner. This requires the support of health physicists for monitoring of radioactivity, facility supervisors and staff for building oversight, and craft support for building maintenance activities. The day-to-day operations associated with the surveillance and maintenance of a facility include building checks to ensure that building parameters are meeting the required operational safety requirements, performance of contamination control measures, and preventative maintenance on the facility and facility equipment. Shutdown implementation will begin in FY 1993, and shutdown completion will occur by the end of FY 1994.

The goal of the shutdown plan activities is to place the isotopes facilities at ORNL in a radiologically and industrially safe condition for routine maintenance and surveillance prior to eventual decommissioning. By so doing, these facilities will meet requirements for

surplus facilities acceptance specified in the National Surplus Facilities Management Program (SFMP) Plan. A radiologically safe condition is defined by SFMP as a facility in which (1) all stored special radioactive materials, high-level wastes, and contaminated liquid wastes have been removed; (2) the structures and radiation monitoring systems are in a physical condition adequate to contain and monitor any radioactive contamination in accordance with DOE Order 5480.1; and (3) security systems and procedures are adequate to prevent unauthorized entry. The general requirements for industrial safety, as specified by DOE-ORNL, will be achieved. In addition, all hazardous chemicals will be removed from the facilities being shut down in order to comply with the SFMP Plan.

The Isotopes Facilities Shutdown Program Work Breakdown Structure (WBS) is described in Sects. 5 and 6. The WBS is based on the assumptions listed in Sect. 4.

The budget requirements for shutdown of the ORNL isotopes facilities are summarized in Fig. 1.1. It depicts the various costs on a fiscal year basis along with costs to the responsible program (NE - Nuclear Energy, EM - Environment Management).

Implementation and completion of the Isotopes Facilities Shutdown Plan will significantly reduce the risks to the environment and public safety and health. Furthermore, it should result in reduced surveillance and maintenance costs for future years.

Table 1.1. Isotope facilities for shutdown

	Building
Krypton-85 Enrichment Facility	3026-C
Alpha Powder Facility	3028
Source Development Laboratory	3029
Radioisotope Production Laboratory-C	3030
Radioisotope Production Laboratory-D	3031
Radioisotope Production Laboratory-H	3118
Radioactive Gas Processing Facility	3033
Actinide Fabrication Facility	3033-A
Isotope Area Storage and Service Building	3036
Alpha Handling Facility	3038-AHF
Isotope Materials Laboratories	3038-E
Radioisotope Packaging and Shipping Facility	3038-M
Isotope Technology Building	3047
Fission Product Development Laboratory	3517
Tritium Target Preparation Facility	7025
Actinide Facility	9204-3

Table 1.2. Summary of radioactive materials inventory

Radioisotope	Quantity
^{3}H	312,000 Ci
^{14}C	45 Ci
^{36}Cl	11 Ci
^{41}Ca	Unknown
^{54}Mn	0.1 Ci
^{60}Co	33,300 Ci
^{63}Ni	108 Ci
^{75}Se	0.07 Ci
^{85}Kr	8130 Ci
^{90}Sr	1,550,000 Ci
^{99}Tc	5355 g
^{103}Pd	>1 Ci
^{106}Ru	1.6 Ci
^{129}I	0.1 Ci
^{133}Ba	0.3 Ci
^{137}Cs	440,000 Ci
^{144}Ce	0.00003 Ci
^{147}Pm	<1 Ci
^{152}Eu	26,000 Ci
^{153}Gd	1,100 Ci
^{154}Eu	33,000 Ci
^{192}Ir	40 Ci
^{207}Bi	.001 Ci
^{209}Po	0.00015 Ci
^{227}Ac	5 Ci
^{232}Th	325,000 g
^{233}U	36 g
^{234}U	0.2 g
^{235}U	649 g
^{237}Np	72 g
^{238}Pu	265 g
^{241}Am	56 g
$^{239}Pu/^{241}Pu$	187 g
^{242}Pu	2 g
^{244}Cm	635 g
^{248}Cm	.018 g
^{252}Cf	022 g
^{240}Pu	27 g

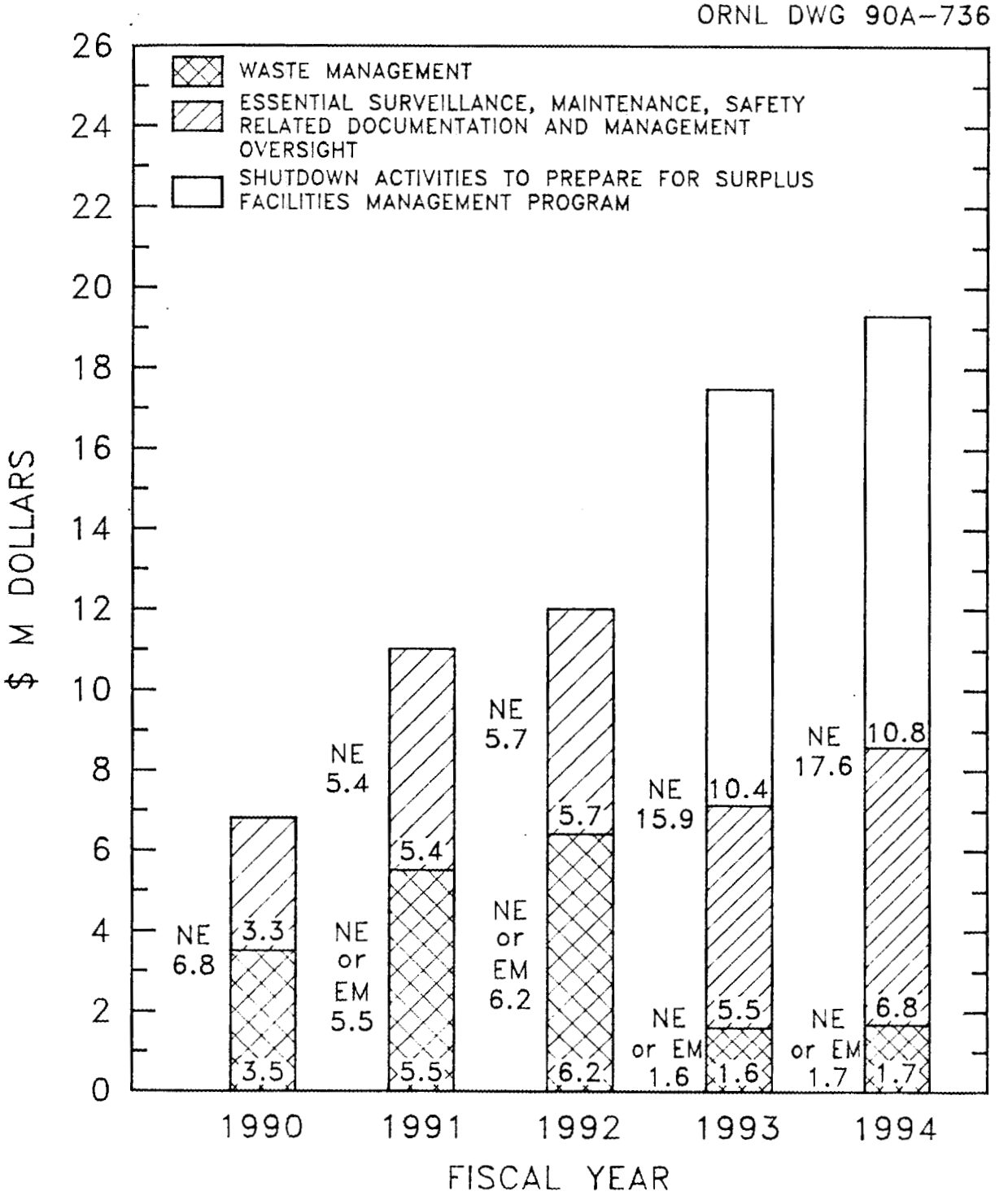

Fig. 1.1. Funding requirements for the ORNL Isotopes Facilities Shutdown Program.

1. INTRODUCTION

This plan presents the plans, organization, and systems that those responsible for managing the safe shutdown of facilities at Oak Ridge National Laboratory (ORNL) which were previously utilized under the Isotopes Production and Distribution (IP&D) Program intend to use. This Plan will be reviewed and updated, as required.

1.1 BACKGROUND

On December 11, 1989, the U.S. Department of Energy (DOE), Headquarters (HQ), in a memorandum addressed to DOE Oak Ridge Operations Office (DOE-ORO), gave instructions to prepare the ORNL IP&D facilities, with the exception of immediate facility needs for ^{85}Kr, ^{3}H, and ^{90}Y, for safe shutdown.

1.2 PURPOSE

The purpose of the ORNL Isotopes Facilities Shutdown Program (IFSP) is to place the ORNL Isotopes Program facilities in a safe shutdown condition for routine maintenance and surveillance prior to eventual decommissioning.

1.3 SCOPE

The Chemical Technology Division (CTD) is responsible for the development, implementation, and completion of required actions for acceptance and transfer of designated ORNL Isotope Program facilities (Table 1.1) into the Surplus Facilities Management Program (SFMP). This program is defined in three work phases.

Phase I - Developing of a safe shutdown plan while maintaining the facilities under the existing maintenance and surveillance plan.

Phase II - Implementing the required actions for placing the facilities in a safe condition and resulting in an approved minimal maintenance and surveillance plan.

Phase III - Completing the required actions for acceptance and transfer of the facilities into the SFMP.

1.4 PRIMARY PARTICIPANTS AND CONTRACTS

The primary participants in the IFSP are:

Oak Ridge Operations Office - Programmatic Support

ORNL Chemical Technology Division - Program Management; Operational and Technical Services

Martin Marietta Energy Systems, Inc., Office of Operational Safety - IFSP Safety Compliance

Martin Marietta Energy Systems, Inc., Quality Assurance - Monitoring IFSP for compliance with Quality Assurance (QA) criteria and providing needed QA documentation

ORNL Environmental and Health Protection Division - SFMP acceptance criteria guidance and waste management

Other contractors may be used to provide specialized services during specific periods of work or for specific purposes. Consultants may be used when specialized expertise is needed for short periods.

1.5 OTHER DOCUMENTATION

Other documentation derived during the course of the IFSP will include:

Environmental Assessment Document

Quality Assurance Plan

Waste Management Plan

Safety Documentation

Maintenance and Surveillance Program Plan with approved procedures

Revised Operational Safety Requirements (OSRs)

Detailed User History Report

SFMP Application

IFSP Final Status Report

2. OBJECTIVES

Three policy goals for project activities are identified:

1. Protect public and on-site personnel health and safety and the quality of the environment.
2. Be credible to the public and DOE by virtue of program integrity and technical excellence.
3. Be cost- and time-effective.

The mission of the IFSP is to determine and complete the required shutdown tasks for ensuring that the isotopes facilities remain safe to the public and environment and to minimize the necessary maintenance and surveillance of the isotopes facilities.

3. MANAGEMENT ORGANIZATION AND RESPONSIBILITIES

The CTD of ORNL is responsible for implementing the safe shutdown of the ORNL isotopes facilities. The organization structure of the CTD management for safe shutdown of the isotopes facilities is illustrated in Fig. 3.1. The Program Manager (PM) is the point of contact for information flow to the Program Office. The PM has direct, primary responsibility and accountability for executing the ORNL Isotopes Facilities Shutdown Program in accordance with the approved Program Plan and Charter.

The PM is responsible for:

- Technical support provided by ORNL or other contractors.
- Environment, safety, and health issues in accordance with federal, state, and local regulations, laws, and standards.
- Reporting of project plans and status in accordance with this Plan and the DOE Program Management System.
- QA in accordance with this Plan.
- Administration, with necessary support from DOE.
- Procurement, to provide the services and materials needed by the project.
- Isotope facilities modification, including design, reviews, and modification management.
- Financial resources to fund the project, with necessary support from DOE.
- Configurational management to establish baselines and control changes.
- Program Organization and information systems to keep all parties properly informed and assurance that all aspects of the system are accorded equal functional importance.

ORNL DWG 90A-780R

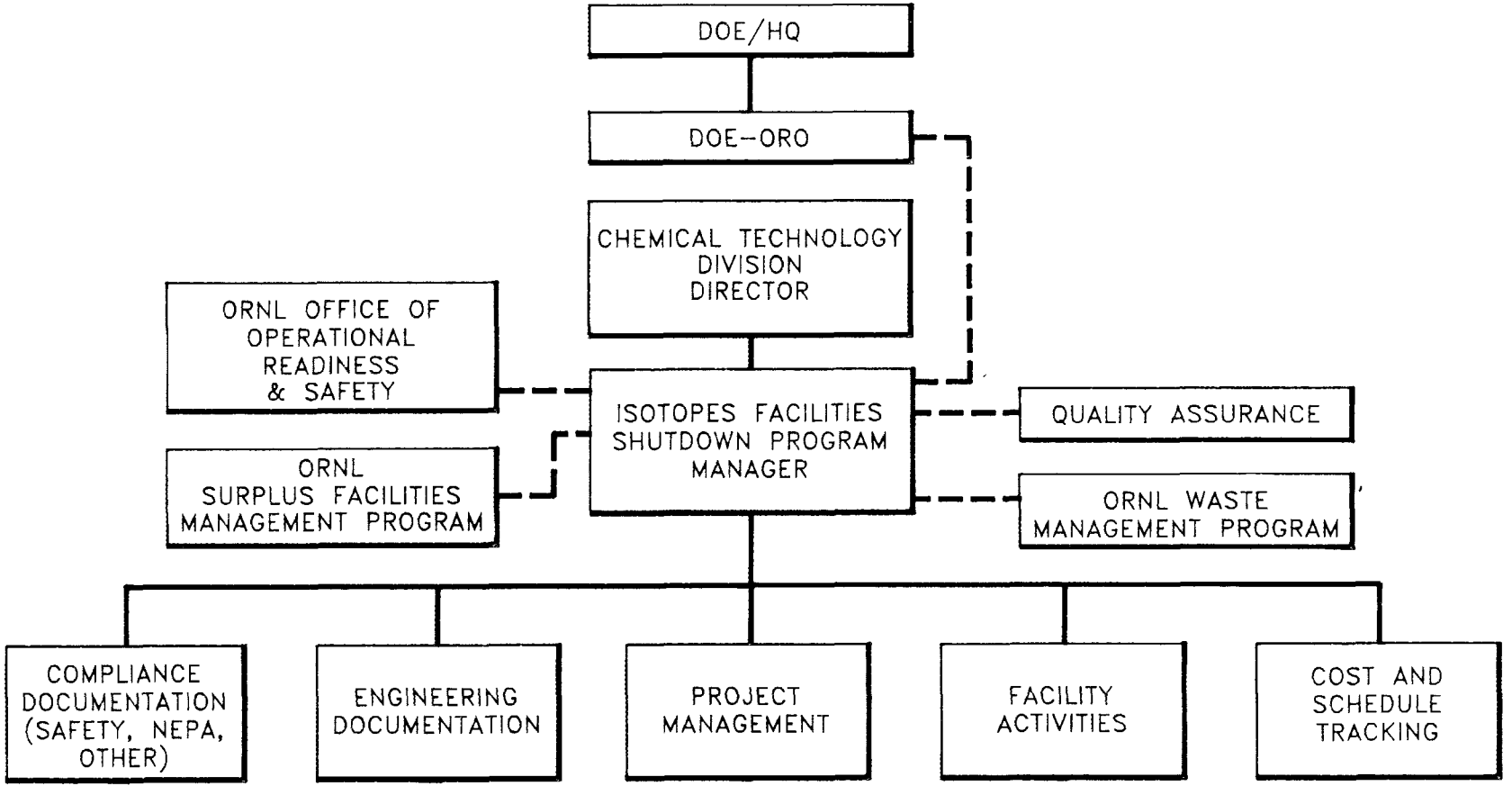

Fig. 3.1. ORNL Isotopes Facilities Shutdown Organization Chart.

4. WORK PLAN BASELINE ASSUMPTIONS

The ORNL Isotopes Facilities Safe Shutdown Plan is based upon the following assumptions:

1. The ORNL Isotopes Facilities Safe Shutdown Plan is developed for the buildings and/or areas within buildings listed in Table 4.1. Appendix A further defines the facilities' status from which a safe shutdown plan was developed.
2. The radioactive materials inventory, along with locations, is listed in Appendix B.
3. No isotope operations are occurring in the identified facilities (Table 4.1), with the exception of ^{90}Y, H^3, ^{85}Kr, Isotope Research Materials Laboratory (IRML) operations, and radioisotope dispensing, packaging, and shipping.
4. Tritium operations will continue until June 30, 1990.
5. Yttrium-90 operations will continue until September 30, 1990.
6. The IRML will be relocated by September 30, 1991. This activity is being addressed by CTD under separate funding and is not covered by this plan other than to accept the relocation date of September 30, 1991, as a baseline assumption. Inventory in Building 3550 is to be moved, and the facility is to be demolished under separate funding to accommodate a new building.
7. Krypton-85 operations will continue until September 30, 1991.
8. Radioisotope dispensing, packaging, and shipping will continue in Building 3038-M until relocated.
9. The facilities will be maintained under the existing maintenance and surveillance plan during FY 1990.
10. Implementation of the ORNL Isotopes Facilities Safe Shutdown Plan will occur during FY 1993 and FY 1994.
11. Acceptance and transfer of the safe shutdown facilities to the Surplus Facilities Management Program will occur at the end of FY 1994.
12. Shutdown tasks are based on the Surplus Facilities Management Program Acceptance Criteria, as described in Appendix C.

13. Waste treatment and disposal charges have been set at a fixed yearly rate based on level-of-activity estimates and are to be paid by Nuclear Energy (NE), irrespective of actual waste production.

14. The Superfund Amendment and Reauthorization Act (SARA) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires a Federal Facilities Agreement (FFA) for federal facilities placed on the National Priority List (NPL). The Oak Ridge Reservation was placed on the NPL on December 21, 1989, and a FFA between DOE-ORO, the Environmental Protection Agency, and the Tennessee Department of Health and Environment is pending. The Federal Facilities Agreement (FFA), when signed, will affect the liquid low-level waste (LLLW) service to most of the isotopes facilities being shut down at ORNL. The LLLW collection tank (WC-10) will be required, upon signing of the FFA, to be removed from service. This tank is being classified as an Environmental, Safety, and Health (ES&H) tank and can be used to prevent creating unacceptable environmental, safety, or health risks in the facilities. Use of the ES&H tank for shutdown activities will require negotiation on a case-by-case basis with the state. It is assumed that WC-10 will be available for use as needed during shutdown implementation.

15. Radioactive materials inventory will be consolidated initially, and by the end of FY 94 will be relocated to non isotope facilities at ORNL or to other DOE sites. For planning purposes, it is assumed that all materials requiring significant shielding (^{60}Co, ^{137}Cs, ^{90}Sr, etc.) will be stored at the Fission Product Development Laboratory (FPDL) (Building 3517) and all other radioactive materials will be stored in two vaults at ORNL (3100 vault located near Building 3019 and 3027 vault located north of Building 3047). FPDL is presently in safe stand-by because of safety concerns. DOE-HQ's approval to utilize this facility for additional inventory storage will be needed by June 1991 to allow implementation of this plan.

16. DOE/HQ has advised that an Environmental Assessment is required before implementation of shutdown activities. It is assumed that the Environmental Assessment Document will be approved by DOE/HQ by June 1991.

17. The shutdown plan, schedule, and cost are based upon current applicable regulations. If new regulations are invoked, the plan, schedule, and cost may be adversely affected.

18. It is assumed that the shutdown schedule is based on the assumption that funding and manpower are readily available.

19. For planning purposes, it is assumed that all shutdown activities will be performed in FY 1993-94. However, if permitted by funding and environmental, safety, and health considerations, some preliminary activities may be conducted in FY 1991-92 if DOE approval is received on (1) radioactive material inventory consolidation plans (item 15 above) and (2) the Environmental Assessment (item 16 above).

Table 4.1. Isotope facilities to be included in shutdown plan

	Building
Krypton-85 Enrichment Facility	3026-C
Alpha Powder Facility	3028
Source Development Laboratory	3029
Radioisotope Production Laboratory (C,D,H)	3030/3031/3118
Radioactive Gas Processing Facility	3033
Actinide Fabrication Facility	3033-A
Isotope Area Storage and Service Building	3036
Alpha Handling Facility	3038-AHF
Isotope Materials Laboratories	3038-E
Radioisotope Packaging and Shipping Facility	3038-M
Isotope Technology Building	3047
Fission Product Development Laboratory	3517
Tritium Target Preparation Facility	7025
Actinide Facility	9204-3

5. WORK PLAN

This section describes the shutdown tasks for ensuring that the Isotopes Facilities remain safe to the public and environment while being managed by the SFMP under minimum maintenance and surveillance. Each phase of project activity is described, including the current phase whereby development and approval of the safe shutdown plan occurs and subsequent phases during which shutdown activities are implemented and the facilities are transferred to the SFMP. The activities described under each phase of the project are identified by their unique element identification numbers from the Work Breakdown Structure (WBS).

5.1 PHASE I

Phase I addresses the current phase during which a safe shutdown plan is developed, reviewed, and approved while maintaining the facilities under the existing maintenance and surveillance plan.

5.1.1 WBS Elements

Maintain Shutdown Facilities (WBS 1.1.1)

The facilities for safe shutdown will be maintained under the existing maintenance and surveillance program for each facility. Manpower for facility maintenance and surveillance will continue at the current level.

Prepare Draft Shutdown Plan (WBS 1.1.2)

The plan will include all activities necessary for placing the facilities in a safe shutdown condition for routine maintenance and surveillance prior to eventual decommissioning. Furthermore, the plan will address all actions needed to place the facilities into the Surplus Facilities Management Program.

Submit Draft Shutdown Plan to DOE/HQ (WBS 1.1.3)

The Shutdown Plan for the ORNL Isotopes Facilities is scheduled to be received by DOE/HQ on June 14, 1990, for their review and comment.

Finalize Shutdown Plan (WBS 1.1.4)

The Shutdown Plan for the ORNL Isotopes Facilities will receive DOE/HQ approval and authorization to begin implementation of the plan.

5.2 PHASE II

Phase II implements the required actions for placing the facilities in a safe condition and results in an approved, revised maintenance and surveillance plan. During this phase, the application for transferring the shutdown facilities into the SFMP is submitted to the SFMP.

Building 3026C (WBS 1.2.1)

Activities in Building 3026C are identified by WBS elements 1.2.1.1 through 1.2.1.8.

Tritium Recovery (WBS 1.2.1.1) - Tritium radioluminescent lights are stored in Building 3026C and contain approximately 111,800 Ci of tritium in an unusable form. Recovery of tritium will involve mechanically breaking the glass tube and purifying and storing the evolved gas for transfer off-site.

Removal of Tritium, Krypton, and Miscellaneous Health and Safety Radioisotopes (WBS 1.2.1.2) - Transfer off site approximately 111,800 Ci of tritium, 8130 Ci of krypton, and small amounts of health and safety radioisotopes.

Deactivate Piping Services to Cells/Hoods/Glove Boxes (WBS 1.2.1.3) - Disconnect, drain, and plug all piping services to cells, hoods, and glove boxes.

Deactivate Krypton Columns (WBS 1.2.1.4) - Drain the circulating cooling system to the Krypton Columns and disconnect the electrical power.

Identify and Drain Stagnant Liquid from Piping (WBS 1.2.1.5) - Identify, drain, and properly disposed of all liquid contained within piping.

ID Tag Verification for All Pipes, Valves, etc. (WBS 1.2.1.6) - Properly identify and tag all piping, valves, etc.

Waste Packaging (WBS 1.2.1.7) - Proper waste removal and packaging will be an ongoing activity during the shutdown activities at Building 3026C.

Cells Cleanup (WBS 1.2.1.8) - Cells will be remotely cleaned of unanchored radioactive and/or contaminated equipment and materials per guidance from SFMP. Gross remote cleanup and loose contamination removal will be executed to ensure reduced maintenance and surveillance cost.

Building 3028 (WBS 1.2.2)

Activities in Building 3028 are identified by WBS elements 1.2.2.1 through 1.2.2.14. The area within and surrounding Building 3028 is highly contaminated from known (Pu,

Cm, and Pm) and unknown sources. WBS 1.2.2.1 and WBS 1.2.2.2 address radioactive contaminants surrounding Building 3028. In 1989 construction was ongoing near Building 3028. Soil radiation levels of 70 R/h were noted before abandoning construction activities. Radioactive characterization will be performed to identify the distribution of radioactivity within a defined area and to determine the vertical and horizontal boundaries (WBS 1.2.2.1). The resulting data will be documented (WBS 1.2.2.2) and soil contamination warnings posted (WBS 1.2.2.11). In previous years, the entire building interior was highly contaminated with alpha. This resulted in sealing the walls, ceilings, and floors with paint. Warnings will be posted in appropriate places (WBS 1.2.2.3). Radioactive inventory will be characterized and transferred to Building 3517 and/or the vault for short-term storage before being transferred off-site (WBS 1.2.2.6 and 1.2.2.7). WBS 1.2.2.8 will provide for installing glass window pane to Cell 7 as a precaution for preventing a breach of containment. The building exterior will be sealed to achieve better building containment (WBS 1.2.2.10). Building 3028 is just barely operating under the minimum allowable negative pressure, even though the ventilation system is run at full capacity. All piping, valves, etc., will be properly identified and tagged (WBS 1.2.2.12). Stagnant liquid within piping will be identified, drained, and properly disposed of (WBS 1.2.2.13). Cells will be remotely cleaned of unanchored radioactive and/or contaminated equipment and materials per contaminated equipment and materials per guidance from the SFMP. Gross remote cleanup and loose contamination removal will be executed to ensure reduced maintenance and surveillance costs (WBS 1.2.2.14). Piping services to cells, hoods, and glove boxes will be deactivated (WBS 1.2.2.4) and glove ports sealed (WBS 1.2.2.5). Waste packaging (WBS 1.2.2.9) will be an ongoing activity during the shutdown activities at Building 3028.

Building 3029 (WBS 1.2.3)

Activities for Building 3029 include WBS elements 1.2.3.1 through 1.2.3.13.

Cs Powder Cleanup (WBS 1.2.3.1) - Cesium powder contamination exists in the tracks for the rear door entry to Cell 3. This currently requires weekly cleanup to maintain acceptable limits of contamination. A thorough decontamination of the door tracks will be completed. This will reduce surveillance and maintenance costs and prevent radioactive releases to the environment.

C-14 Glove Boxes Disposal (WBS 1.2.3.2) - The C-14 glove boxes are highly contaminated and will be properly disposed of.

Deactivate Piping Services to Cells/Hoods/Glove Boxes (WBS 1.2.3.3) - Disconnect, drain, and plug all piping services to cells, hoods, and glove boxes.

Characterization of 94 Radioactive Sources (WBS 1.2.3.4) - Characterize 94 radioactive sources (see Appendix B) for identity and activity.

Characterization of Ir-192 Pellets (WBS 1.2.3.5) - Characterize ^{192}Ir pellets for activity.

Transfer Sources and Pellets to INEL (WBS 1.2.3.6) - Transfer sources and pellets (WBS 1.2.3.4 and 1.2.3.5) to INEL - (If not possible, will transfer to Bldg. 3517.)

Install FRACAS System (WBS 1.2.3.7).

Waste Packaging (WBS 1.2.3.8) - Proper waste removal and packaging will be an ongoing activity during the shutdown activities.

Identify and Drain Stagnant Liquid from Piping (WBS 1.2.3.9) - Identify, drain, and properly dispose of all liquid contained within piping.

ID Tag Verification for all Pipes, Valves, etc. (WBS 1.2.3.10) - Properly identify and tag all piping, valves, etc.

Transfer of Radioactive Material (WBS 1.2.3.11) - Transfer nuclear material (see Appendix B) to ORNL vault.

Lead Disposal (WBS 1.2.3.12) - Dispose of lead waste.

Cells Cleanup (WBS 1.2.3.13) - Cells will be remotely cleaned of unanchored radioactive and/or contaminated equipment and materials per guidance from the SFMP. Gross remote cleanup and loose contamination removal will be executed to ensure reduced maintenance and surveillance costs.

Building 3030 (WBS 1.2.4)

Activities in Building 3030 are identified by WBS elements 1.2.4.1 through 1.2.4.5.

Seal Glove Ports (WBS 1.2.4.1) - Remove gloves from glove box ports and seal ports.

Waste Packaging (WBS 1.2.4.2) - Proper waste removal and packaging will be an ongoing activity during the shutdown activities.

Deactivate Piping Services to Cells/Hoods/Glove Boxes (WBS 1.2.4.3) - Disconnect, drain, and plug all piping services to cells, hoods, and glove boxes.

ID Tag Verification for all Pipes, Valves, etc. (WBS 1.2.4.4) - Properly identify and tag all piping, valves, etc.

Transfer/Disposal Radioactive Material (WBS 1.2.4.5) - (See Appendix B).

Building 3031 (WBS 1.2.5)

Activities in Building 3031 are identified by WBS elements 1.2.5.1 through 1.2.5.5.

Deactivate Piping Services to Cells/Hoods/Glove Boxes (WBS 1.2.5.1) - Disconnect, drain, and plug all piping services to cells, hoods, and glove boxes.

Seal Glove Ports (WBS 1.2.5.2) - Remove gloves from glove box ports and seal ports.

Waste Packaging (WBS 1.2.5.3) - Proper waste removal and packaging will be an ongoing activity during the shutdown activities.

ID Tag Verification for all Pipes, Valves, etc. (1.2.5.4) - Properly identify and tag all piping, valves, etc.

Roof Repair (WBS 1.2.5.5) - Repair roof to prevent adverse building conditions resulting from faulty roof.

Building 3118 (WBS 1.2.6)

Activities in Building 3118 are identified by WBS elements 1.2.6.1 through 1.2.6.2.

Radioactive Material Characterization/Transfer/Disposal (WBS 1.2.6.1) - Radioactive materials of unknown quantities will be characterized and transferred or disposed of (see Appendix B).

Waste Packaging (WBS 1.2.6.2) - Proper waste removal and packaging will be an ongoing activity during the shutdown activities.

Building 3033 (WBS 1.2.7)

Activities in Building 3033 are identified by WBS elements 1.2.7.1 through 1.2.7.4.

Deactivate Piping Services to Cells/Hoods/Glove Boxes (WBS 1.2.7.1) - Disconnect, drain, and plug all piping services to cells, hoods, and glove boxes.

Transfer Tritium (WBS 1.2.7.2) - Transfer tritium off-site.

ID Tag Verification for All Pipes, Valves, etc. (WBS 1.2.7.3) - Properly identify and tag all piping, valves, etc.

Waste Packaging (WBS 1.2.7.4) - Proper waste removal and packaging will be an ongoing activity during the shutdown activities.

Building 3033A (WBS 1.2.8)

Activities in Building 3033A are identified by WBS elements 1.2.8.1 through 1.2.8.3.

Deactivate Piping Services to Cells/Hoods/Glove Boxes (WBS 1.2.8.1) - Disconnect, drain, and plug all piping services to cells, hoods, and glove boxes.

Transfer Radioactive Materials (WBS 1.2.8.2) - Transfer radioactive materials (see Appendix B) to the ORNL vault.

Roof Repair (WBS 1.2.8.3) - Repair roof to prevent water from entering building during periods of rain.

Building 3036 (WBS 1.2.9)

Activities in Building 3036 are identified by WBS elements 1.2.9.1 through 1.2.9.5.

Deactivate Unused Piping Services (WBS 1.2.9.1).

Transfer Stable Isotopes (WBS 1.2.9.2) - The stable isotopes will be relocated by September 30, 1991. This activity is being addressed by CTD under separate funding and is not covered by this plan.

Housecleaning (WBS 1.2.9.3) - General housecleaning will be performed.

Soil Contamination Posting (WBS 1.2.9.4) - The soil beneath Building 3036 is suspected to have radioactive contamination. Appropriate posting will be done.

Underground Tank Posting (WBS 1.2.9.5) - An underground tank used for collecting radioactive-contaminated liquid is located underneath Building 3036. Proper posting will be done.

Building 3038-AHF (WBS 1.2.10)

Activities in Building 3038-AHF are identified by WBS elements 1.2.10.1 through 1.2.10.4.

Deactivate Piping Services to Cells/Hoods/Glove Boxes (WBS 1.2.10.1) - Disconnect, drain, and plug all piping services to cells, hoods, and glove boxes.

Transfer Radioactive Material (WBS 1.2.10.2) - Transfer nuclear material (see Appendix B) to ORNL vault.

Seal Glove Ports (WBS 1.2.10.3) - Remove gloves from glove box ports and seal ports.

Cells Cleanup (WBS 1.2.10.4) - Cells will be remotely cleaned of unanchored radioactive and/or contaminated equipment and materials per guidance from the SFMP.

Gross remote cleanup and loose contamination removal will be executed to ensure reduced maintenance and surveillance costs.

Building 3038-E (WBS 1.2.11)

Activities in Building 3038-E are identified by WBS elements 1.2.11.1 through 1.2.11.4.

Seal Glove Ports (WBS 1.2.11.1) - Remove gloves from glove box ports and seal ports.

Deactivate Piping Services to Cells/Hoods/Glove Boxes (WBS 1.2.11.2) - Disconnect, drain, and plug all piping services to cells, hoods, and glove boxes.

Solidify and Transfer Radioactive Materials (WBS 1.2.11.3) - Evaporate radioactive materials for solidification and transfer to the ORNL vault.

Waste Packaging (WBS 1.2.11.4) - Proper waste removal and packaging will be an ongoing activity during the shutdown activities.

Building 3038-M (WBS 1.2.12)

Activities in Building 3038-M are identified by WBS elements 1.2.12.1 through 1.2.12.5.

Deactivate Piping Services (WBS 1.2.12.1) - Disconnect, drain, and plug all piping services to cells, hoods, and glove boxes.

Solidify Liquid Radioactive Material (WBS 1.2.12.2) - Evaporate liquid nuclear material (see Appendix B) for solidification.

Remove Radioactive Material (WBS 1.2.12.3) - Move nuclear material (see Appendix B) to ORNL vault.

Barricade Cleanup (WBS 1.2.12.4) - Clean barricade area of radioactive contamination and any radioactive materials handled by WBS 1.2.12.2 and WBS 1.2.12.3.

Relocate Packaging and Shipping Operations (WBS 1.2.12.5) - Relocate the Packaging and Shipping Operations. This WBS element will identify an area for relocation and implement the necessary administrative actions for transfer.

Building 3047 (WBS 1.2.13)

Activities in Building 3047 are identified by WBS 1.2.13.1 through 1.2.13.10.

Deactivate Piping Services to Cells/Hoods/Glove Boxes (WBS 1.2.13.1) - Disconnect, drain, and plug all piping services to cells, hoods, and glove boxes.

Waste Packaging (WBS 1.2.13.2) - Proper waste removal and packaging will be an ongoing activity during the shutdown activities.

Cells Cleanup (WBS 1.2.13.3) - Cells will be remotely cleaned of unanchored radioactive and/or contaminated equipment and materials per guidance from the SFMP. Gross remote cleanup and loose contamination removal will be executed to ensure reduced maintenance and surveillance costs.

Cell D Sump Sludge Removal (WBS 1.2.13.4) - Sludge located in the sump pit probes 900 R/h. This WBS activity address the removal and disposal of the radioactive sludge.

Radioactive Materials Removal (WBS 1.2.13.5) - Transfer radioactive materials (see Appendix B) to ORNL vault.

Seal Glove Ports (WBS 1.2.13.6) - Remove gloves from glove ports and seal ports.

ID Tag Verification for all Pipes, Valves, etc. (WBS 1.2.13.7) - Properly identify and tag all piping, valves, etc.

Identify and Drain Stagnant Liquid from Piping (WBS 1.2.13.8) - Identify, drain, and properly dispose of all liquid contained within piping.

Cell C Window Repair (WBS 1.2.13.9) - The liquid-filled Cell C window leaks. The window will be repaired to prevent further leaks.

Filter Pit Cleanup (WBS 1.2.13.10) - The change-out of HEPA filters exposes maintenance personnel to a dose rate of about 0.6 R/h for a 20- to 30-min filter change. This occurs on a frequent basis. This WBS element would involve activities to reduce filter change-out frequency and lower personnel exposure to radiation. This, in turn, will result in lower surveillance and maintenance costs.

Building 3517 (WBS 1.2.14)

Activities for Building 3517 include WBS elements 1.2.14.1 through 1.2.14.16.

Building Upgrade for Acceptance of Radioactive Inventory/Packaging (WBS 1.2.14.1) - Building 3517 is currently not in compliance with DOE safety regulations. This WBS element will implement corrective measures for ventilation and repair of hot cell penetrations.

Hot Transfer Pump/Lines Removal (WBS 1.2.14.2) - Remove hot transfer pump and lines located outside Building 3517.

Transfer Shielded Carriers to SWSA5 (WBS 1.2.14.3) - Transfer shielded carriers located at Building 3517 to SWSA5.

Transfer Cm-244 to REDC (Bldg. 7920) at ORNL (WBS 1.2.14.4) - Transfer ^{244}Cm to REDC.

Transfer Hot Lead to Retrievable Storage (WBS 1.2.14.5).

Cells Cleanup (WBS 1.2.14.6) - Cells will be remotely cleaned of unanchored radioactive and/or contaminated equipment and materials per guidance from the SFMP. Gross remote cleanup and loose contamination removal will be executed to ensure reduced maintenance and surveillance costs.

Waste Packaging (WBS 1.2.14.7) - Proper waste removal and packaging will be an ongoing activity during the shutdown activities.

Removal/Disposal of Cell 14E Left Manipulator (Remove Duct Seal and Secure Cell Penetrations) (WBS 1.2.14.8).

Lead Shielding Removal from Block Plug Holes; Cleanup/Replace (WBS 1.2.14.9)

Asbestos Containment (WBS 1.2.14.10) - Ensure containment of asbestos-insulated piping.

Housekeeping (WBS 1.2.14.11) - General housekeeping will be ongoing.

ID Tag Verification for all Pipes, Valves, etc. (WBS 1.2.14.12) - Properly identify and tag all piping, valves, etc.

Identify and Drain Stagnant Liquid from Piping (WBS 1.2.14.13) - Identify, drain, and properly dispose of all liquid contained within piping.

Deactivate Piping Services to Cells/Hoods/Glove Boxes (WBS 1.2.14.14) - Disconnect, drain, and plug all piping services to cells, hoods, and glove boxes.

Repackage Cs-137 and Sr-90 Sources (WBS 1.2.14.15). - Sources will be disassembled and packaged as necessary for acceptance by the WESF at Hanford.

Transfer WESF Sr-90 and Cs-137 Sources to Hanford (WBS 1.2.14.16).

<u>Building 3550 (WBS 1.2.15)</u>

(Inventory Removal and Building Razing Under Separate Funding).

<u>Building 7025 (WBS 1.2.16)</u>

Activities for Building 7025 include WBS elements 1.2.16.1 through 1.2.16.3.

Transfer of Tritium Inventory (WBS 1.2.16.1) - Transfer tritium to Bldg. 3033 for loading in containers to ship to customer or Mound Laboratory (see Appendix B).

Transfer Thorium Inventory (WBS 1.2.16.2) - Transfer thorium (see Appendix B) to Y-12.

Cleanup of Tritium Legacy (WBS 1.2.16.3) - Clean Building 7025 of any tritium-contaminated equipment and materials.

Building 9204-3 (WBS 1.2.17)

Activities in Building 9204-3 are identified by WBS element 1.2.17.1

Secure Access to Designated Actinides Area Within Building 9204-3 (WBS 1.2.17.1) - A small area within Building 9204-3 is being sealed off and locked to prevent unauthorized entry. This area is identified in Sect. 4 (Fig. 4.18) and includes the Actinides Area and Room 2432 (Equipment Wash and Service Area).

Access Control for Facilities (WBS 1.2.18)

This WBS element involves those activities necessary for restricting access to the shutdown facilities. A fence will be constructed around those facilities located in the ORNL Isotopes Circle area with restricted key card access. The remaining shutdown facilities will be key-locked with restricted access.

Facilities LLW System Disconnect Evaluation and Response (WBS 1.2.19)

The Federal Facilities Agreement, when signed, will affect the following shutdown facilities:

Buildings

3026C	3033
3028	3033A
3029	3038M
3030	3038E
3031	3047

These buildings may no longer have access to any LLLW drain systems. This WBS element will evaluate the situation and respond accordingly.

Facilities Alarm Systems Evaluation and Corrective Actions (WBS 1.2.20)

Facilities Alarm Systems Evaluation and Corrective Actions include WBS elements 1.2.20.1 through 1.2.20.5.

Evaluate Facilities Monitoring Systems (WBS 1.2.20.1) - Review the existing detector and alarm monitor systems and evaluate the systems adequacy for monitoring the facilities under reduced surveillance.

Install Liquid Level Alarms (WBS 1.2.20.2) - Provide liquid-level detectors and alarms in areas where there is a potential for collection of contaminated liquid. Connect alarm annunciators to ORNL Waste Operations Control Center for 24-hour monitoring.

Replace Airborne Contamination Monitors (WBS 1.2.20.3) - Provide continuous air monitors to replace nonrepairable units.

Replace Radiation Field Monitor (WBS 1.2.20.4) - Provide radiation monitors to replace units which cannot be calibrated.

Correct Deficiencies in Monitoring Systems (WBS 1.2.20.5) - Provide additional remote sensing and alarm systems as determined by 1.2.20.1.

Facilities Documentation (WBS 1.2.21)

Facilities documentation activities are described by WBS elements 1.2.21.1 through 1.2.21.10. They are as follows:

Prepare Environmental Assessment Document (WBS 1.2.21.1) - An Environmental Assessment will be prepared to address environmental issues involved with shutdown of the isotope facilities.

Submit Environmental Assessment to DOE for Approval (WBS 1.2.21.2) - The Environmental Assessment will be submitted to DOE for approval.

QA Document (WBS 1.2.21.3) - A Quality Assurance Document addressing shutdown implementation will be prepared.

Waste Management Plan (WBS 1.2.21.4) - A Waste Management Plan addressing the disposition of waste resulting from shutdown implementation will be prepared.

Safety Documentation (WBS 1.2.21.5) - Safety Documentation Mandated by the MMES-OORS will be prepared.

Maintenance and Surveillance Program Plan with Approved Procedures (WBS 1.2.21.6) - A Maintenance and Surveillance Program Plan with approved procedures will be prepared which addresses each of the facilities after shutdown completion.

Establish Safety-Related As-Built Drawings (WBS 1.2.21.7) - As-built drawings will be prepared for all building safety systems.

Detailed User History (WBS 1.2.21.8) - A detailed user history will be prepared.

Revised OSRs and Approval (WBS 1.2.21.9) - The OSRs will be revised and approved accordingly after shutdown completion.

Facilities Final Status Report (WBS 1.2.21.10) - A final status report addressing the state of each facility will be prepared at completion of shutdown activities.

Maintenance and Surveillance (WBS 1.2.22)

This WBS element involves all routine maintenance and surveillance activities for the Isotopes Shutdown Facilities while undergoing shutdown implementation. This requires the support of health physicists for monitoring of radioactivity, facility supervisors and staff for building oversight, and craft support for building maintenance activities. The day-to-day operations associated with the surveillance and maintenance of a facility includes building checks to ensure that building parameters are meeting the required operational safety requirements, performance of contamination control measures (to include area smears and radiation field measurements), and preventative maintenance on the facility and facility equipment.

Shutdown Project Management and Program Oversight (WBS 1.2.23)

This WBS element involves activities necessary for project management and oversight of the Isotopes Shutdown Facilities Program.

Utilities (WBS 1.2.24)

WBS 1.2.24 accounts for the necessary utilities of each shutdown facility.

Waste Treatment and Disposal (WBS 1.2.25)

Activities under WBS element 1.2.25 include operation of a ventilation system that maintains negative pressure on the facilities to prevent the release of radioactive materials to the environment; fugitive waste costs for inleakage of groundwater; routine maintenance of the waste operations system; and special cleanup equipment.

Application for Facilities Transfer to SFMP (WBS 1.2.26)

WBS element 1.2.26 activities will investigate and obtain all information for completing the application for SFMP. The application will be submitted to SFMP.

5.3 PHASE III

Phase III completes the required actions for acceptance and transfer of the facilities into the SFMP.

Acceptance and Transfer of Facilities into SFMP (WBS 1.3.1)

This is the final WBS element activity in the ORNL Isotopes Facilities Safe Shutdown Program. It consists of formal acceptance and transfer of the facilities into the SFMP by DOE/HQ.

6. WORK BREAKDOWN STRUCTURE

The Work Breakdown Structure (WBS) for the ORNL Isotopes Facilities Shutdown Program (IFSP) is shown in Fig. 6.1. The WBS shall be used to identify work activities; plan and schedule work; develop resource budgets to support work; contract for work; collect technical, schedule, and cost performance data; and report both the plans and performance of the project to others. This coordinated use of the WBS is required of all participants in the ORNL IFSP and shall be the vehicle to maintain complete integration of the technical, schedule, and cost baseline at all times. Elements of the WBS will then provide the integration points for assessing performance against these baselines.

Each element of the WBS represents discrete groupings of work which will produce services, hardware, or data. Descending levels in the hierarchy provide increasingly detailed definition of the services, hardware, or data. A numbering system will be used to identify each element.

The four levels of the WBS shown in Fig. 6.1 are Levels 1 through 4. These will be considered the ORNL IFSP Summary. All project participants will use the same numbering scheme to code WBS elements as described below.

Planning - All work to produce hardware, services, or data shall be planned into logical work groupings or packages which are successively subdivided into smaller and smaller work groupings. The activities required to perform the work in each group shall be identified, defined, and logically arrayed in precedence networks. Procurement actions shall be planned such that each contracted element shall be contracted to only one organization. More than one element may be contracted to a single organization.

All tasks required of a contractor, whether in the original contract or a modification thereto, shall be described by WBS codes in contracting documents. These WBS codes shall be specified in Requests for Proposal, Requests for Bid, and all procurement correspondence. Each task undertaken must be directly correlated with the WBS elements in the contract Statement of Work (SOW). Contracts that include more than one element of the WBS require planning and reporting of the work into each appropriate element as well as for the total contract. The ORNL IFSP participants shall use the WBS dictionary

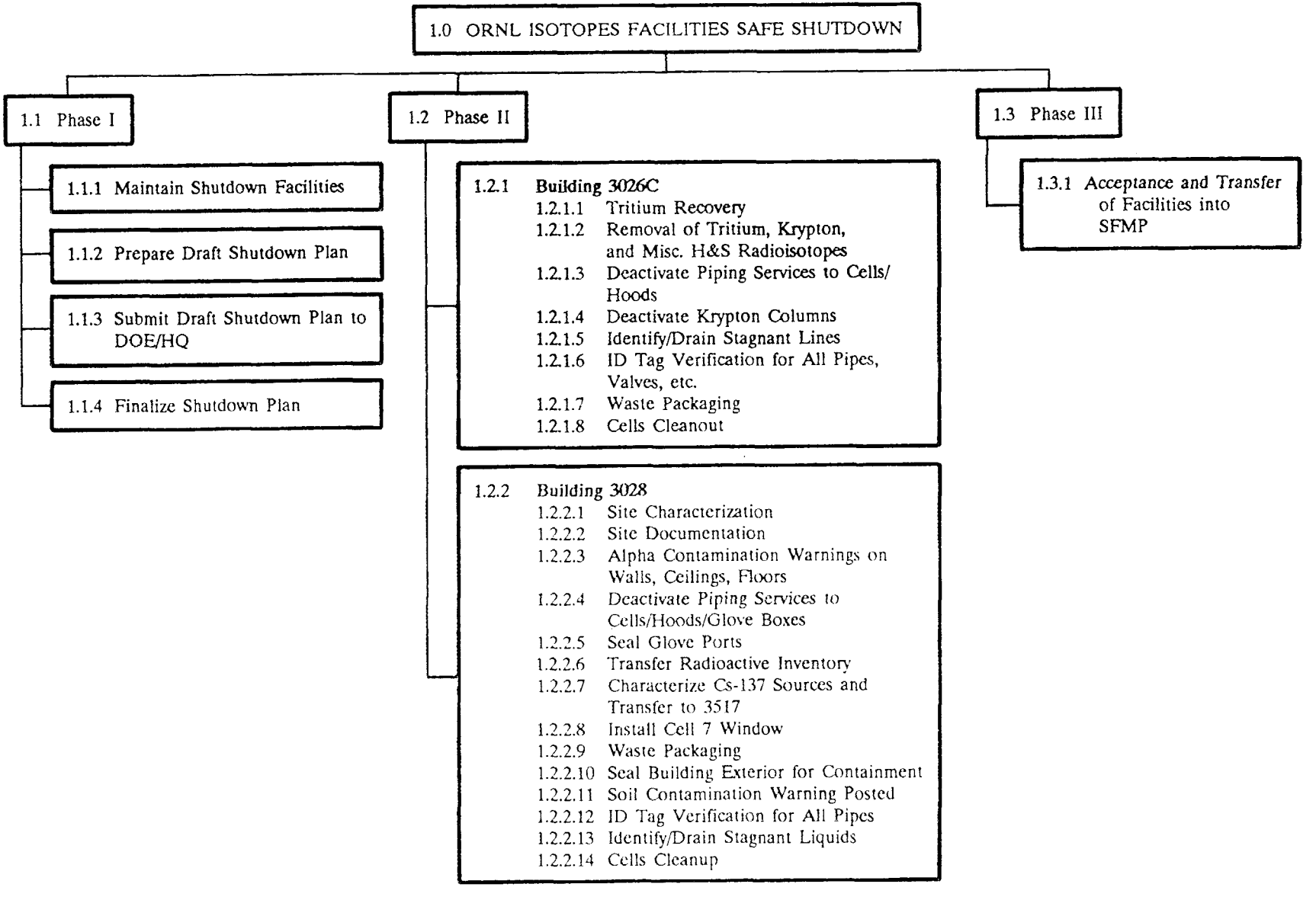

Fig. 6.1. ORNL Isotopes Facilities Shutdown Program Work Breakdown Structure.

1.0 ORNL ISOTOPES FACILITIES SAFE SHUTDOWN

1.2 Phase II

1.2.3 **Building 3029**
- 1.2.3.1 Cs-137 Powder Cleanup
- 1.2.3.2 C-14 Glove Boxes Disposal
- 1.2.3.3 Deactivate Piping Services to Cells/Hoods/ Glove Boxes
- 1.2.3.4 Characterization of 94 Radioactive Sources
- 1.2.3.5 Characterization of Ir-192 Pellets
- 1.2.3.6 Transfer Sources and Pellets
- 1.2.3.7 Install FRACAS System
- 1.2.3.8 Waste Packaging
- 1.2.3.9 Identify/Drain Stagnant Liquids
- 1.2.3.10 ID Tag Verification for All Pipes, Valves, etc.
- 1.2.3.11 Transfer of Radioactive Material
- 1.2.3.12 Lead Disposal
- 1.2.3.13 Cells Cleanup

1.2.4 **Building 3030**
- 1.2.4.1 Seal Glove Box Ports
- 1.2.4.2 Waste Packaging
- 1.2.4.3 Deactivate Piping Services to Cells/Hoods/ Glove Boxes
- 1.2.4.4 ID Tag Verification for All Pipes, Valves, etc.
- 1.2.4.5 Transfer/Disposal Radioactive Material

1.2.5 **Building 3031**
- 1.2.5.1 Deactivate Piping Services to Cells/Hoods/ Glove Boxes
- 1.2.5.2 Seal Glove Box Ports
- 1.2.5.3 Waste Packaging
- 1.2.5.4 ID Tag Verification for All Pipes, Valves, etc.
- 1.2.5.5 Roof Repair

Fig. 6.1. (continued)

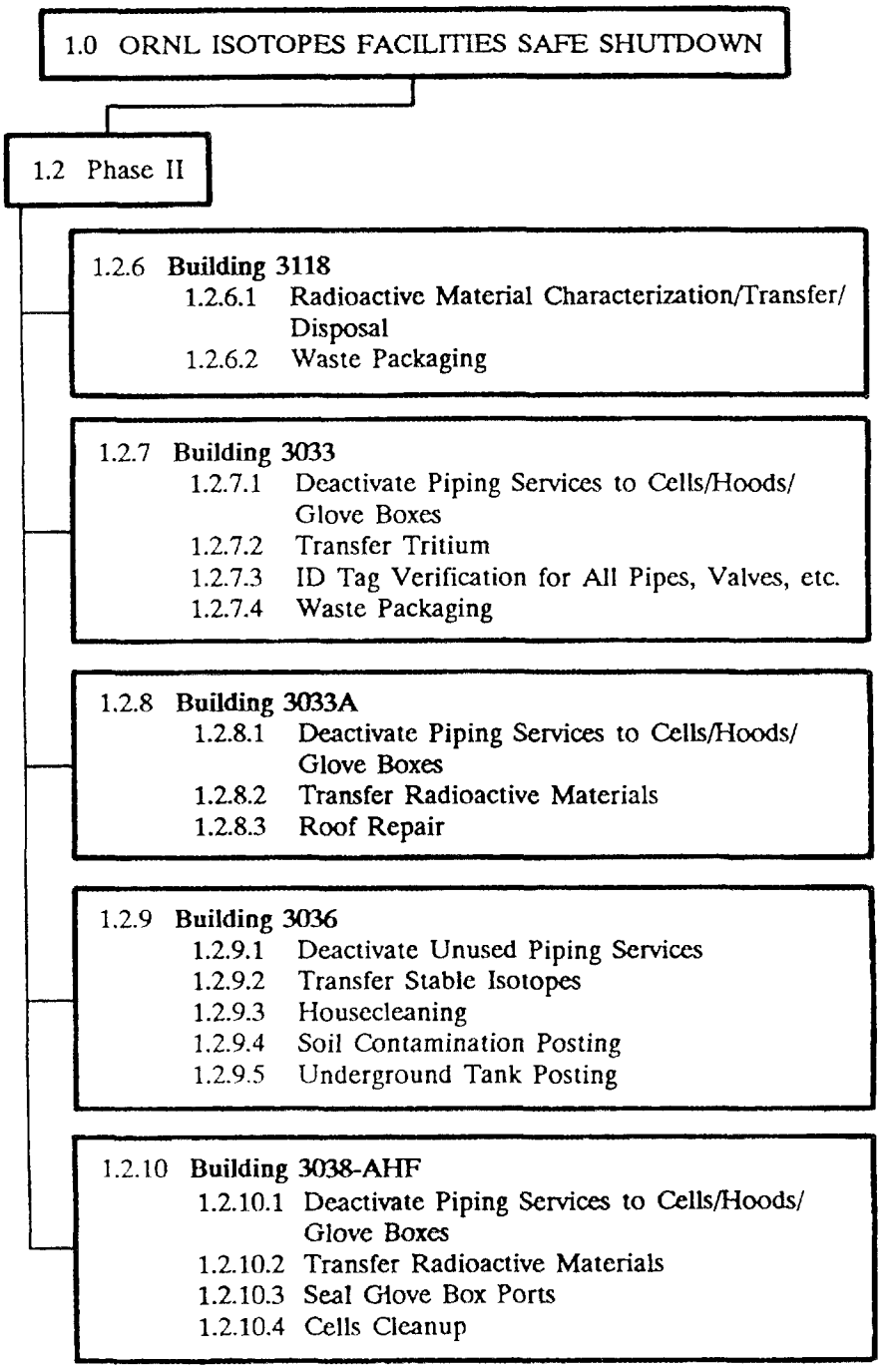

Fig. 6.1. (continued)

1.0 ORNL ISOTOPES FACILITIES SAFE SHUTDOWN

1.2 Phase II

1.2.11 **Building 3038-E**
- 1.2.11.1 Deactivate Piping Services to Cells/Hooks/ Glove Boxes
- 1.2.11.2 Seal Glove Box Ports
- 1.2.11.3 Solidify and Transfer Radioactive Materials
- 1.2.11.4 Waste Packaging

1.2.12 **Building 3038-M**
- 1.2.12.1 Deactivate Piping Services
- 1.2.12.2 Solidify Liquid Radioactive Inventory
- 1.2.12.3 Remove Radioactive Material
- 1.2.12.4 Barricade Cleanup
- 1.2.12.5 Relocate Packaging and Shipping Operations

1.2.13 **Building 3047**
- 1.2.13.1 Deactivate Piping Services to Cells/Hoods/ Glove Boxes
- 1.2.13.2 Waste Packaging
- 1.2.13.3 Cells Cleanup
- 1.2.13.4 Cell D Sump Sludge Removal
- 1.2.13.5 Radioactive Materials Removal
- 1.2.13.6 Seal Glove Box Ports
- 1.2.13.7 ID Tag Verification for All Pipes, Valves, etc.
- 1.2.13.8 Identify/Remove Stagnant Liquids From Pipes, etc.
- 1.2.13.9 Cell C Window Repair
- 1.2.13.10 Filter Pit Cleanup

Fig. 6.1. (continued)

1.0 ORNL ISOTOPES FACILITIES SAFE SHUTDOWN

1.2 Phase II

1.2.14 **Building 3517**
- 1.2.14.1 Building Upgrade for Acceptance of Radioactive Inventory/Packaging
- 1.2.14.2 Hot Transfer Pump/Lines Removal
- 1.2.14.3 Transfer Shielded Carriers to SWSA 5
- 1.2.14.4 Transfer Cm-244 to REDC at ORNL
- 1.2.14.5 Transfer Hot Lead to Retrievable Storage
- 1.2.14.6 Cells Cleanup
- 1.2.14.7 Waste Packaging
- 1.2.14.8 Removal/Disposal of Cell 14E Left Manipulator (Remove Duct Seal and Secure Cell Penetrations)
- 1.2.14.9 Lead Shielding Removal from Block Plug Holes; Clean up/Replace
- 1.2.14.10 Asbestos Containment
- 1.2.14.11 Housekeeping
- 1.2.14.12 ID Tag Verification for All Pipes, Valves, etc.
- 1.2.14.13 Identify/Remove Stagnant Liquids from Piping, Tanks, etc.
- 1.2.14.14 Deactivate Piping Service to Cells/Hoods/ Glove Boxes
- 1.2.14.15 Repackage Cs-137 and Sr-90 Sources
- 1.2.14.16 Transfer WESF Sr-90 and Cs-137 Sources to Hanford

1.2.15 **Building 3550**
(Inventory Removal and Building Razing Under Separate Funding)

1.2.16 **Building 7025**
- 1.2.16.1 Transfer of Tritium Inventory
- 1.2.16.2 Transfer Thorium Inventory
- 1.2.16.3 Cleanup of Tritium Legacy

Fig. 6.1. (continued)

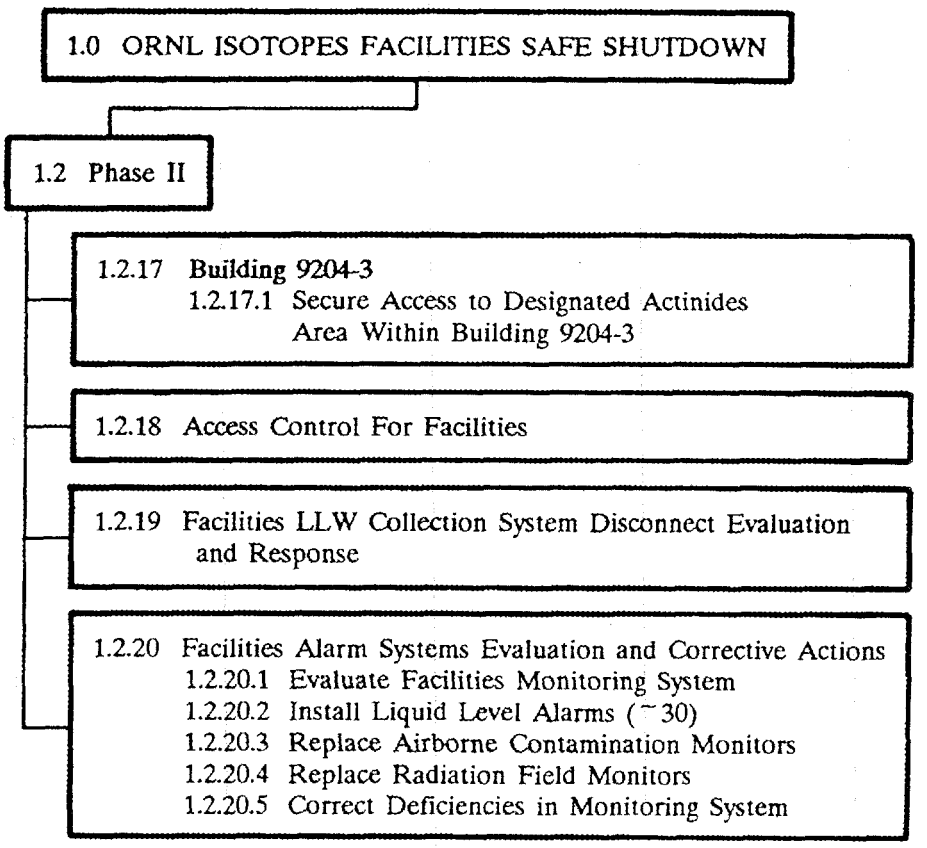

Fig. 6.1. (continued)

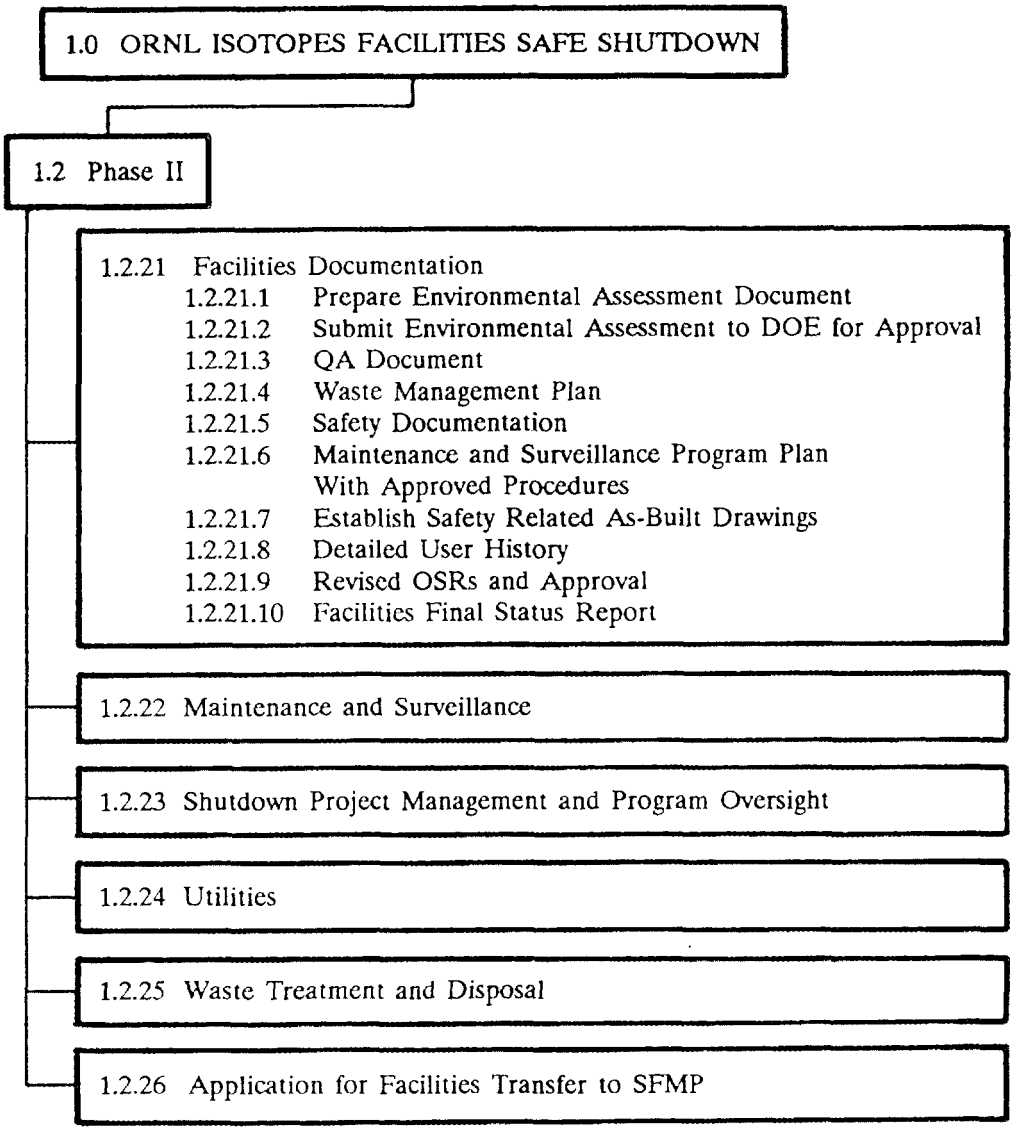

Fig. 6.1. (continued)

and numbering system to identify elements of work for contract planning, procurement, scheduling, budgeting, and reporting.

Scheduling - The schedules from all ORNL IFSP participants shall identify all activities by WBS number. This will permit integration of schedule information and facilitate review of status reports and change proposals.

Cost Estimating - Cost estimates shall be prepared for each WBS element to assist budgeting and project validation by DOE Headquarters (DOE-HQ). Each estimate developed shall be identified by WBS number, as well as other data structures, to ensure that all budgeting and project validation relevant costs are identified and that only costs relevant to ORNL IFSP work efforts are included.

Funding - Requests for funding shall be coded by WBS number as well as by other data structures. The work content, management priority, and status of each WBS element shall be defined by WBS number. This will provide an efficient mechanism for establishing, justifying, and allocating project funds over the DOE planning horizon. Equally important, it will provide a means of rapidly assessing the impact of changes in funding levels on work content, schedules, and contractual support.

Budgets - Budgets shall be prepared by WBS elements, as well as other data structures, following directly from the manner in which the work was planned, scheduled, estimated, and funded.

Performance Measurement - Accurate measurement of performance that relates directly and unambiguously to each product, service, or data element being produced is an important element of management control. Clear identification of technical, schedule, and cost performance to work package, contractor, and major system elements by WBS will permit management to use its resources of time and talent most effectively. Clear identification of work package performance will facilitate communication to address those issues that require attention and avoid addressing those that do not.

Configuration Management - The ORNL IFSP shall employ the baseline management process to establish and control the technical schedule and cost baseline for the project. Collectively, these baselines compress the program baseline. In the technical area, the WBS shall be used to establish, define, control, and baseline as it is expanded by development activities. The WBS shall be used to identify the various products, services,

or data produced. These baseline elements shall consist of system engineering documentation, including functional requirement design criteria, and performance specifications (the functional baseline); design documentation, including configuration item and process specification (the allocated baseline); and production and construction documentation, including detailed drawings, acceptance test and inspection requirements, and logistic support requirements (the product baseline). These elements of the technical baseline shall be controlled through the configuration management process and identified by their WBS number.

Integrated Logistic Support (ILS) - ILS is the composite of all support elements that shall be used to ensure effective and efficient operation of the ORNL IFSP during its life cycle. The products of this effort are directly associated with each of the elements of the Program and must be precisely identified with them. The WBS shall be used to accomplish this identification.

7. SCHEDULE AND MILESTONES

The ORNL Isotopes Facilities Shutdown Program schedule baseline consists of three integrated elements: an activity network, a hierarchy of milestones, and an activity schedule. The ORNL IFSP schedule is shown in Fig. 7.1. This schedule is based on the assumption that funding and manpower are readily available. This schedule will be updated periodically to reflect any changes which occur.

7.1 MILESTONES

Milestones shall be identified at logical points in the activity network where significant progress can be measured. They will be chosen for management control at various management levels. There are three types of milestones: (1) major, (2) key, and (3) accountable key milestones.

Major milestones are the lowest-level milestones to be identified and controlled by the integrating contractor (Martin Marietta Energy Systems, Inc.). Major milestones shall be chosen at important progress points for ORNL's CTD. Failure to reach major milestones as planned is likely to threaten timely completion of activities leading to key milestones.

Key milestones are those controlled by the ORNL Isotopes Facilities Program Manager and reflect major product deliverable and decision points within the program. Key milestones shall be established at key transition points and for key objectives. Failures to reach key milestones as planned is likely to threaten timely completion of activities leading to accountable key milestones.

Accountable key milestones are the highest-level milestones and are the points at which the program reports the results of major work segments to DOE-ORO.

Contractors outside Energy Systems shall determine lower-level milestones by which to gauge their progress toward reaching an assigned major milestone. The Program Manager shall review and approve contractor schedules incorporating major milestones and first-tier contractor milestones.

7.2 SCHEDULES

The ORNL Isotopes Facilities Shutdown Program Schedule (Fig. 7.1) provides the basis for scheduling activities.

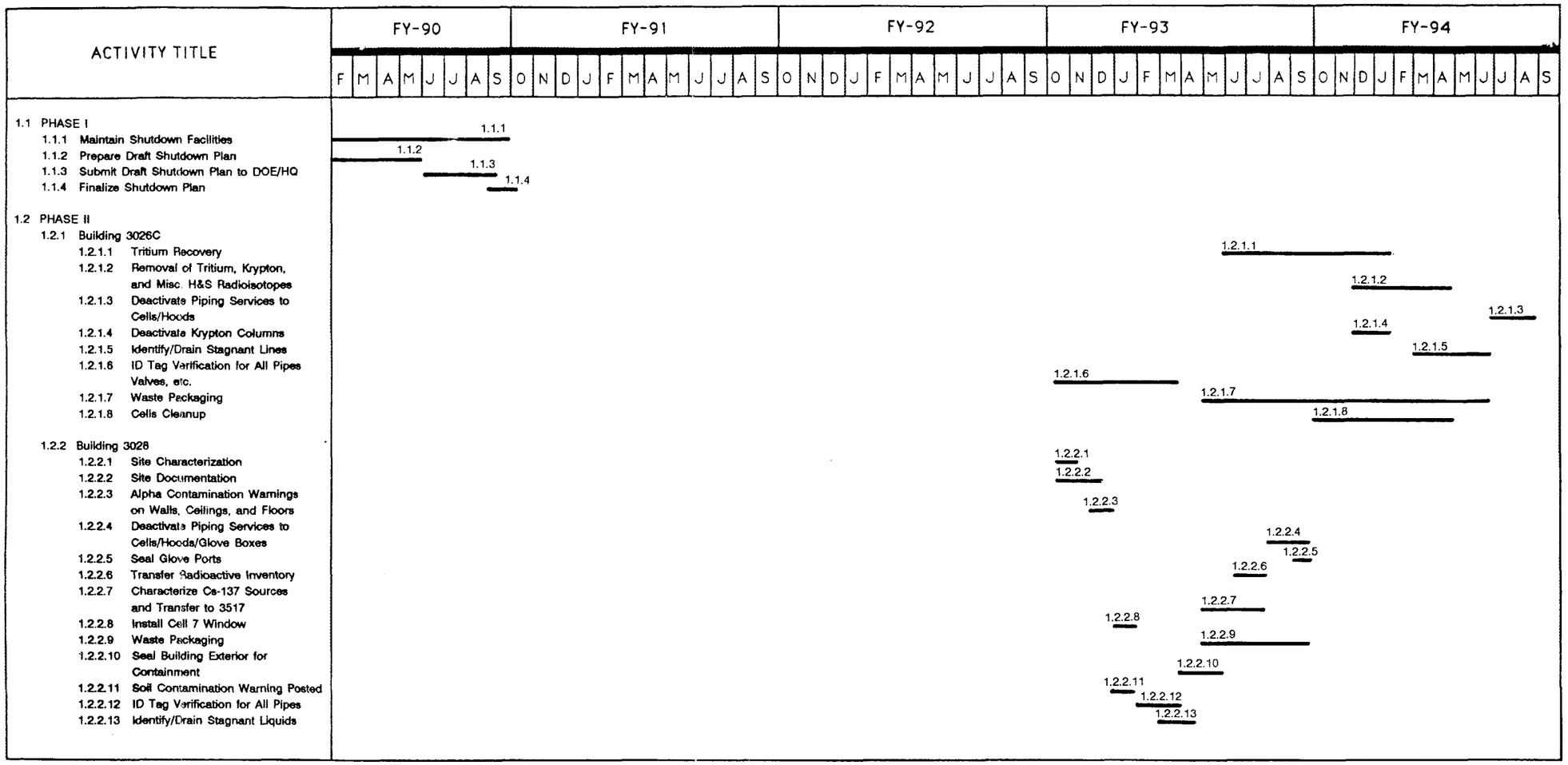

Fig. 7.1. CRNL Isotopes Facilities Shutdown Program Schedule.

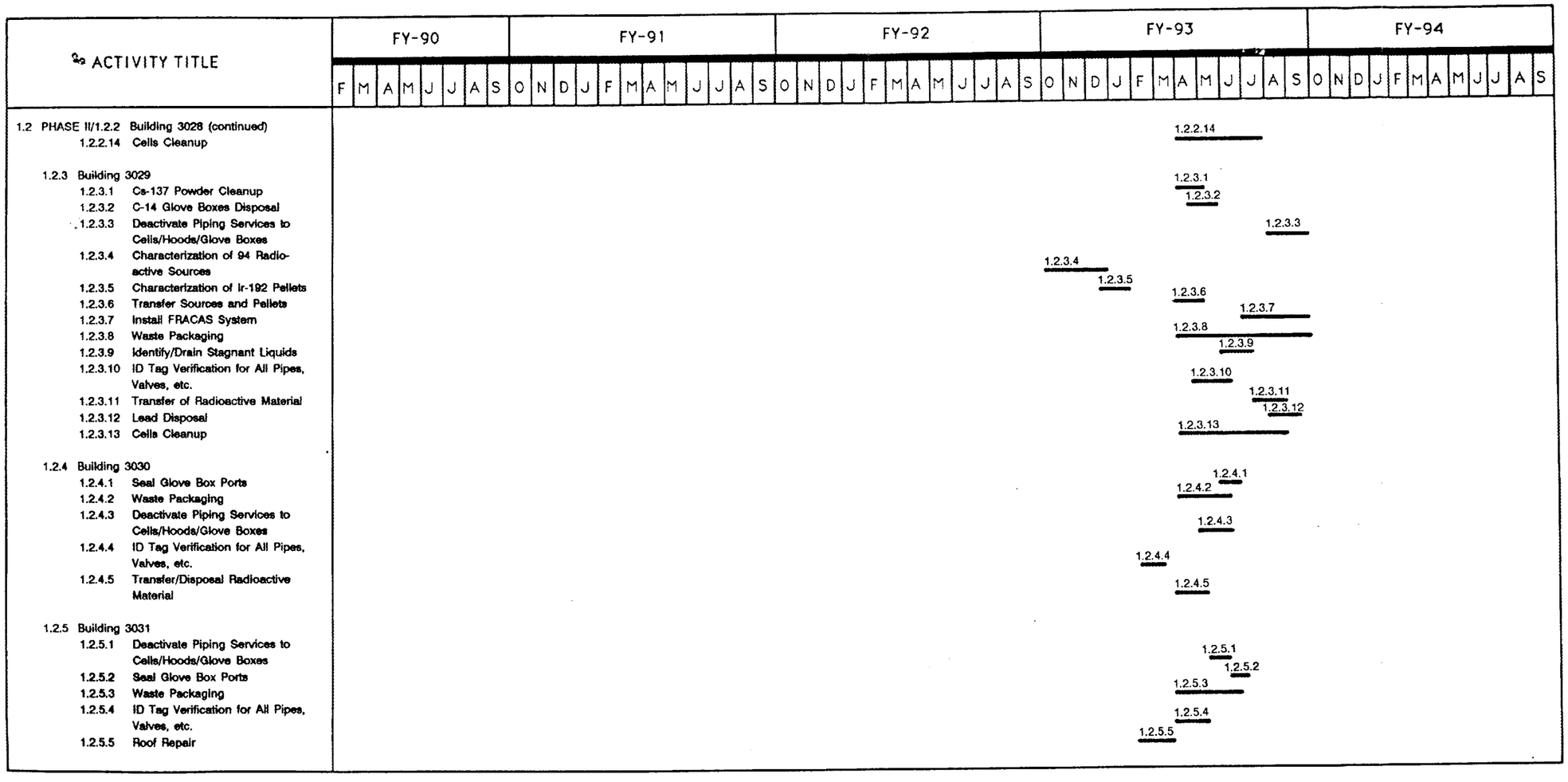

Fig. 7.1. (continued)

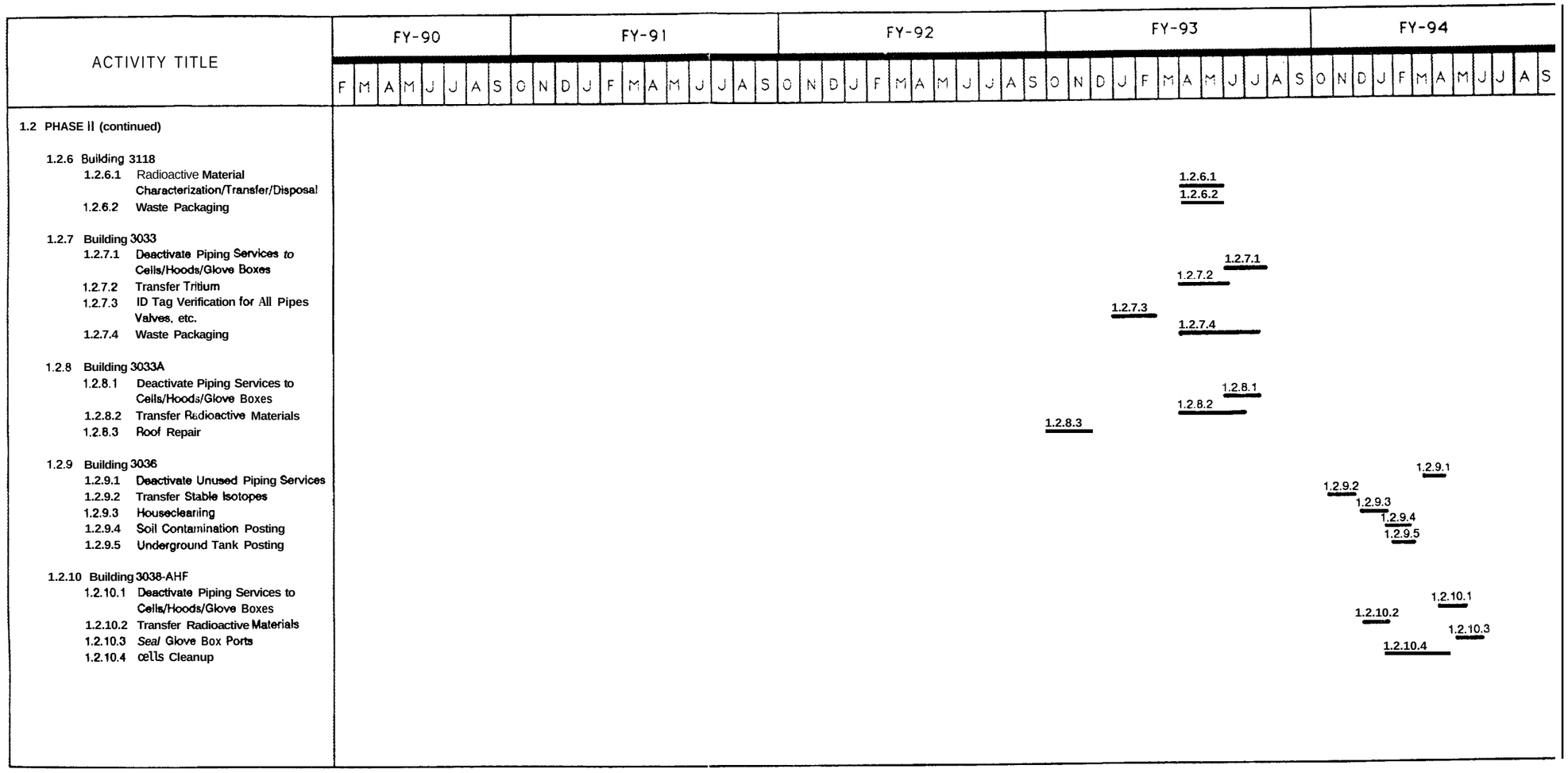

Fig. 7.1. (continued)

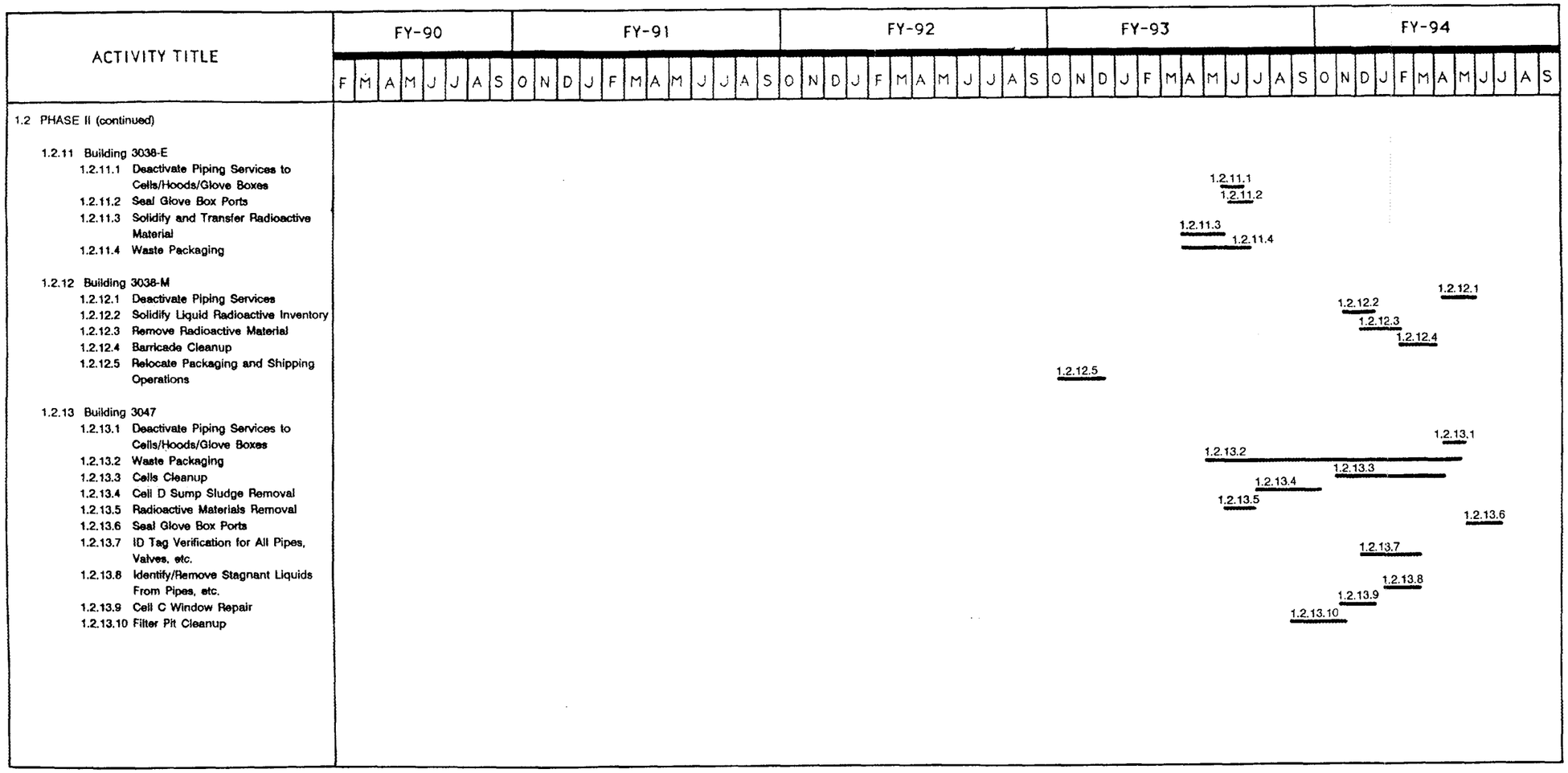

Fig. 7.1. (continued)

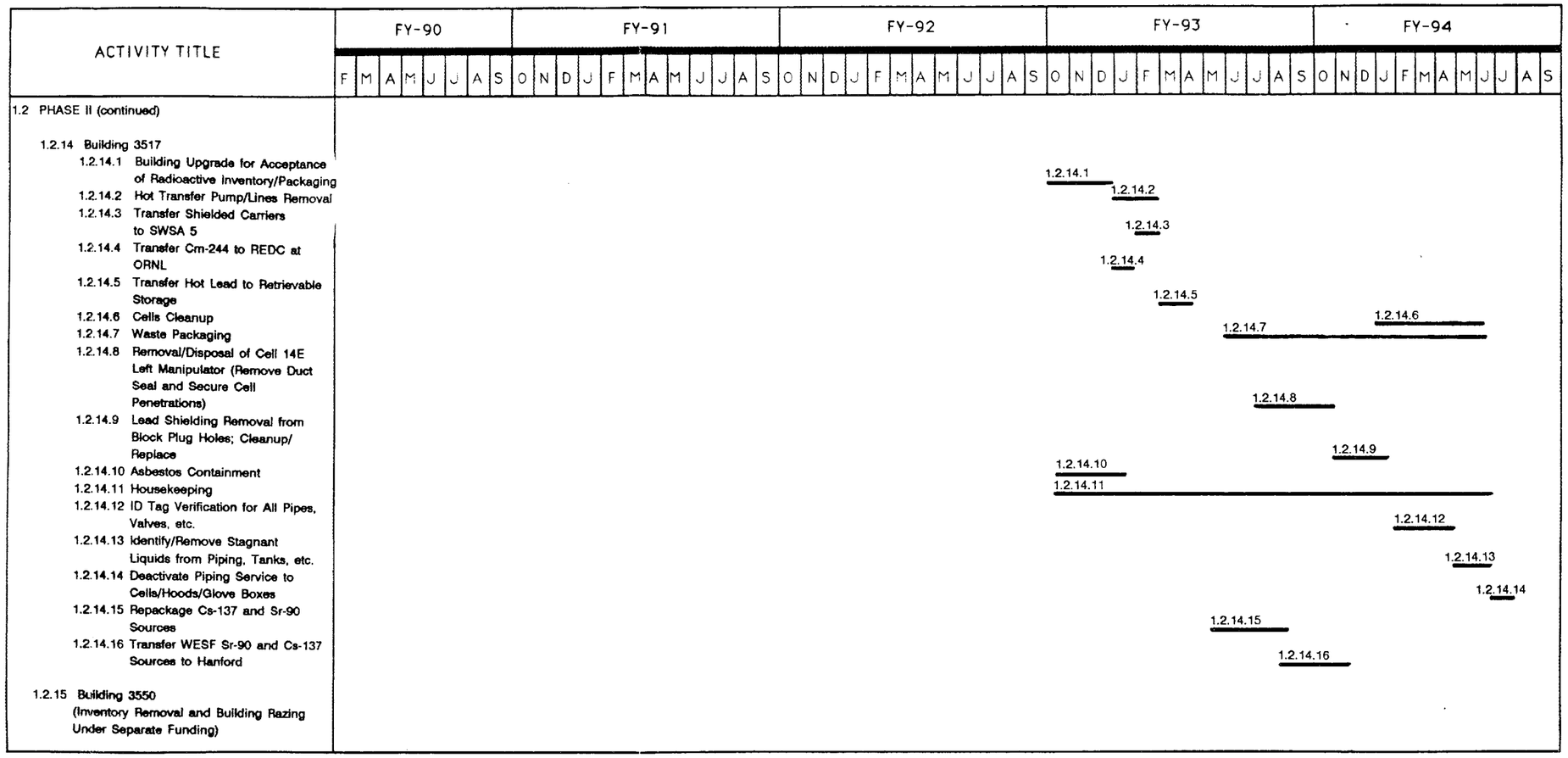

Fig. 7.1. (continued)

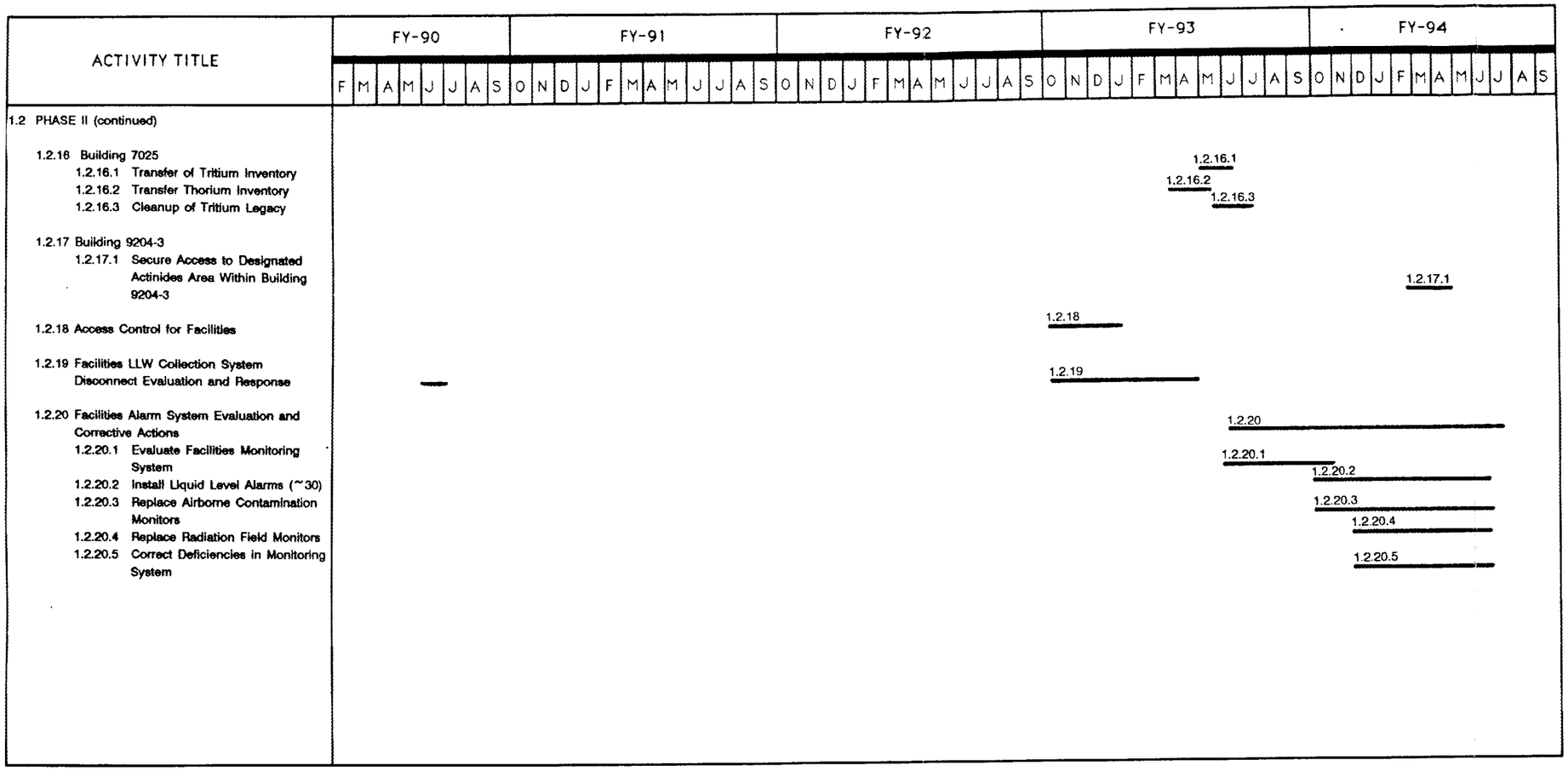

Fig. 7.1. (continued)

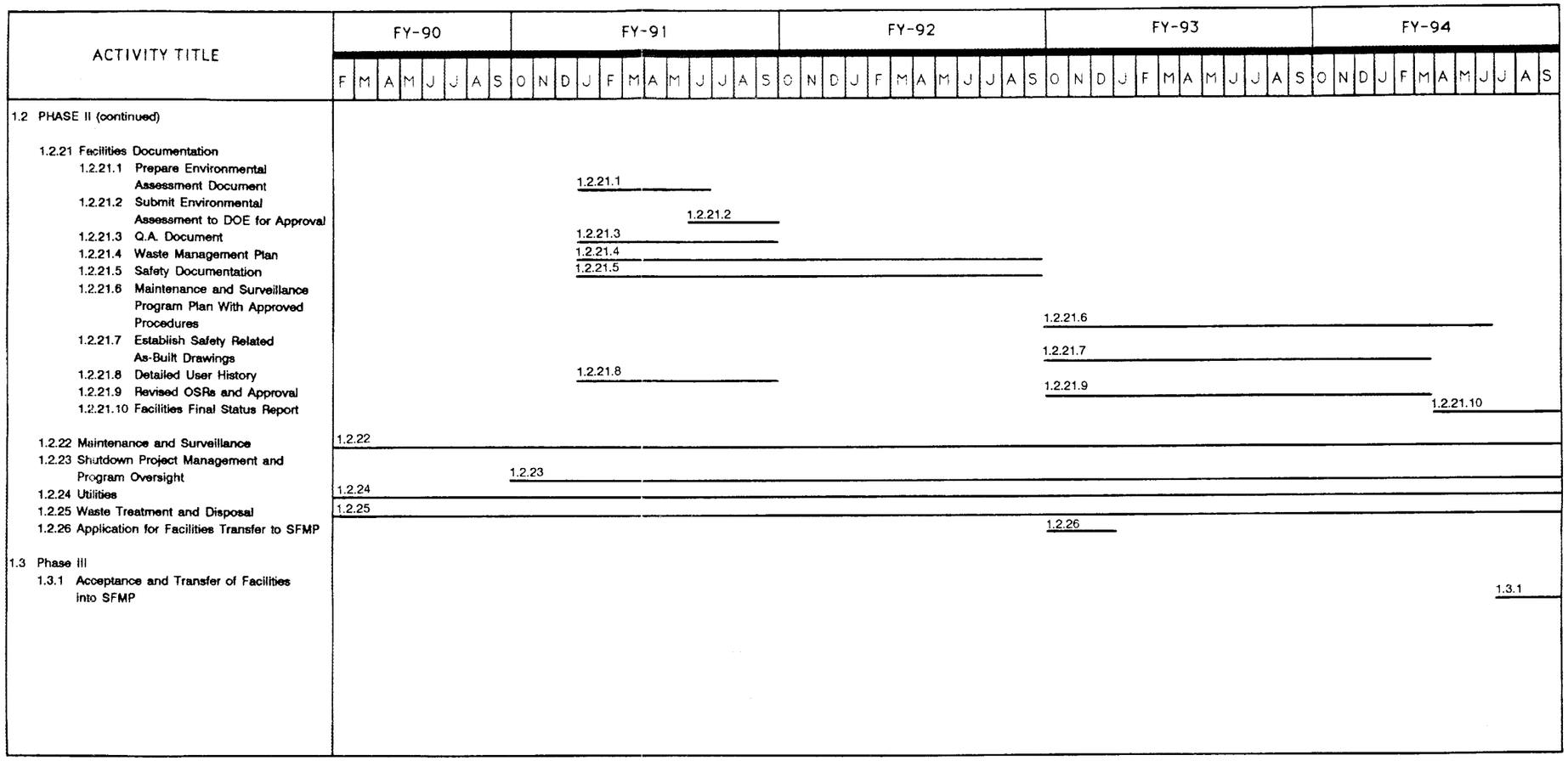

Fig. 7.1. (continued)

8. COSTS AND MANPOWER

The costs are presented in Table 8.1. All necessary manpower will be supplied by the ORNL CTD, ORNL crafts union, and Energy Systems Engineering. Outside contractors will assist when necessary.

Table 8.1. Budget requirements for the ORNL Isotopes Facilities Shutdown Program
($ in thousands)

WBS ELEMENT		FY 90	FY 91	FY 92	FY 93	FY 94
1.1 PHASE I						
1.1.1	Maintain Shutdown Facilities	2640	-	-	-	-
1.1.2	Prepare Draft Shutdown Plan	150	-	-	-	-
1.1.3	Submit Draft Shutdown Plan to DOE/HQ	30	-	-	-	-
1.1.4	Finalize Shutdown Plan	30	-	-	-	-
1.2 PHASE II						
1.2.1	Building 3026C					
1.2.1.1	Tritium Recovery	-	-	-	334	167
1.2.1.2	Removal of Tritium, Krypton, and Misc. H&S Radioisotopes	-	-	-	-	378
1.2.1.3	Deactivate Piping Services to Cells/Hoods	-	-	-	-	89
1.2.1.4	Deactivate Krypton Columns	-	-	-	-	67
1.2.1.5	Identify/Drain Stagnant Lines	-	-	-	-	122
1.2.1.6	ID Tag Verification for All Pipes Valves, etc.	-	-	-	178	-
1.2.1.7	Waste Packaging	-	-	-	56	67
1.2.1.8	Cells Cleanup	-	-	-	-	189
1.2.2	Building 3028					
1.2.2.1	Site Characterization	-	-	-	111	-
1.2.2.2	Site Documentation	-	-	-	56	-
1.2.2.3	Alpha Contamination Warnings on Walls, Ceilings, and Floors	-	-	-	11	-
1.2.2.4	Deactivate Piping Services to Cells/Hoods/Glove Boxes	-	-	-	56	-
1.2.2.5	Seal Glove Ports	-	-	-	56	-
1.2.2.6	Transfer Nuclear Inventory	-	-	-	67	-
1.2.2.7	Characterize Cs-137 Sources and Transfer to 3517	-	-	-	111	-
1.2.2.8	Install Cell 7 Window	-	-	-	56	-
1.2.2.9	Waste Packaging	-	-	-	111	-
1.2.2.10	Seal Building Exterior for Containment	-	-	-	111	-
1.2.2.11	Soil Contamination Warning Posted	-	-	-	11	-
1.2.2.12	ID Tag Verification for All Pipes	-	-	-	111	-
1.2.2.13	Identify/Drain Stagnant Liquids	-	-	-	111	-
1.2.2.14	Cells Cleanup	-	-	-	234	-
1.2.3	Building 3029					
1.2.3.1	Cs-137 Powder Cleanup	-	-	-	223	-
1.2.3.2	C-14 Glove Boxes Disposal	-	-	-	89	-
1.2.3.3	Deactivate Piping Services to Cells/Hoods/Glove Boxes	-	-	-	45	-
1.2.3.4	Characterization of 94 Radio-active Sources	-	-	-	111	-
1.2.3.5	Characterization of Ir-192 Pellets	-	-	-	111	-
1.2.3.6	Transfer Sources and Pellets	-	-	-	67	-
1.2.3.7	Install Fracas System	-	-		111	-
1.2.3.8	Waste Packaging	-	-	-	111	-
1.2.3.9	Identify/Drain Stagnant Liquids	-	-	-	56	-

Table 8.1. (continued)

WBS ELEMENT			FY 90	FY 91	FY 92	FY 93	FY 94
1.2 PHASE II/1.2.3 Building 3029 (continued)							
	1.2.3.10	ID Tag Verification for All Pipes, Valves, etc.	-	-	-	89	-
	1.2.3.11	Transfer of Radioactive Material	-	-	-	234	-
	1.2.3.12	Lead Disposal	-	-	-	111	-
	1.2.3.13	Cells Cleanup	-	-	-	111	-
1.2.4 Building 3030							
	1.2.4.1	Seal Glove Box Ports	-	-	-	11	-
	1.2.4.2	Waste Packaging	-	-	-	56	-
	1.2.4.3	Deactivate Piping Services to Cells/Hoods/Glove Boxes	-	-	-	22	-
	1.2.4.4	ID Tag Verification for All Pipes, Valves, etc.	-	-	-	22	-
	1.2.4.5	Transfer/Disposal Radioactive Material	-	-	-	67	-
1.2.5 Building 3031							
	1.2.5.1	Deactivate Piping Services to Cells/Hoods/Glove Boxes	-	-	-	22	-
	1.2.5.2	Seal Glove Box Ports	-	-	-	11	-
	1.2.5.3	Waste Packaging	-	-	-	56	-
	1.2.5.4	ID Tag Verification for All Pipes, Valves, etc.	-	-	-	22	-
	1.2.5.5	Roof Repair	-	-	-	56	-
1.2.6 Building 3118							
	1.2.6.1	Radioactive Material Characterization/ Transfer/Disposal	-	-	-	223	-
	1.2.6.2	Waste Packaging	-	-	-	56	-
1.2.7 Building 3033							
	1.2.7.1	Deactivate Piping Services to Cells/Hoods/Glove Boxes	-	-	-	56	-
	1.2.7.2	Transfer Tritium	-	-	-	234	-
	1.2.7.3	ID Tag Verification for All Pipes, Valves, etc.	-	-	-	56	-
	1.2.7.4	Waste Packaging	-	-	-	56	-
1.2.8 Building 3033A							
	1.2.8.1	Deactivate Piping Services to Cells/Hoods/Glove Boxes	-	-	-	56	-
	1.2.8.2	Transfer Radioactive materials	-	-	-	56	-
	1.2.8.3	Roof Repair	-	-	-	56	-
1.2.9 Building 3036							
	1.2.9.1	Deactivate Unused Piping Services	-	-	-	-	33
	1.2.9.2	Transfer Stable Isotopes	-	-	-	-	33
	1.2.9.3	Housecleaning	-	-	-	-	45
	1.2.9.4	Soil Contamination Posting	-	-	-	-	33
	1.2.9.5	Underground Tank Posting	-	-	-	-	33

Table 8.1. (continued)

WBS ELEMENT	FY 90	FY 91	FY 92	FY 93	FY 94
1.2 PHASE II (continued)					
1.2.10 Building 3038-AHF					
1.2.10.1 Deactivate Piping Services to Cells/Hoods/Glove Boxes	-	-	-	-	122
1.2.10.2 Transfer Radioactive materials	-	-	-	-	78
1.2.10.3 Seal Glove Box Ports	-	-	-	-	67
1.2.10.4 Cells Cleanup	-	-	-	-	245
1.2.11 Building 3038-E					
1.2.11.1 Deactivate Piping Services to Cells/Hoods/Glove Boxes	-	-	-	56	-
1.2.11.2 Seal Glove Box Ports	-	-	-	33	-
1.2.11.3 Solidify and Transfer Radioactive Material	-	-	-	111	-
1.2.11.4 Waste Packaging	-	-	-	56	-
1.2.12 Building 3038-M					
1.2.12.1 Deactivate Piping Services	-	-	-	-	22
1.2.12.2 Solidify Liquid Nuclear Inventory	-	-	-	-	122
1.2.12.3 Remove Radioactive Material	-	-	-	-	67
1.2.12.4 Barricade Cleanup	-	-	-	-	523
1.2.12.5 Relocate Packaging and Shipping Operations	-	-	-	156	-
1.2.13 Building 3047					
1.2.13.1 Deactivate Piping Services to Cells/Hoods/Glove Boxes	-	-	-	-	56
1.2.13.2 Waste Packaging	-	-	-	56	67
1.2.13.3 Cells Cleanup	-	-	-	-	122
1.2.13.4 Cell D Sump Sludge Removal	-	-	-	167	156
1.2.13.5 Radioactive Materials Removal	-	-	-	67	-
1.2.13.6 Seal Glove Box Ports	-	-	-	-	45
1.2.13.7 ID Tag Verification for All Pipes, Valves, etc.	-	-	-	-	189
1.2.13.8 Identify/Remove Stagnant Liquids From Pipes, etc.	-	-	-	-	189
1.2.13.9 Cell C Window Repair	-	-	-	-	45
1.2.13.10 Filter Pit Cleanup	-	-	-	-	245
1.2.14 Building 3517					
1.2.14.1 Building Upgrade for Acceptance of Nuclear Inventory/Packaging	-	-	-	779	-
1.2.14.2 Hot Transfer Pump/Lines Removal	-	-	-	45	-
1.2.14.3 Transfer Shielded Carriers to SWSA 5	-	-	-	11	-
1.2.14.4 Transfer Cm-244 to REDC at ORNL	-	-	-	67	-
1.2.14.5 Transfer Hot Lead to Retrievable Storage	-	-	-	234	-
1.2.14.6 Cells Cleanup	-	-	-	-	378
1.2.14.7 Waste Packaging	-	-	-	-	245
1.2.14.8 Removal/Disposal of Cell 14E Left Manipulator (Remove Duct Seal and Secure Cell Penetrations)	-	-	-	-	500

Table 8.1. (continued)

WBS ELEMENT	FY 90	FY 91	FY 92	FY 93	FY 94
1.2 PHASE II/1.2.14 Building 3517 (continued)					
1.2.14.9 Lead Shielding Removal from Block Plug Holes; Cleanup/ Replace	-	-	-	-	167
1.2.14.10 Asbestos Containment	-	-	-	234	-
1.2.14.11 Housekeeping	-	-	-	111	122
1.2.14.12 ID Tag Verification for All Pipes, Valves, etc.	-	-	-	-	189
1.2.14.13 Identify/Remove Stagnant Liquids from Piping, Tanks, etc.	-	-	-	-	189
1.2.14.14 Deactivate Piping Service to Cells/Hoods/Glove Boxes	-	-	-	-	245
1.2.14.15 Repackage Cs-137 and Sr-90 Sources	-	-	-	-	1225
1.2.14.16 Transfer WESF Sr-90 and Cs-137 Sources to Hanford	-	-	-	-	557
1.2.15 Building 3550 (Inventory Removal and Building Razing Under Separate Funding)	-	-	-	-	-
1.2.16 Building 7025					
1.2.16.1 Transfer of Tritium Inventory	-	-	-	45	-
1.2.16.2 Transfer Thorium Inventory	-	-	-	34	-
1.2.16.3 Cleanup of Tritium Legacy	-	-		111	-
1.2.17 Building 9204-3					
1.2.17.1 Secure Access to Designated Actinides Area Within Building 9204-3	-	-	-	-	189
1.2.18 Access Control for Facilities	-	-	-	523	-
1.2.19 Facilities LLW Collection System Disconnect Evaluation and Response	10	-	-	657	378
1.2.20 Facilities Alarm System Evaluation and Corrective Actions					
1.2.20.1 Evaluate Facilities Monitoring System	-	-	-	67	-
1.2.20.2 Install Liquid Level Alarms	-	-	-	53	223
1.2.20.3 Replace Airborne Contamination Monitors	-	-	-	53	53
1.2.20.4 Replace Radiation Field Monitors	-	-	-	53	111
1.2.20.5 Correct Deficiencies in Monitoring System	-	-	-	-	500
1.2.21 Facilities Documentation					
1.2.21.1 Prepare Environmental Assessment Document	40	-	-	-	-
1.2.21.2 Submit Environmental Assessment to DOE for Approval	20	-	-	-	-
1.2.21.3 Q.A. Document	30	-	-	-	-
1.2.21.4 Waste Management Plan	30	-	-	-	-
1.2.21.5 Safety Documentation	-	1600	1400	940	1920
1.2.21.6 Maintenance and Surveillance Program Plan With Approved Procedures	-	-	-	700	746
1.2.21.7 Establish Safety Related As-Built Drawings	-	-	-	935	1002
1.2.21.8 Detailed User History	30	-	-	-	-

Table 8.1. (continued)

WBS ELEMENT	FY 90	FY 91	FY 92	FY 93	FY 94
1.2 PHASE II (continued)					
1.2.21 Facilities Documentation (continued)					
1.2.21.9 Revised OSRs and Approval Pertinent Documentation	-	-	-	-	56
1.2.21.10 Facilities Final Status Report	-	-	-	-	78
1.2.22 Maintenance and Surveillance	-	3300	3700	3900	4120
1.2.23 Shutdown Project Management and Program Oversight	-	180	190	295	311
1.2.24 Utilities	330	350	370	390	412
1.2.25 Waste Treatment and Disposal*	3460	0	0	445	0
1.2.26 Application for Facilities Transfer to SFMP	-	-	-	39	17
1.3 Phase III					
1.3.1 Acceptance and Transfer of Facilities into SFMP	-	-	-	-	22
Totals	6800	5430	5660	15867	17571

*Additional Waste Treatment and Disposal funding, essential to the program, is to be provided in ADS 341 and ADS 346 for FY 1991 ($5.5 million) and FY 1992 ($6.2 million); FY 1993 requires $1.6 million and FY 1994 requires $1.7 million.

9. FUNCTIONAL SUPPORT REQUIREMENTS

This section summarizes the relationship between ORNL-CTD, DOE-ORO, and DOE/HQ with respect to the functional organization structure of the ORNL Isotopes Facilities Shutdown Program.

9.1 ORNL-CTD

The ORNL-CTD is responsible for daily oversight and implementation of all activities leading to the safe shutdown of the isotopes facilities. ORNL CTD will keep DOE-ORO fully informed of progress and issues.

9.2 DOE-ORO

DOE-ORO will be the interface between ORNL CTD and DOE/HQ. DOE-ORO will track the completion of activities and inform DOE/HQ of schedule progress and budget requirements. DOE-ORO is responsible for resolving internal issues with matrix organizations to assure timely implementation of the plan.

9.3 DOE/HQ

The DOE/HQ is the source of program policy direction, programmatic issue resolution, and necessary funding.

9.4 CONFLICT RESOLUTION

Three types of conflict may occur: programmatic, operational, or programmatic-operational. Programmatic conflicts which may evolve concerning scope of work, technical interfaces, or other issues related to development of the IFSP, will be resolved by DOE/HQ. Operational conflicts may arise concerning administrative support and will be resolved by DOE-ORO. Conflicts concerning differences between Program Office and Operations Office priorities, methods, or other issues related to the IFSP will be resolved between the two organizations (DOE/HQ and DOE-ORO). The ORNL CTD will be responsible for resolving internal issues and will use the operational or programmatic support of DOE-ORO or DOE/HQ, as required.

10. MANAGEMENT, MEASUREMENT, PLANNING, AND CONTROL SYSTEMS

The baseline management process to be utilized for management of the ORNL Isotopes Facilities will be described in a separate Project Management Plan (PMP) to be issued in early FY 1991.

The initial technical, schedule, and cost baselines of the ORNL Isotopes Facilities Shutdown PMP have been presented in Sects. 2, 5, 7, and 8. These baselines are the criteria against which project progress will be measured, planned, and controlled.

11. MANAGEMENT AND REPORTING

11.1 DOCUMENTATION

Technical documentation will consist of those WBS elements under WBS 1.2.21 described in Sect. 5.

11.2 REPORTS

The ORNL's Isotopes Facilities Shutdown Program Manager shall report to DOE in accordance with DOE policy requiring reports of the status. The program manager shall submit monthly, quarterly, supplemental, and annual reports unless otherwise directed by DOE.

11.3 STATUS REVIEWS

The status reviews shall be used to keep ORNL CTD and DOE management informed of progress and status.

12. CONFIGURATION MANAGEMENT PLAN FOR THE ORNL ISOTOPES PRODUCTION AND DISTRIBUTION FACILITIES SHUTDOWN

Drawings, procedures, and other documents critical to safety must agree with the field conditions at the time of shutdown and/or subsequent operations and maintenance activities. Controls for the storage of, and changes to, these records need to be approved and implemented. Field conditions as used herein are the current configuration of the buildings, systems, and equipment; the status of stored materials and supplies; the body of distribution documentation and other prior-use records; and the current practices that affect safety, security, and environmental impact.

The following elements shall be included in the configuration Management Plan:

1. Identify drawings that must reflect field conditions;
2. Identify new and existing procedures required for the shutdown;
3. Identify documents required to identify the status of safety, security, contamination, waste management, or environmental impact at the time of shutdown;
4. Identify any and all other records that need to be maintained as a record of past activities, including earlier use, or for the convenience of other operations;
5. Identify organizational positions that will formally control changes and storage for each identified drawing, procedure, document, or other record. Responsibilities can be distributed depending upon the source of the records;
6. Identify file points for the storage and configuration control of the above identified documents;
7. Provide a record inventory disposition schedule (RIDS) for all records addressed herein.

13. QUALITY ASSURANCE

This section outlines the Quality Assurance (QA) actions for the preparation of the Project Management Plan (PMP) for the ORNL Isotopes Facilities Shutdown - a QA document for implementing shutdown will be prepared later and is identified as work element 1.2.21.3 of this PMP.

13.1. Description of Scope and Objectives - See Sects. 1 and 2.

13.2. Criteria - A list of document titles, numbers, dates, and sources shall be provided in the PMP documentation.

13.3. PMP Team Organization - to be provided by the Program Manager (PM).

13.4. Management Controls - The PM will control the PMP team's exercise of responsibilities through project meetings and a local tracking system.

13.5. Qualifications of Team Members - Summaries of team member qualifications will be provided by the PM as applicable to tasks assigned.

13.6. Team Training - Team training will be provided through review and discussion of criteria documents, and by 12-h tours of Buildings 3028, 3029, 3038M, 3036, 3517, 3026C, 3033, 3033A, 3550, 7025, 3030/3031/3118, 3047, 3038E, 3038-AHF, and 9204-3.

13.7. Peer or Technical Review - The PM shall select peer and or technical personnel for review of PMP documents. These personnel will include all affected facility managers and key subordinates, the Office of Operational Safety, Environmental and Health Protection, Instrumentation and Controls maintenance (tracking), Plant and Equipment maintenance (tracking), Quality Engineering and Inspection (tracking), Laboratory Protection, Fire Protection Engineering, and any organizations sharing the buildings affected.

13.8. Control of Document Distribution - Formal controls will be used for distribution of criteria information and PMP review documentation. This distribution will include the peer or technical review group and the PMP committee.

13.9. Corrective Actions - Changes or additions to draft documentation will be promptly included. Responses will be provided for all comments received.

13.10. Final Draft Review - Prior reviewers will be included in the review cycle for the final draft.

13.11. QA Plan (QAP) for Shutdown - The PM shall identify line personnel that shall provide the QAP for implementation of shutdown in conjunction with the PMP QAP. The QAP will be issued in final, approved form prior to the beginning of the major portion of the shutdown activities in FY 1993-94. Any preliminary shutdown activities that may be performed in FY 1991-92, as allowed by funding and safety/environmental requirements, will be conducted in accordance with a set of "compensatory measures" based upon the existing QA plan for the Radiochemical Technology Section.

13.12. Records - The PM shall provide formal maintenance of PMP documentation until the record inventory disposition schedules are completed upon achieving the PMP milestone.

APPENDIX A

INFORMATION ON FACILITIES

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ABSTRACT

This appendix presents information about the isotope facilities that are to be (1) maintained in a safe condition under the existing maintenance and surveillance plan, and (2) prepared for acceptance and transfer into the Surplus Facilities Management Program.

The site and supporting ORNL operational services that interface with the facilities are described briefly in Sect. A.1. A description of the individual facilities by building is presented in Sect. A.2.

A.1. SITE DESCRIPTION

A.1.1 Site and General Environs

Most of the isotope facilities in the shutdown plan are located at the central Oak Ridge National Laboratory (ORNL) complex in Bethel Valley. ORNL is sited on the DOE Oak Ridge Reservation approximately 13 km (8 miles) from the population center of the city of Oak Ridge. Maps showing the location of Oak Ridge in relationship to the geographic region and the location of the main ORNL site are presented in Figs. A.1.1.1 and A.1.1.2. The locations of isotope areas within ORNL are shown in Fig. A.1.1.3. Most of the isotope facilities in the shutdown plan are located in close proximity to the main administrative building (4500N) and research facilities. One facility, Building 7025, is located in the 7000 area about 2.2 km (1.4 miles) east of the main ORNL complex (not shown on the map). One facility occupies a small area within Building 9204-3 at the Y-12 site.

The Oak Ridge Reservation lies in an area between two mountain ranges. The Cumberlands rise to 910 m (3000 ft) or more 16 km (10 miles) northwest, while 113 km (70 miles) to the southeast the Great Smoky Mountains reach an altitude of some 2010 m (6600 ft). The area is part of the valley-and-ridge physiographic province. The reservation is a wooded complex dominated by a series of ridges and valleys tending northeast/southeast. It is bounded on three sides by the Clinch River, which is a tributary of the Tennessee River and is part of the water system controlled by the Tennessee Valley Authority.

The mountains on the east and the Cumberland Plateau on the west have a protecting and moderating influence on the region's climate. As a result, it is milder than the more continental climate found just to the west on the Plateau or on the eastern side of the Smoky Mountains. The prevailing winds follow the general topographic trend of the ridges: daytime, up-valley winds come from the southwest; nighttime, down-valley winds come from the northeast. The Smoky Mountains to the southeast provide general sheltering; severe storms such as tornadoes or high-velocity windstorms are rare. Similarly, the mountains divert hot, southerly winds that develop along the southern Atlantic coast. The average monthly temperature ranges from about 3.5°C (38°F) in winter to 25°C (77°F)

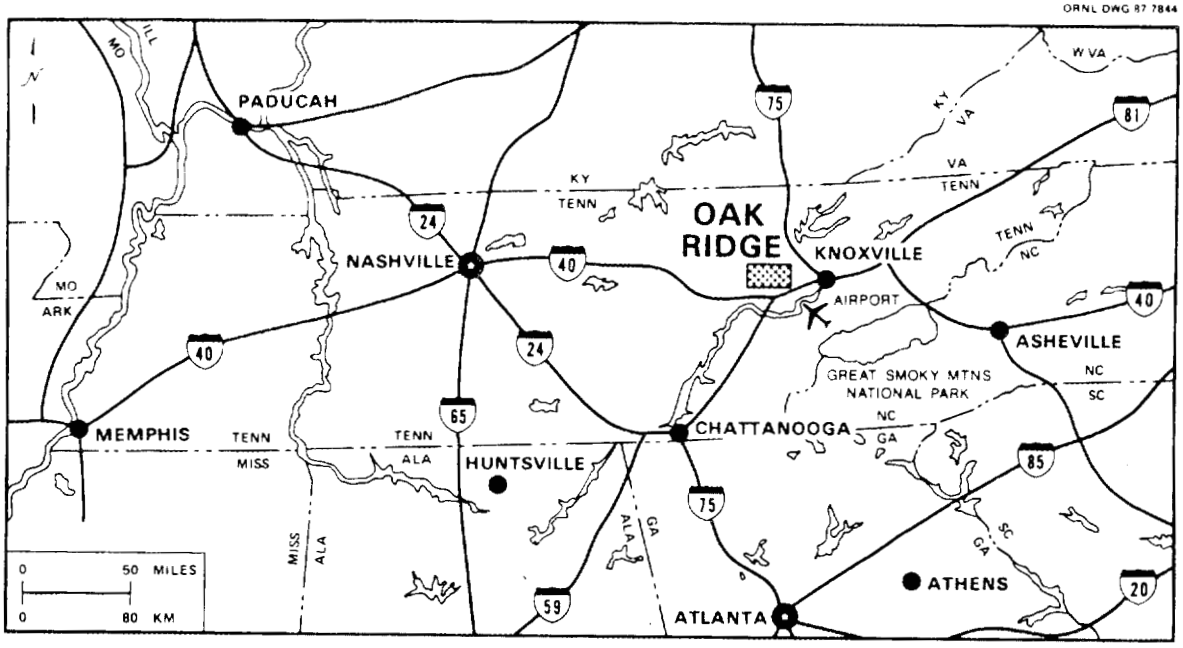

Fig. A.1.1.1. Map showing location of Oak Ridge in relationship to geographic region.

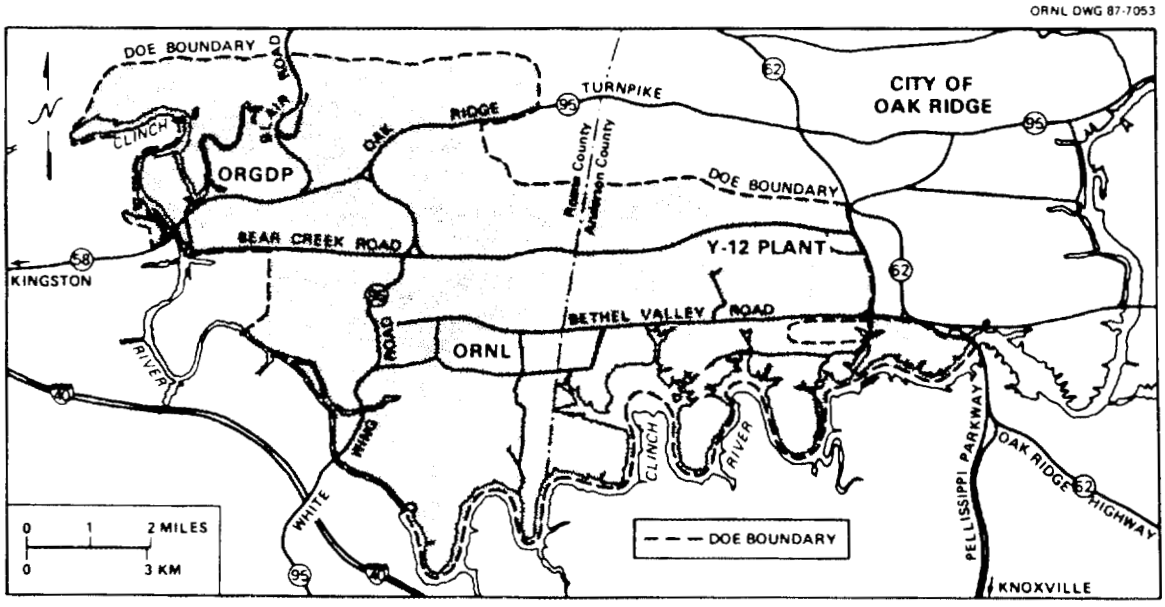

Fig. A.1.1.2. Map showing the Department of Energy's Oak Ridge Reservation and the location of the ORNL and Y-12 sites.

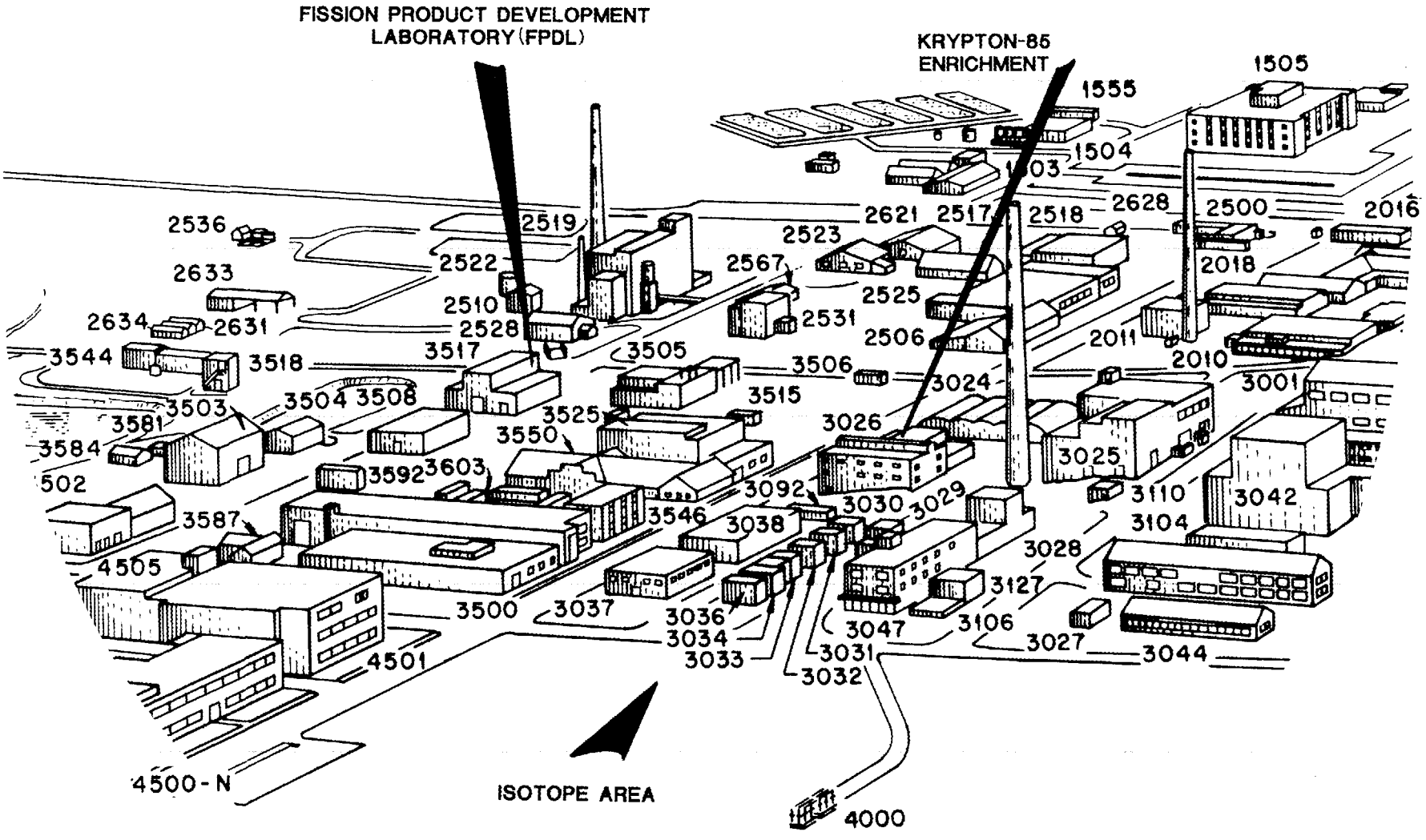

Fig. A.1.1.3. Location of isotope facilities at ORNL and Y-12 sites.

in summer. The 38-year annual average precipitation (water equivalent) is 1.36 m (53.5 in.), including approximately 0.25 m (9.8 in.) of snowfall, with monthly precipitation peaking in January and February.

The population (1980 census) of the city of Oak Ridge is 28,000. Except for the city of Oak Ridge, the land near the Oak Ridge Reservation is predominantly rural, used largely for residences, small farms, and cattle pasture. Knoxville, the major metropolitan area nearest Oak Ridge, is located about 40 km (25 miles) to the east and has a population of approximately 183,000.

The central ORNL site is located in Bethel Valley between Chestnut Ridge on the north and Haw Ridge. Although the valley floor is highly developed within the central site area, the surrounding terrain is wooded. White Oak Creek passes to the south of the developed area and leaves the valley through a gap in Haw Ridge into Melton Valley. Experimental programs that require isolation are located at satellite sites in Melton Valley.

One of the buildings in this plan (Building 7025) lies at the extreme eastern end of the developed area in Bethel Valley. Most of the 7000 area consists of shops (e.g., maintenance) and stores receiving and warehouses. Building 7205 is located at the extreme eastern limit of this area. The only utilities supplied are water and electricity.

Building 9204-3 is located in the south-central part of the developed area at Y-12. The Y-12 complex is situated in Bear Creek Valley adjacent to the city of Oak Ridge. Most of the Y-12 facilities lie on the valley floor between Pine Ridge on the north and Chestnut Ridge on the south.

A.1.2 Supporting ORNL Operational Services

A.1.2.1 The 3039 Stack Ventilation Systems

The ORNL has two central systems in the main plant area for handling waste gases - the cell ventilation system and the process off-gas system - which discharge to the 3039 stack. Waste gases that may contain radioactivity are treated at the source facility to reduce the radioactivity to acceptable levels before they are discharged to the central system. The form of the radioactivity determines the type of cleanup procedure used. Radioactive particulates are removed from air streams using High Efficiency Particulate Air (HEPA) filters.

The central cell ventilation systems, sometimes called the "high-volume, low-level" systems, are designed to handle the waste streams from hot cells and limited access areas. The average flow through the cell ventilation system is 155,400 scfm (98% of stack flow). There are five area systems, each of which is serviced by an electric blower with steam turbine backup. Emergency power is supplied to all cell ventilation fans (except the Oak Ridge Research Reactor); however, there is no treatment of cell ventilation gases at the 3039 stack facility. The buildings in this shutdown plan that are served by the central cell ventilation service are listed in Table A.1.2.1, along with other buildings on the same blower.

The process off-gas system is designed to handle the off-gases from process equipment and laboratory experiments or under conditions where reduced pressure is required. It is a much smaller volume than the cell ventilation waste. The normal flow is 4000 std ft^3/min at a negative pressure of 42 in. w.g. The process off-gas waste stream is treated at the 3039 facility before discharge to the stack. The central treatment system includes a venturi scrubber to remove acid fumes, demister, roughing filters, and HEPA filtration. The system has steam turbine backup in case of loss of power.

The 3039 stack is 76.2 m (250 ft) high. Stack releases are monitored.

Various combinations of local ventilation system with roof exhaust fan, the 3039 cell ventilation system, and/or the 3039 process off-gas system are used in the isotope buildings in this shutdown plan. These are given in the descriptions of the individual buildings (Sect. A.2). Note that cell ventilation air from alpha hot cells is exhausted to the 3039 process off-gas system, which provides secondary treatment.

A.1.2.2 Liquid Low-Level Waste System

Most of the isotope facilities are equipped with "hot" drains located in hot cells, glove boxes, hoods, and occasionally floor drains that are connected to the ORNL liquid low-level waste (LLLW) system. Typically, waste that is collected in "hot" drains flows by gravity through pipes to underground collection tanks where the waste is neutralized, if necessary. The piping and tanks are known as the collection and transfer system (CAT). The waste accumulated in the collection tanks is transferred via underground piping to the low-level waste (LLW) evaporator facility (Building 2531), where it is concentrated in one of two evaporator units. The evaporator overheads are condensed and transferred to the

Table A.1.2.1. 3039 stack cell ventilation service for buildings in the Isotope Facilities Shutdown Plan

Blower	Isotope buildings in this shutdown plan	Other buildings sharing the blower
Isotope area (48,000 std ft^3/min)	3028	3005
	3029	3098
	3030	
	3031	
	3033	
	3033-A	
	3038	
	3047	
3025, 3026 area (34,000 std ft^3/min)	3026	3025
3500 area (24,000 std ft^3/min)	3517	2531
		2537
		3505
		3506
		3507
		3525

Process Waste Treatment Plant (PWTP) for further treatment. The concentrated waste is stored in stainless steel tanks. The storage tanks are located in below-grade, shielded concrete vaults with stainless steel liners. Transfers are handled remotely. This system minimizes the radiation exposure to personnel.

The buildings in this shutdown plan which currently have hard-piped LLLW service are listed in Table A.1.2.2.

The CAT system in the Isotope Circle area was constructed in the early 1950s, and most of the piping and collection tanks are singly contained. Current regulations require doubly contained piping and tanks and leak detection systems. Some (or all) of the CAT system serving isotope facilities may be shut down upon signing of the pending Federal Facilities Agreement (FFA). It is important to keep these tanks open for shutdown cleanup, if possible, in order to minimize radiation exposure to cleanup and waste handling personnel.

A.1.2.3 Process Waste System

Process wastewater is water that is slightly or potentially contaminated (e.g., waste from some building sinks, floor drains, steam condensate from heating coils, etc.) Many of the isotope buildings have drains to the process waste system in addition to the "hot" drains. Process wastewater is collected by underground pipelines and pumped to one of two 350,000-gal tanks (2600 Area) in preparation for processing through the process waste treatment plant (PWTP, Building 3544). The wastewater is clarified and processed through an ion-exchange system for removal of ^{90}Sr and ^{137}Cs. The waste from the regeneration of the ion-exchange bed is sent to the LLLW system storage tanks.

The effluent from the PWTP is routed to the nonradiological wastewater treatment plant (NRWTP, Building 3608). At the NRWTP, all waste is sent through dual-media filters, air-stripped for removal of volatile organics, and treated with granular activated carbon to remove nonvolatile organics and mercury. The final treatment tank is used for pH adjustment. The effluent is monitored prior to discharge to White Oak Creek. The outfall is a NPDES-permitted discharge point.

Table A.1.2.2. Liquid low-level waste collection tank service for buildings in the Isotope Facilities Shutdown Plan

Building	Waste collection tank
3026-C	WC-17
	WC-18
3028, general	WC-10
3028, Cell 7[a]	WC-2
3029	WC-10
3030	WC-10
3031	WC-10
3033	WC-10
3033-A	WC-10
3036	None
3038-E	Hot drains sealed
3038-M	Hot drains sealed
3038-AHF	WC-2
3047	WC-10
3118	No regular LLLW service; by removing plug access to WC-10
3517	S-223, S-324, and S-523[b]
7025	No CAT service

[a]Building 3028, Cell 7 has one hot drain routed to WC-2 and two hot drains to WC-10.

[b]Located in shielded cell; doubly contained pipeline to evaporator facility.

A.2. DESCRIPTION OF FACILITIES

A.2.1 Building 3026-C - Krypton-85 Enrichment Facility

A.2.1.1 Description

Building 3026-C is a two-story wooden structure (22 ft high) located on Central Avenue to the west of the Isotope Circle facilities. The building layout is shown in Fig. A.2.1.1. Ancillary facilities consist of offices, low- and high-level radioactivity laboratories, and a counting room. An instrument shop, operated by the Instrumentation and Controls Division is located in the southwest corner of Building 3026-C but is not related to facility operations. All areas of the building are protected by automatic fire sprinklers monitored at the ORNL Fire Department.

A tritium facility at the northwest corner of Building 3026-C is constructed of reinforced concrete. The small laboratories, counting room, and cell banks are also of reinforced concrete. With the exception of these concrete structures, the partitions and ceilings throughout Building 3026-C are wooden.

A.2.1.1.1 Cells

The two-story structure (i.e., high bay area) of Building 3026-C houses two banks of four hot cells each. These cells are constructed of reinforced concrete 2 ft thick (top, sides, and partitions) with a 4- by 6-ft floor space for each cell. The inside height of Bank 1 (Cell 4) and Bank 2, (Cells 2 and 4) is 10 ft, and the height of each of the other cells is 8 ft. The cells of Bank 1 on the west side are equipped with zinc-bromide-filled viewing windows and master-slave manipulators. Access to each cell in Bank 2 is through a 2- by 2-ft doorway shielded by 7-in.-thick steel doors. Attached to the north side of Bank 2 (Cell 3) is a 3- by 6-ft by 7-ft-high structure, constructed of 2-in.-thick upper and lower hinged steel doors on the west side. The east-side doorways of Bank 2 cells are opened during part of the normal krypton diffusion operation; the shielding during this time consists of a 2-in.-thick lead glass viewing window permanently mounted in 2 in. of lead brick. Overhead access to Cells 2 and 4 of Bank 2 is through concrete roof blocks, which are removed for in-cell maintenance. There are no radioactive liquids generated in the thermal diffusion process. Cells floor drains discharge to the LLLW system.

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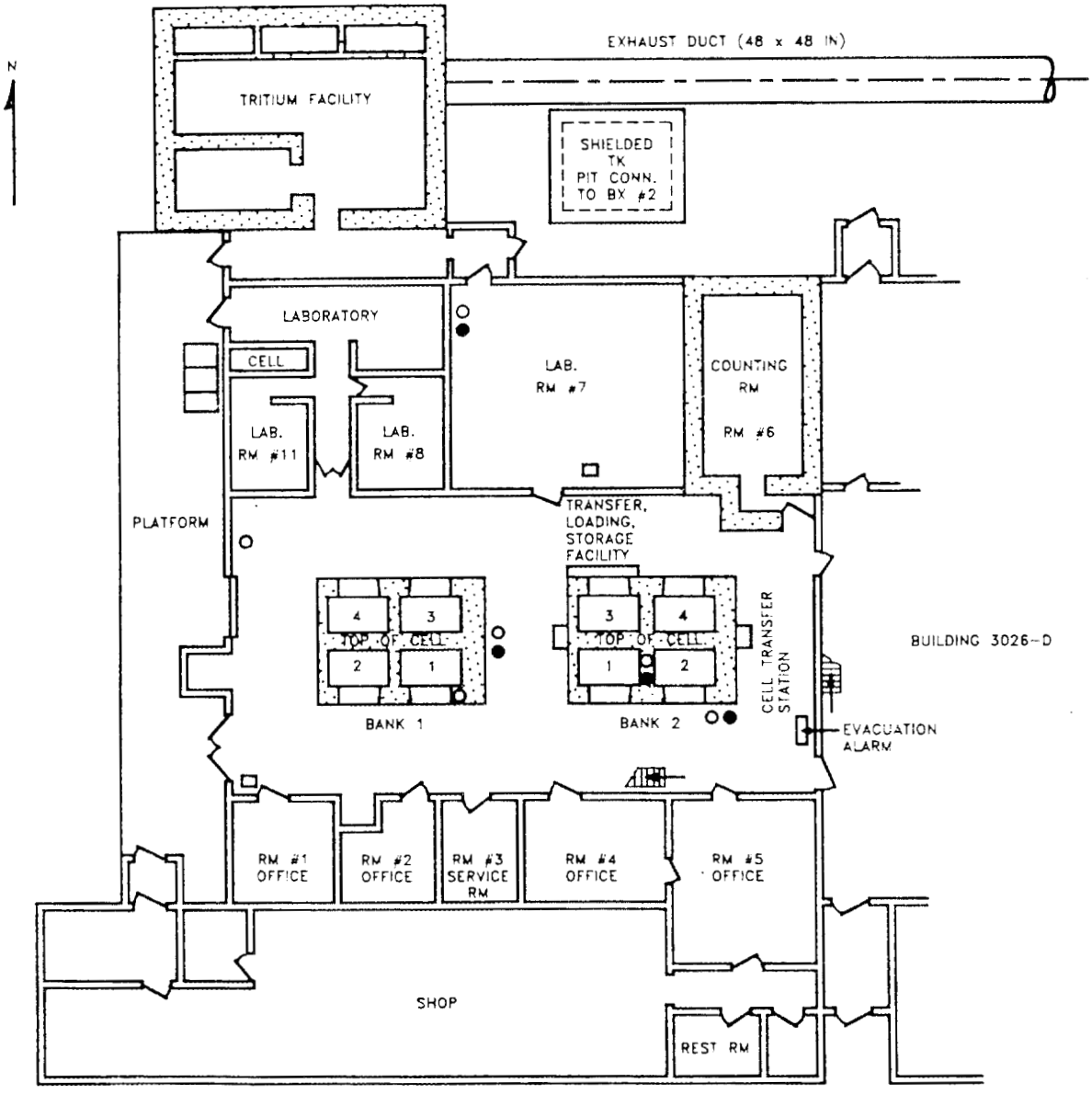


First Floor Building 3026-C

Fig. A.2.1.1. Floor plan of Building 3026-C.

On the west side of Bank 2, a shielded sampling station is equipped with a vacuum pump venting to cell ventilation, a sampling manifold, a cold trap, in-line rupture discs, and a surge tank.

Contamination in Buildings 3026-C is controlled by the building ventilation system, which moves air from areas of lesser contamination potential to areas of higher potential and exhausts the air through the cell ventilation system. Thus, the ventilation air in the facility flows from the operating room through the cell in-leakage openings into the cells from which it is discharged to the building cell ventilation header that connects to the 3039 stack system. To ensure inleakage to the cells, the interiors are maintained at 0.75 to 1.0 in w.g. negative pressure relative to the operating area. The cells and transfer and sampling stations are monitored continuously with preset differential pressure gauges which activate a local alarm and telemeter a signal to the Waste Operations Control Center (Building 3130). There are no backup monitors or gauges on this component of the facility.

Should ventilation disruption occur during off-operating shifts, the patrol operator on duty in Building 3130 will notify assigned facility operating personnel. The 3039 stack system has an alternate ventilating fan and power source in case of mechanical failure of the system in use, and a diesel generator provides emergency power should an outage occur.

A.2.1.1.2 Laboratories

Ventilation of the three small laboratories in the Room 11 complex is provided by hood exhausts connected to the Building 3026-C ventilation duct to the 3039 stack. The duct from one of the hot hoods is provided with a HEPA filter. All laboratories are used for low-level radioactive work. Another hood exhaust is located in the northwest corner of the main 3026-C cell operating area. There is lead shielding on the south wall of Laboratory 11.

A.2.1.1.3 Tritium Storage

Tritium is stored in the concrete tritium laboratory room on the north side of the building and in a hood in Room 7. A doorway on the south side of the concrete room is closed only by a steel grate which is kept locked for security reasons when the laboratory is not attended. The laboratory provides storage space for tritium light sources. Unassembled tritium-filled tubes are also stored in a hood in Room 7.

Air flows into the tritium facility through the open door at the south side of the laboratory and through a ceiling duct. Air is exhausted to the 3039 cell ventilation system through a hood in the small room on the south wall and through vents on the north and west walls. The flow rate is approximately 1500 cfm. Air flows through the Room 7 hood at the rate of 300 cfm; it enters Room 7 through a roughing filter in the door, which leads to the operating area.

A.2.1.1.4 Instrument Shop

The shop located in the southeast corner of Building 3026-C is unrelated to the operations of either 3026-C or 3026-D. It is separated from other activities in the buildings by at least two doors and can be entered or exited without entering the operating areas.

A.2.1.2 History

The building which was constructed in 1943, was primarily used for about 5 years to develop methods of isolating fission products. After the war, the effort shifted to processing radioisotopes for research and medical purposes. The waste from processing irradiated reactor fuel elements for uranium and plutonium recovery in Building 3019 was piped directly to Building 3026-C. At Building 3026-C, it was processed to isolate short-lived isotopes. Some of the isotopes recovered were ^{129}I, ^{131}I, ^{79}Se, ^{107}Pd, and ^{147}Pm. The feed stream from 3019 would have contained fission products such as ^{137}Cs and ^{90}Sr as well as alpha-emitting actinides. The commercial isotope program started in Building 3026-C.

The krypton system was installed in the east cell bank (Cell Bank 2) in the mid-1960s and is still operational. Because of the long operational period the system is highly contaminated with krypton, which is embedded in the metal equipment.

By the early to mid-1960s the two front cells of the west cell bank (Bank 1) were being used by the Metals and Ceramics Division. It is thought that irradiated reactor fuel elements were segmented in these cells. Cells were also originally used for source safety testing and, more recently, have been used for hot metallographic work. They have now been shut down and turned over to the Isotopes Program.

Since 1974, Cells 3 and 4 of Bank 1 have been used exclusively for nuclear medicine research.

A.2.1.2 General Status

The krypton operations in Building 3026-C are currently in operation. Krypton loading operations in Building 3026-C are planned to continue until September 30, 1991. The Health and Safety Research Division uses Cells 3 and 4 in Bank 1 (west), the Laboratory 11 complex, and the counting room for nuclear medicine research. The Instrument and Control Division operates a shop in the southwest corner of the building in which they repair and maintain monitoring equipment. The Plant and Equipment Division maintain a field engineering office in Room 5. The baseline assumption for the shutdown plan is that all activities will be terminated in Building 3026-C by September 30, 1991.

The general status of the building is summarized in Table A.2.1.1.

Table A.2.1.1. Building 3026-C - general status of facility

Facility/area	Comments
Building	
Type	Wood
Roof and exterior walls	Fair condition
Building ventilation	Containment is by hot cells and hoods; no secondary containment. The building is not sealed; no air locks. Building ventilation air moves from the operating area through cell inleakage openings or hoods and is discharged to the 3039 cell ventilation system and stack; no HEPA filters. Cell Bank 2 handles only radioactive gas (krypton). May be roughing filters on two cells in cell Bank 1, but this could not be confirmed.
Liquid waste system	Cell floor drains and hood "hot" sinks drain to tanks W-17 and W-18.
Monitoring	Cells and transfer stations continuously monitored with preset differential pressure gauges that activate local alarms and telemeter a signal to the Waste Operations Control Center (Building 3130).
Other comments	In early days, facilities were used to process fission products, uranium, and plutonium and to segment irradiated reactor fuel elements. May find residual contamination (e.g., alpha, ^{137}Cs).
	Facilities, utilities, and services are in fair condition; however, everything is currently operational.
	Asbestos insulation: some sound, some not sound.
	Relatively large quantities of contaminated lead shielding.

Table A.2.1.1 (continued)

Facility/area	Comments
Cell Bank 1 (west)	
Cells 1 and 2	No operations. Used by ORNL Metals and Ceramics Division for hot metallographic work. It is thought that reactor fuel elements were segmented in these cells; cells are contaminated with ^{60}Co and ^{137}Cs.
Cells 3 and 4	Used for nuclear medicine research; short-lived radioisotopes.
Cell Bank 2 (Krypton)	Operating facility; krypton (gas) inventory stored in Cells 1 and 3. After shutdown and removal of the inventory, equipment will be contaminated with krypton; thermal diffusion system in Cells 2 and 4 will be highly contaminated; slow release of residual krypton embedded in the metal to cell ventilation air.
Laboratories	
Tritium facility and Laboratory 7	Large inventory of tritium (gas) contained in glass tubes from the Tritium Light Program are stored in the tritium facility and in a hood in Laboratory 7; 74 tubes that originally contained about 7000 Ci of tritium are known to be leaking.
	Tritium-contaminated equipment.
	"Hot" drain in the Room 7 hood and in the hood in the small room on the south wall of the main tritium room.
Laboratory 11 complex	Used by nuclear medicine for research and development work on radioisotopic tracers; HEPA filters on hoods.
	HEPA filter on exhaust from one hood.

A.2.2 Building 3028 - Alpha Powder Facility

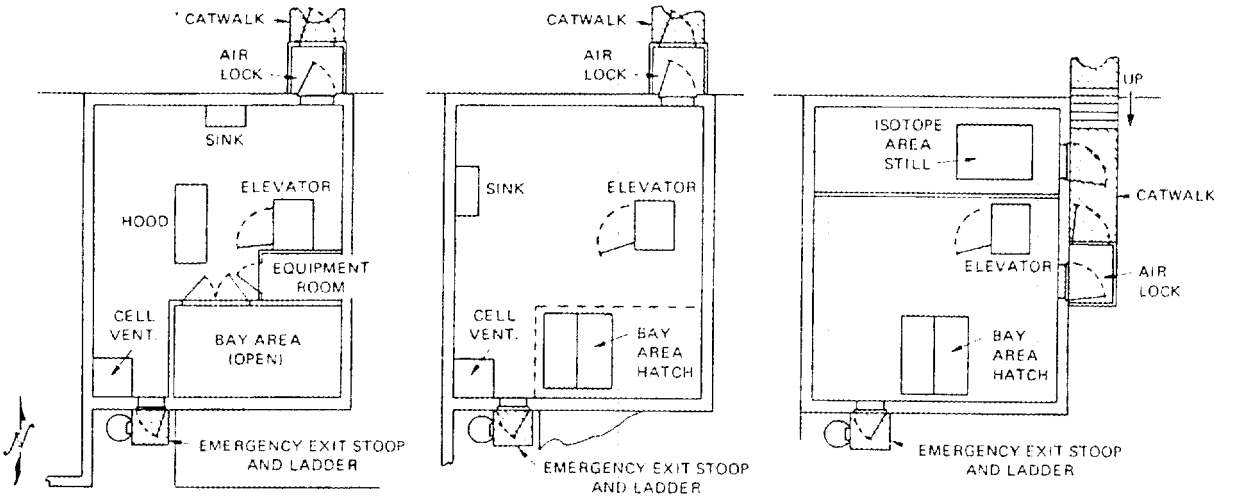
A.2.2.1 Description

Building 3028 was constructed to separate ^{131}I and later modified to separate ^{133}Xe and other short-lived fission products from uranium-aluminum targets. The building was later expanded to include curium processing cells. It is a steel-frame structure covered by metal siding and is located in the northwest area of Isotope Circle, directly west of Building 3047.

The building has a four-story central section with one-story cell operating areas on the east and west sides (Fig. A.2.2.1). The first floor covers 4000 ft^2, and the total volume of free space is 80,000 ft^3. Alpha powder handling operations were conducted on the east side in Cells 1, 2, 3, 4, and 5. On the west side, ^{147}Pm processing was conducted in Cell 6. Iodine-131 and other short-lived fission products operations were conducted in Cell 7 and the Xe-133 recovery and purification cubicle. After shutdown of the ^{131}I production capability, various mechanical and chemical processes were conducted in Cell 7 to produce radioisotopes upon customer demand. The fourth floor has been used only for storage in recent years.

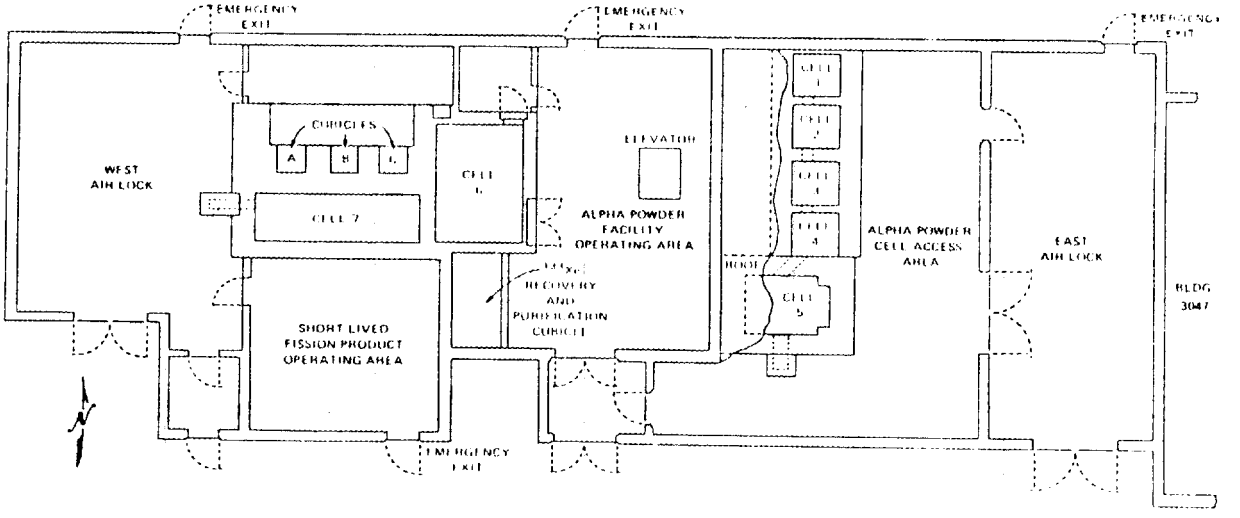
Cells 1, 2, 3, and 4 are manipulator cells with one observation window each. They have steel tank walls and tops containing 2 ft of water for neutron shielding. The steel tanks are bolted together in series and are interconnected with an air-lock system. Each cell is lined with stainless steel, and all penetrations are seal-welded. Cells 2 and 3 have back windows with glove ports. Cell 5 is a manipulator cell with the following features: a stainless-steel operating pan; 9.5 in. armored steel plate and 1-ft concrete north, south, and west walls and top; a small armored access port in the south wall and the viewing window in the west wall; a pass-through air lock to Cell 4; and a 3-ft east wall with a water-filled, armored-steel, rear-access door. Cell 6 has 7.5-ft-high stacked barytes walls, steel-clad lead access doors in the north and east walls, and lead shielding along the east wall. Cell 7 is a manipulator cell with the following features: 3-ft, high-density concrete south and west walls; a l-ft east wall lined with 4 in. lead; north wall consisting of 2-ft concrete partition; top consisting of a stack of five sheets of 3.5-in. armor-plate steel; a roof plug access; and an armored, lead-lined access port in the west wall.

ORNL DWG 90-599



Second Floor Third Floor Fourth Floor

Upper Floors Building 3028



First Floor Building 3028

Fig. A.2.2.1. Floor plan of Building 3028 - Alpha Powder Facility (APF) and Short-Lived Fission Product Facility (SEPF).

Cell windows for 1, 2, 3, and 4 are water-filled, safety-plate glass accessed from the exterior (cold side). Cell 5 has an oil-filled window that is accessed from the interior (hot side). Cell 6 is a process cell and has no window. Cell 7 has one mineral oil-filled, leaded glass window that is accessed from the cold side. Replacement of the other window was started but was not finished due to lack of funding, and it has only a single pan of glass.

The operating cells provide the primary containment of radioactive materials, with secondary containment being the building itself. The cells operate at a minimum of -0.3 in. (normally 1 to 2 in. negative) w.g. to maintain containment. The building's outer surface is "cocooned" with polyurethane foam, but the exterior is in poor condition. All normal entries have air locks for lift trucks and personnel access and gasketed doors to minimize inleakage.

The building interior operates under containment (at least -0.3 in. w.g.) at all times. Building ventilation passes through a network of exhaust ducts to a series of roughing and HEPA filters in an unshielded filter house on the roof. The west end discharges to the isotope area cell ventilation system and the 3039 stack. The east end (the alpha handling facility) is discharged to a short stack on the roof.

The exhaust air from the alpha cells and from Cell 7 is passed through two sets of HEPA filters and discharged to the isotopes area process off-gas system, where it is scrubbed and receives additional HEPA filtration at the 3039 stack facility. The exhaust from Cells 5 and 6 is double-HEPA filtered and discharged to the isotopes area cell ventilation system and 3039 stack. Cell 7 also has charcoal filters.

A.2.2.2 History

The building was constructed about 1950 as part of the Isotopes Program. It originally housed the ^{131}I processing facility (now the Short-Lived Fission Product Cells) and the separation facility (a four-story ion-exchange column) for ^{147}Pm. The ^{131}I facility was converted to manipulator cells in the early 1960s and expanded to the Short-Lived Fission Product Facility. The ^{133}Xe facility was added at about that time. Products and processes developed for sale included ^{133}Xe, ^{131}I, and ^{99}Mo. The ^{133}Xe operation continued through 1980, and the Short-Lived Fission Product Program was discontinued in 1985.

The ion-exchange columns were removed in the early 1960s. The upper three floors were converted to target fabrication facilities in the mid to late 1960s. Target fabrication

was a full-cost-recovery program at that time. Water-shielded cells were installed on the first floor in 1964 for the curium source fabrication program of Space Nuclear Systems. The curium fabrication program was not a full-cost-recovery isotope program. The curium cells were partially decontaminated in the early 1980s; and the facility was redesignated as the Alpha Powder Facility, which brought it back into a full-cost-recovery isotope program. In the late 1970s, the target facility moved to Building 3038 and the upper floors were occupied by Nuclear Medicine Research, which was funded by Energy Research (Health and Safety Research Division, H&SRD). They turned the laboratory facilities over to the Office of Risk Assessment (H&SRD) in 1988. The major contamination in this building is left from the curium processing, the source fabrication work, and the ^{147}Pm processing.

A.2.2.3 General Status

The general status of Building 3028 is summarized in Table A.2.2.1. There are no operations on the first and fourth floors other than those required to maintain compliance with health and safety requirements. The Health and Safety Research Division is operating the laboratories on the second and third floors. The baseline assumption for the shutdown plan is that these activities will be terminated in Building 3028.

Table A.2.2.1. Building 3028 - general status of facility

Facility/area	Comments
Building	
Type	Steel frame with metal siding.
Roof and exterior walls	General condition of building exterior is poor; cocoon is in bad condition; roof leaks.
Building containment and ventilation	Building sealed; air locks; building operates in a "contained" condition of at least 0.30 in. w.g. negative pressure with respect to outside atmosphere. Meeting building containment is becoming more and more of a problem because of the poor condition of the building exterior; ventilation system on the east wing is run at full capacity and is just meeting requirements. Building ventilation; filter house with double HEPA filtration on roof; west end exhausts to isotope area cell ventilation system and 3039 stack; east end (alpha handling facility) exhausts to local fan and short stack on east end roof. Cell ventilation: (1) alpha cells and Cell 7, HEPA filtration, exhaust to process off-gas system and 3039 stack; (2) Cells 5 and 6, HEPA filtration, exhaust to isotope area cell ventilation system and 3039 stack.
Liquid waste systems	Cell floor drains: Cells 1 to 4 drain to intermediate holding tank; from there, waste is pumped to the LLLW system. Pump has not been checked in 4 years, and its condition is unknown. Other cells drain directly to the LLLW system. Building 3028 drains to tank WC-10, except Cell 7. Cell 7 has one drain to tank WC-2 and two drains to WC-10. There is some question as to whether the Cell 5 drain is connected.
Cask handling	Forklift (9800-lb capacity).

Table A.2.2.1 (continued)

Facility/area	Comments
East Air Lock	Pit below the floor in southeast corner has filters for Building 3047 and part of the filters for Building 3028 process off-gas; pit contained 6 in. of water last time it was opened; floor above pit roped off as radiation zone.
	500-gal waste tank that services the alpha cells located in pit under floor. The pump has not been checked in 4 years.
	Chilled water unit used to cool floor pans of alpha cells; may be contaminated inside.
	Old pipe weld camera with ^{60}Co source stored here.
Alpha Cells Charging Area	Area is highly alpha contaminated. All painted surfaces have contamination under them.
	Entrance into old cell ventilation duct should be sealed to prevent new ventilation system from pulling contamination from the duct.
	Off-gas filters for Cells 1 to 4 are located in ceiling of the cell charging area. Filters cannot be reached safely without scaffolding. Permanent scaffolding is needed for safety (rather than the temporary measures now used).
Cells	
Cells 1-4 (alpha)	Highly contaminated with alpha (Pu, Cm).
	Lighting and electrical services are in poor condition due to radiation damage.
	Liquid waste pump (needed for cell washdown) may not be operable.

Table A.2.2.1 (continued)

Facility/area	Comments
Cells (continued)	
Cells 1-4 (continued) (alpha)	Cell 1: empty.
	Cell 2: contains ^{238}Pu and ^{244}Cm sources.
	Cell 3: contains waste.
	Cell 4: contains a welder; no operating light fixtures.
Cell 5 (alpha and beta/gamma)	Contaminated with alpha and beta/gamma.
	Some question as to whether floor drain is connected to LLLW system.
Cell 6 (Pipe cell)	Highly contaminated with ^{147}Pm. Cell must be entered at least once a year to change filters.
Cell 7 (short-lived fission products)	Relatively clean; entered in 1986 to connect new cell ventilation system; no operation since that time.
	West cell window has only one pane of glass. Work started to convert west window to lead glass but stopped due to lack of funding. Window should be replaced. If off-gas safety system failed, it could pull single pane in, breaking containment.
	Filter system was never completed to give testable HEPA filters on Cell 7.
	Process off-gas from Cell 7 exhausts through potassium iodide impregnated charcoal filters and a caustic scrubber (inactive) to the isotope area process off-gas system. It is not known if the scrubber still contains contaminated caustic solution or dried salts.
Cubicle area	Contaminated; old equipment still there.

Table A.2.2.1 (continued)

Facility/area	Comments
West Air Lock	Casks containing ^{137}Cs and ^{90}Sr.
	Charcoal filter pit under floor; probably is contaminated; however, short-lived fission products were last processed in 1986 and those would have decayed.
Second and Third Floors	May find contamination from past activities. Second, third, and fourth floors and the elevator shaft have plutonium and ^{147}Pr contamination under the paint; paint is chipping and peeling.
	Health and Safety Research Division personnel are currently operating "cold" laboratories on these floors.
Fourth Floor	Empty.
	Roof leaks; steam line leak.

A.2.3 Building 3029 - Source Development Laboratory

A.2.3.1 Description

Building 3029 is located in the west-central area of the Isotope Circle, southwest of Building 3047. The building is a single-story steel-frame structure covered by corrugated metal siding. The floor area is 3,000 ft^2, and the total free-space volume is 33,000 ft^3. The building layout is shown in Fig. A.2.3.1.

The operating area contains four manipulator-type hot cells. Cells 1, 2, and 3 were used to process high-level beta/gamma sources; Cell 4 was used for short-lived materials and ^{192}Ir monitoring. The cell access area contains a ^{60}Co storage and irradiation area known as the ^{60}Co garden. The ^{60}Co garden has been placed in the Surplus Facilities Management Program and is not part of the isotope facilities shutdown. Two laboratory hoods located in the soutwest corner of the operating area are used for preparing both elemental $^{131}I_2$ and $CH_3\ ^{131}I$. These hoods are equipped for use as glove boxes. There are two small glove boxes in the northeast corner of the cell access area.

Cell 1 and 3 can operate independently or in combination with Cell 2. Cell 2 is dependent on Cell 1 or 3 for transferring materials in or out of the cell. Cells 1 and 3 are lined with stainless steel and have 3-ft barytes concrete walls. Cell 3 also has 2 in. of lead shielding on the operator side. Cell 2 has a 3-ft barytes concrete wall on the operating side, 1 ft of steel on the cell access side, a stainless steel pan, and walls coated with a radiation-resistant sealant. Cell 4 is lined with stainless steel and has 2-ft barytes concrete walls and top.

Cells 1, 2, 3, and 4 have mineral oil-filled, lead glass windows. Access to windows in Cells 1, 2, and 4 is from cold side; in Cell 3, it is from the hot side.

The building's outer surface is sealed for airtightness by cocooning with polyurethane foam. All normal entries have air locks for lift trucks and personnel access and have gasketed doors to minimize inleakage. Building ventilation is provided by a roof-mounted exhaust fan with HEPA filters. In conjunction with dampered inlet and exhaust vents, it is operated to maintain a slight negative pressure in the building and to automatically place the system in a "contained" state when air monitors detect radioactivity.

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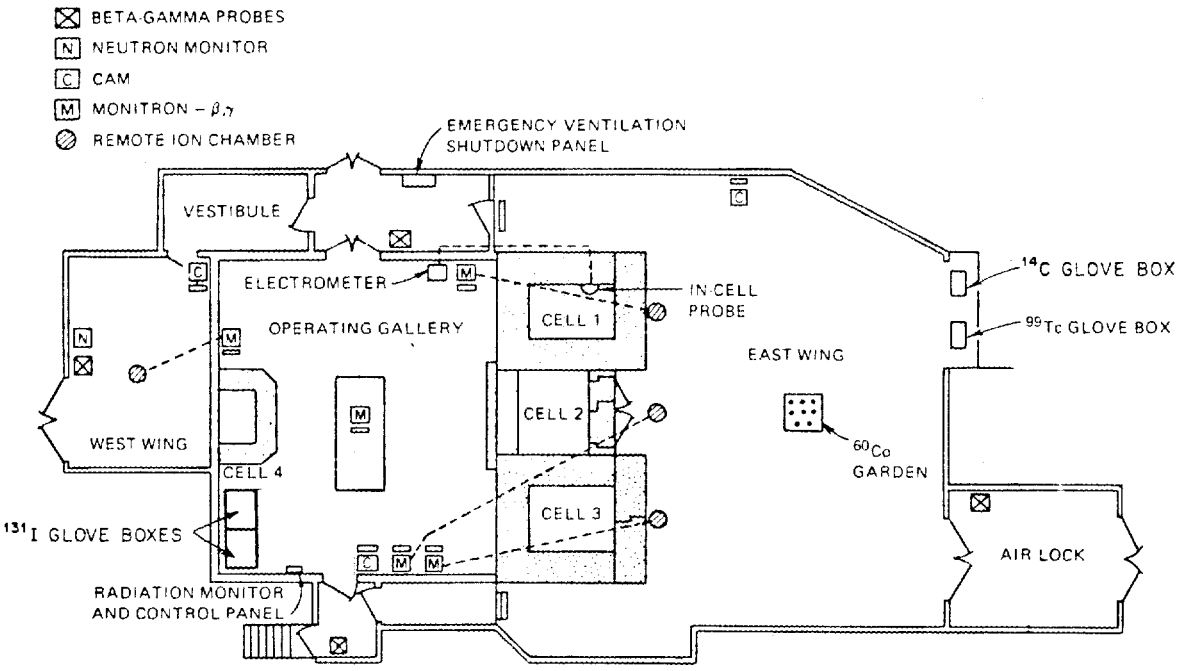

Building 3029

Fig. A.2.3.1. Floor plan of Building 3029 - Source Development Laboratory.

The exhaust air from the cells is passed through a minimum of two sets of HEPA filters and discharged to the 3039 stack system.

A.2.3.2 History

Building 3029 was constructed in 1952 and originally contained a system of remotely operated barricades and a small manipulator cell (now called Cell 4). The facility was built as part of, and has always been used in, the Isotopes Program. Isotopes originally handled in the facility were ^{192}Ir (source fabrication) and small ^{60}Co sources. Cell 1 was built in 1955-56 to handle large quantities of ^{60}Co. Very little ^{60}Co source fabrication has been done since the late 1950s. Cell 3 was built in 1960-62 for ^{137}Cs source fabrication. Cell 2 was built by enclosing the space between Cells 1 and 3 and is used for waste handling and pass-through between the cells. Major building operations included ^{60}Co, ^{137}Cs, ^{90}Sr, and ^{192}Ir source fabrication.

A.2.3.3 General Status

The general status of Building 3029 is summarized in Table A.2.3.1. Current activities in the building to be phased out are as follows:

1. Iodine-131 is processed in glove box A in the southwest corner of the operating area. The iodine is used to test the HFIR filter system. This work is performed every 6 months.
2. Cell 1 is used to transfer samples from a shipping cask to a smaller transfer cask for the Metals and Ceramics Division. This work is performed about every 2 to 3 months.

Cell 2 has waste that is being loaded out as manpower allows.

Table A.2.3.1. Building 3029 - general status of facility

Facility/area	Comments
Building	
Type	Steel frame with metal siding.
Roof	Needs maintenance every 2 to 6 years.
Exterior walls	Cocooned with polyurethane foam; need maintenance every 2 to 6 years.
Building containment and ventilation	Building sealed; air locks; operates to maintain a slight negative pressure in the building relative to the environment and to automatically maintain the system in a "contained" state when air monitors detect radioactivity.
	Local area ventilation system; unshielded filter house with double HEPA filtration on the roof.
	Cell ventilation: HEPA filters and exhaust to 3039 stack.
	No air conditioning; temperature may reach 110°F on hot days.
Liquid waste systems	Building sinks and floor drains: process waste system.
	Cell floor drains: drain to tank WC-10.
Cask handling	Forklift (9800-lb capacity).
Cells	Cells 1-3: used to process high-level beta/gamma sources (^{37}Cs, ^{90}Sr, and in the past ^{60}Co).
	Cell 4: short-lived radioisotopes, ^{192}Ir.
Cell 1	Cell 1 is a transfer cell and is fairly clean.
	No in-cell HEPA filters; filter house with double HEPA filtration on the roof.

Table A.2.3.1 (continued)

Facility/area	Comments
Cells (continued)	
Cell 2	Cell 2 is highly contaminated with beta/gamma radioactivity. There are 42 sources in this cell. The sources are unknowns but are believed to be ^{137}Cs. There is one ^{90}Sr source. Cell 2 also contains waste. HEPA filters in the cell and double HEPA filters on the roof. The filter house on the roof is reading 2 R/h about 1 ft in front of the filter house on the cell side. Electrical system is deteriorating due to high radiation levels.
Cell 3	Cell 3 was decontaminated to 20-mrem smears about 2 years ago. The contamination is mostly ^{90}Sr, but there is some ^{137}Cs. Cell 3 is ducted to Cell 2 and filtered through the Cell 2 filter house. Cell 2 filter house is running with the damper fully open. The new system was connected to the roof of Cell 3, but the cell was never entered to install in-cell filters. The Cell 3 filter house is locked out. No lights or electrical outlets due to radiation damage.
Cell 4	Cell 4 is fairly clean; it is used only for transfers. No in-cell HEPA filters; double HEPA filters in outside filter house.
Operating gallery	
Iodine glove boxes (enclosed hoods)	These glove boxes are hoods that were converted to glove boxes for processing elemental $^{131}I_2$ and CH_3 ^{131}I. Drain to glove box B leaks. Leakage is alpha contaminated. The area under the box is highly alpha contaminated and is sealed. It is not known why there is alpha contamination, since no known work with alpha-emitting materials was done in the building.

Table A.2.3.1 (continued)

Facility/area	Comments
Operating gallery (continued)	
Iodine glove boxes (enclosed hoods) (continued)	No alpha-monitoring instruments in the building.
East Wing	
Cell access area	Area around the back doors of Cells 2 and 3 has high radiation readings. Lead shielding has been placed around the base of each cell. The background from this area causes the area to be zoned as a radiation zone. Radiation levels behind the lead bricks are 300 to 400 R/h. Cesium powder was spilled out the back of Cell 3. Cleanup will require the removal of floor concrete and perhaps some removal of door concrete and/or removal of cell door operating trolley. Contamination is leaking from under the Cell 3 door. Weekly cleanup is required. Smear counts usually 1000 to 1500 dpm.
^{60}Co garden (not part of isotopes shutdown but present in the building)	There is a ^{60}Co storage and irradiation facility (known as the ^{60}Co garden) containing several kilocuries of ^{60}Co located under the floor of the east wing. Although not part of this project, its presence will need to be taken into consideration in conducting shutdown activities. The ^{60}Co garden is in the Surplus Facilities Management Program.
^{14}C glove box	Contamination levels are not known but are considered to be high. Box is empty and has not been used for at least 5 or 6 years.
^{90}Tc glove box	Used to weigh ^{99}Tc powder for shipment; highly contaminated; all inventory has been removed.

Table A.2.3.1 (continued)

Facility/area	Comments
East wing (continued)	
^{99}Tc storage cabinets	^{99}Tc is sealed in plastic bottles that are sealed in isotope cans and stored in two filing cabinets. These are old "classified" document-type files. The records on the inventory have been handed down for many years with some inventory cards dating back to the early 1960s. The inventory is not accurate and is probably high. Most of the bottles exceed the amount allowed by the SAR for glove boxes, making it impossible to take inventory.
West Wing	Two casks that contain ^{192}Ir pellets. Old material, no inventory records. Decayed to very low levels at this time.
	Two small containers with unidentified sources that appeared overnight; history unknown.
	Storage well below the floor. No records. No funding for inspection.

A.2.4 Buildings 3030, 3031, and 3118 - Radioisotope Production Laboratories C, D, and H

A.2.4.1 Description of Facilities

Buildings 3030 and 3031, the Radioisotope Production Laboratories, were designed for limited production and development processing of reactor-produced beta/gamma-emitting radioisotopes for industrial, medical, and research applications. Building 3118 was constructed by enclosing the space between 3030 and 3031 and covers the access doors to the cells in these buildings. These buildings are located in the west-central area of the Isotope Circle and north of Building 3038.

A.2.4.1.1 Building 3030

Chemical processing of a wide variety of radioisotopes has been carried out in the single hot cell of Building 3030. Primarily, these were irradiated targets from the HFIR and ORR reactor facilities and the 86-in. cyclotron.

Building 3030 is a steel frame structure covered by corrugated aluminum siding. The single-story facility has a floor area of 825 ft^2. A manipulator-type hot cell is located on the middle of the east wall, as shown in Fig. A.2.4.1. Two laboratory hoods occupy the northeast section of the building, and a glove box (an enclosed hood with glove ports) is included in the northwest corner. Since the building itself is not sealed, the manipulator cell and laboratory hoods constitute the primary means of containment. All high-level work was conducted in the hot cell. The hot cell has 2-ft concrete walls with 4 in. of lead brick shielding on the west (front) and south (side) cell walls and an unshielded top cover. The cell is provided with an oil-filled, lead glass window. A stainless steel operating pan covers the floor and interior walls up to the level of the viewing window. A 27- by 15-in. gasketed steel door port is used for insertion and removal of equipment. An administratively controlled, padlocked steel door at the back of the cell allows access from Building 3118. This door is used mainly for transfer of shielded materials and large equipment. Personnel entry is allowed after decontamination has reduced radiation to a safe level.

The building operates at a slight negative pressure (nominally -0.15 in. w.g.) relative to the atmosphere. Since the siding is not sealed the building cannot operate in a "contained" state.

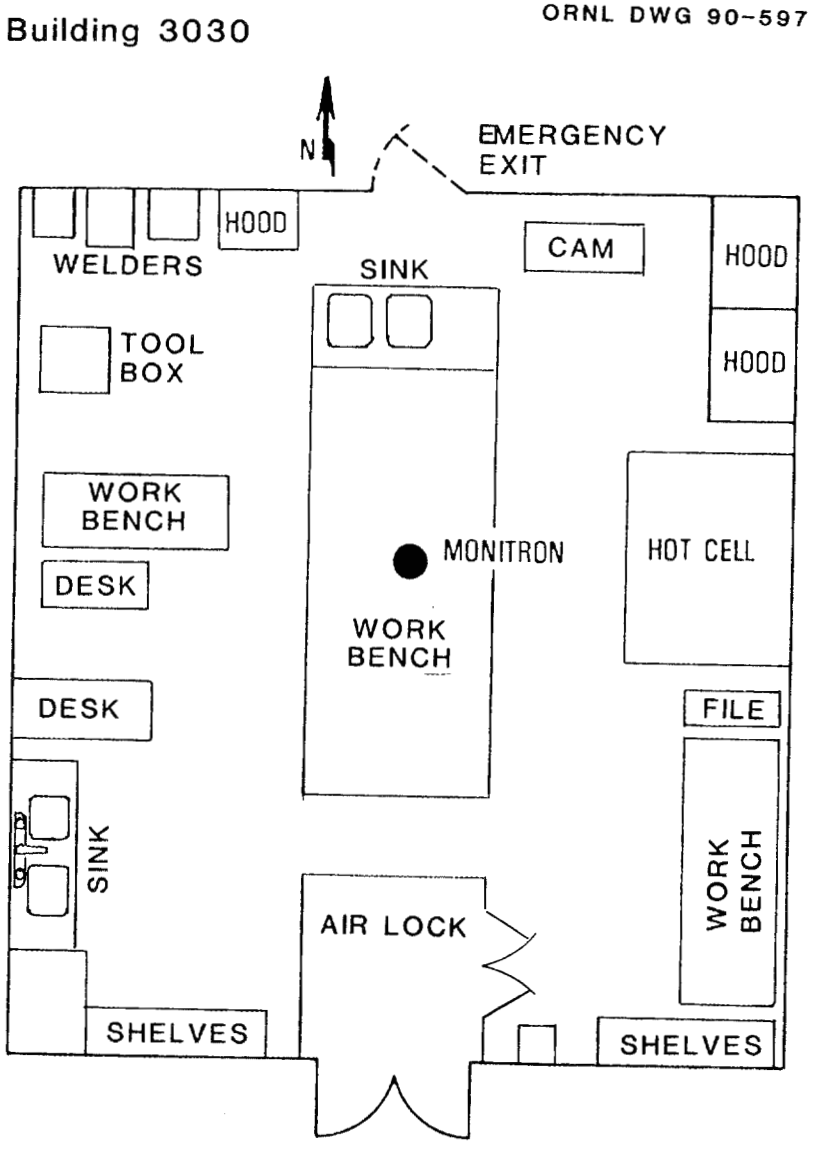

Fig. A.2.4.1. Floor plan of Building 3030 - Radioisotope Development Facility.

A.2.4.1.2 Building 3031

Building 3031 was being prepared for a proposed ^{90}Y facility when the shutdown decision was made. Prior to that, the building had been used for processing ^{153}Gd, a medical radioisotope. The building is a single-story steel frame structure covered by corrugated metal siding with a floor area of 825 ft^2. It has one manipulator cell located in the middle of the west wall and hoods in the corners (Fig. A.2.4.2). The hot cell has 1-ft barytes concrete walls with 5-in. steel armor plate on the operating (east) face of the cell wall starting 2 ft 10 in. above the floor and an unshielded top cover. The cell is provided with a mineral oil-filled, lead glass window. A stainless steel operating pan covers the floor and interior walls up to the level of the viewing window. Small steel doors on each side of the cell are used for insertion and removal of small equipment and containers. A thick steel double door at the back of the cell can provide access for large items from Building 3118 if needed. This door is padlocked against unauthorized use.

The building operates at a slight negative pressure (nominally - 0.15 in. w.g.) relative to the atmosphere. The process of sealing the building for a proposed yttrium facility was started but not completed. The building cannot operate in a "contained" state.

A.2.4.1.3 Building 3118

Building 3118 is a steel frame structure covered with corrugated aluminum siding that was erected by roofing and enclosing the space between Buildings 3030 and 3031. Building 3118 provides access to the rear entry doors for the hot cells in Buildings 3030 and 3031, storage of some old sources, and temporary holding of contaminated waste.

A.2.4.2 History

Buildings 3030 and 3031 were constructed to perform limited production and development work with radioisotopes used for industrial, medical, and research applications. The hot cell in Building 3030 has been used to process irradiated cyclotron and reactor targets to produce numerous unique radioisotopes such as (1) ^{56}Co recovery from an iron target, (2) ^{57}Co recovery from a nickel cyclotron target, (3) preparation of a purified ^{198}Au solution, (4) purification of ^{55}Fe, (5) separation of ^{234}Np from a uranium target, (6) processing of ^{75}Se, (7) preparation of purified ^{90}Sr nitrate, (8) processing of ^{119m}Sn, (9) purification of ^{237}U, (10) processing of ^{33}P, and (11) processing of ^{192}Ir.

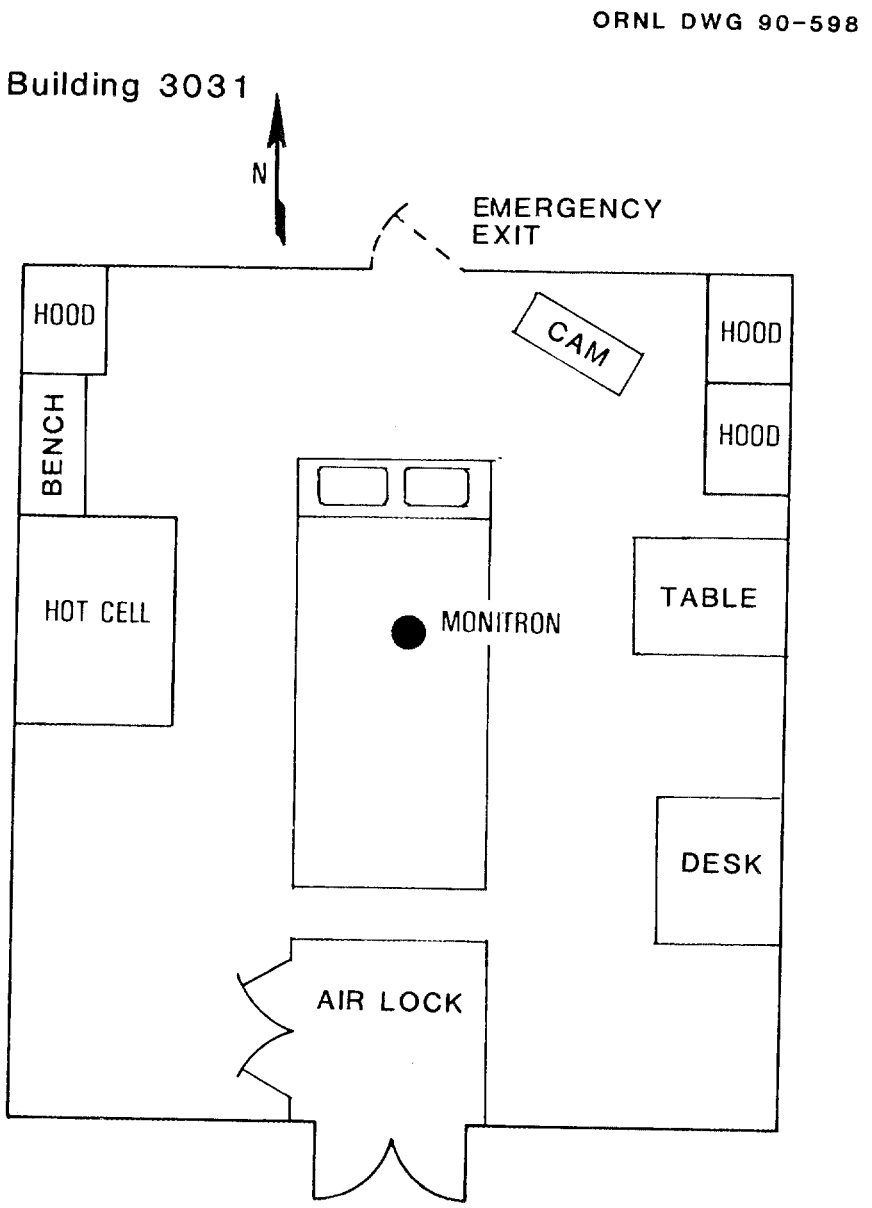

Fig. A.2.4.2. Floor plan of Building 3031 - Radioisotope Development Facility.

The hot cell in Building 3031 was used in the final separation of gadolinium from europium targets. The ^{153}Gd processed here is used in nuclear medicine research to determine bone density for osteoporosis research and treatment evaluation.

Building 3118 is basically a shed covering the rear-entry doors to the hot cells in Buildings 3030 and 3031. It was added in the early 1960s.

A.2.4.3 General Status

The general condition of Buildings 3030, 3031, and 3118 is summarized in Tables A.2.4.1, A.2.4.2, and A.2.4.3, respectively. There are no current operations in Building 3030 or 3031. Building 3118 is used for forklift storage and temporary holding of contaminated waste as well as other storage. Building 3118 may be used for forklift storage and as waste staging area during shutdown activities.

Table A.2.4.1. Building 3030 - general status of facility

Facility/area	Comments
Building	
Type	Steel frame with metal siding
Roof	Needs maintenance every 2 to 6 years
Exterior walls	Siding is not sealed; leak in the wall when it rains
Building ventilation	Operates at a slight negative pressure (nominally - 0.15 in. w.g.); building is not sealed; air lock on front entry.
	Building ventilation provided by local system; exhaust to unshielded filter house (double HEPA filtration) on roof.
	Cell ventilation; HEPA filters and exhaust to 3039 stack.
Liquid waste systems	Building sink and floor drains: process waste system. Cell floor drain: drains to tank WC-10.
Cell and hoods	
Cell	Beta/gamma hot cell.
	Cell contains ^{192}I and ^{103}Pd sources.
	In-cell roughing filter. Cell ventilation, process off-gas, and glove-box exhaust routed to concrete block filter house in the alley north of Building 3030. No access for maintenance or pressure test ports. Concrete block walls must be torn down service filters.
	Manipulator boots need replacing.
Hoods	Assumed to be contaminated.
Laboratory	Small quantities of ^{63}Ni, ^{153}Gd, and ^{103}Pd under the bench; ^{109}Po in the cabinet. Cesium-137 stored in a Class A package on the floor.

Table A.2.4.1 (continued)

Facility/area	Comments
West wall	Abandoned hot drains and hot off-gas lines under floor; welded closed.

Table A.2.4.2. Building 3031 - general status of facility

Facility/area	Comments
Building	
Type	Steel frame with metal siding.
Roof	Needs maintenance; leaks.
Exterior walls	Cocooning process incomplete; exterior has been sprayed with a cocooning material.
Building ventilation and containment	Operates at a slight negative pressure (nominally -0.15 in. w.g.)
	Process of sealing building for a proposed yttrium facility was started but not completed. Ventilation system partially modified. Air lock installed at single entry door.
	Building ventilation provided by local system; exhaust to unshielded filter house (single HEPA filtration) on roof.
	Cell ventilation; HEPA filters and exhaust to 3039 stack.
	Air conditioning system is not functional. Heating unit needs maintenance.
Liquid waste systems	Building sink and floor drains: process waste system.
	Cell floor drain and enclosed hood: drain to tank WC-10.
Monitoring instrumentation	CAM unit is old; repair parts no longer available.

Table A.2.4.2 (continued)

Facility/area	Comments
Cell and Hoods	
Cell	Beta/gamma hot cell.
	Contamination levels are unknown, but recent history suggests low. Relatively "clean." One can of waste.
	Cell ventilation exhaust has double HEPA filtration; no in-cell filter.
	Process off-gas with double HEPA filtration.
	No in-cell electrical service; electrical through access ports only.
One enclosed hood	Contamination level, 6000 dis/min.
	Equipped with glove ports; lead shielding; drain to tank WC-10.
Two hoods	Contamination level below 2000 dis/min.
	Each equipped with process waste drain.

Table A.2.4.3. Building 3118 - general status of facility

Facility/area	Comments
Building	
Type	Metal shed on concrete pad.
Roof and walls	Acceptable for use.
Building ventilation	Local system; building is not sealed; no air locks.
	No air conditioning.
Liquid waste systems	Sink: process waste treatment system.
	Floor drain that is plugged; drains to tank WC-10; must pull plug to use.
Stored materials	^{241}Am sources; ^{90}Sr; irradiated aluminum nitride sources containing ^{14}C, ^{153}Gd, Eu, and Gd radioisotopes; unknown Savannah River nuclides.
	Contaminated glassware in drums (short half-life).
	Lead-lined waste dumpster for wastes >200 mR/h.
	Forklift.
	Glove box (no contamination).

A.2.5 Building 3033 - Tritium and Krypton Production Facility

2.5.1 Description

The tritium and krypton production facility is housed in Building 3033, which is located in the central area of the Isotope Circle, northeast of Building 3038. This building contains two separate radioisotope processing systems for handling gaseous ^{3}H and ^{85}Kr.

The building is a steel frame structure covered with aluminum siding. The floor space is about 1200 ft^2 with a total volume of about 20,000 ft^3. The outer surface of the building has been sealed by a cocooning process to make it as airtight as possible. Personnel and equipment entrances are gasketed. The building is maintained at a negative pressure of 0.3 in. w.g. or more relative to the outside atmosphere. The three areas of the building, the krypton process cell, the tritium process room, and the utility area are shown in Fig. A.2.5.1.

The krypton process cell consists of a composite shielded enclosure made of 2.25-in.-thick steel plate overlaid with 1 in. of lead, supported by a 8-in.-thick by 2-ft-high concrete wall at the bottom. Part of the enclosure houses the in-process storage tanks and is made of stacked 4-in.-thick lead bricks. The main enclosure pressure is maintained at -1 in. w.g. relative to the room pressure.

The separation columns and carbon reactor are housed in a separate enclosure, which consists of a steel frame overlaid with 4 in. of lead brick. The permanent storage cubicle which contains four charcoal-filled storage tanks, is located outside the building. It consists of a nonventilated 2-ft-thick reinforced-concrete enclosure. The krypton feed gas is located inside a 1-in.-thick steel plate enclosure, which is also outside the building. Process components contained in the enclosure are connected with 3/8-in. copper tubing shielded by 1-in. lead. Each of these enclosures (with the exception of the permanent storage which is not in service) is connected to the Isotopes Area cell ventilation system.

Tritium radiation consists of a relatively soft beta emission, which produces essentially no penetrating radiation hazard. The tritium is handled in a hood inside the tritium room. The hood is connected to the isotope area cell ventilation system and is maintained at a nominal -0.5-in. w.g. relative to the tritium room.

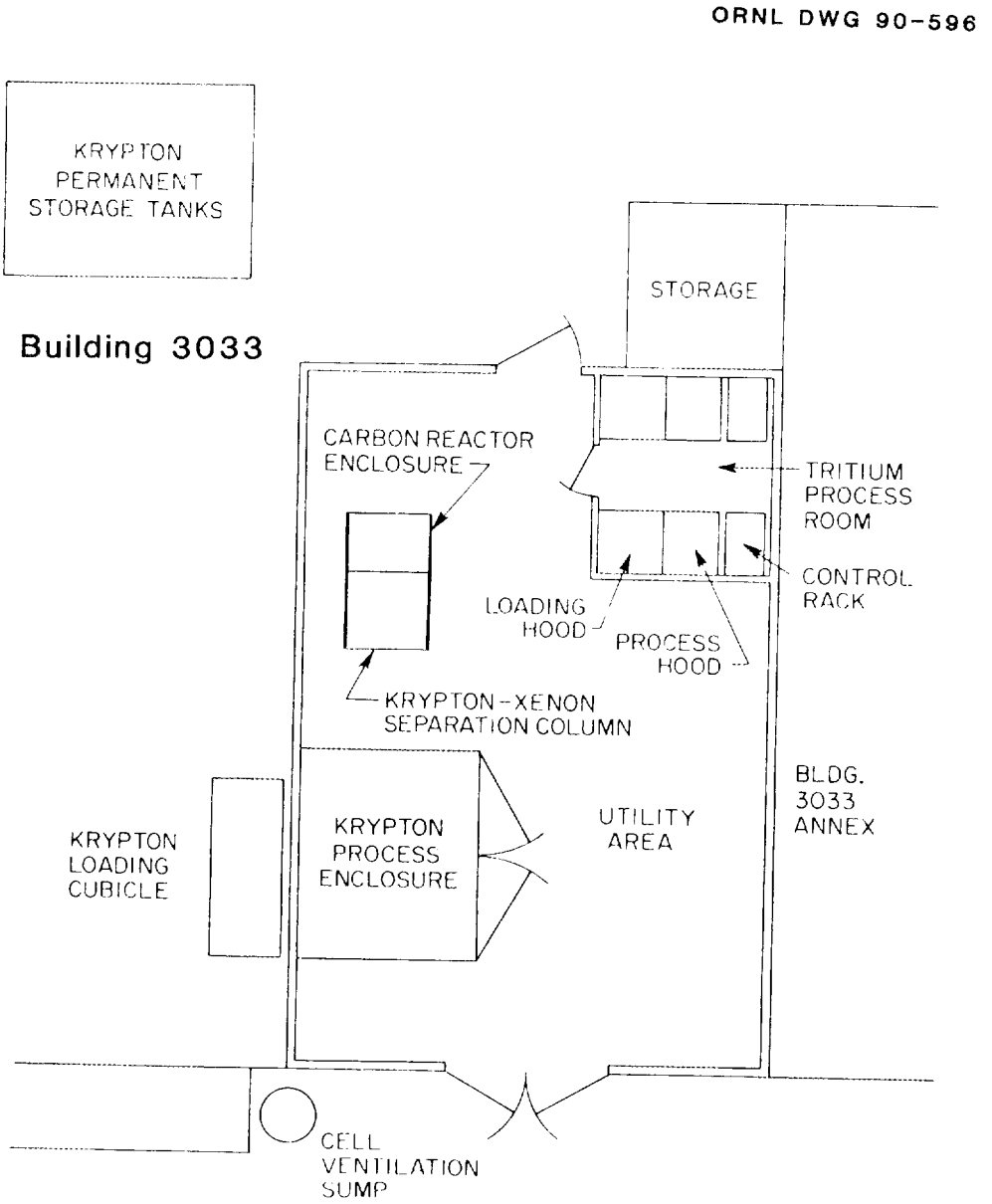

Fig. A.2.5.1. Floor plan of Building 3033 - Tritium and Krypton Production Facility.

A.2.5.2 History

Building 3033 was constructed in the late 1940s and was used to process ^{14}C, ^{85}Kr, and ^{3}H Processing of ^{14}C was discontinued in 1975. The processing of ^{3}H for sales to private industry is continuing today. Krypton-85 campaigns are conducted periodically, most recently in September 1989.

A.2.5.3 General Status

The operations in Building 3033 consist of two separate radioactive gas processing systems. Tritium operations involve the receiving of bulk tritium shipments from the Savannah River Plant, followed by purification, loading of shipping containers, and shipment to numerous customers worldwide. Krypton operations include the purification of krypton (as received from the Idaho National Engineering Laboratory) in preparation for direct sale or as feed to the thermal diffusion columns in Building 3026-C.

The tritium operations in Building 3033 are currently in operation at full capacity. However, the DOE plans to transfer all the tritium commercial sales work to Mound Laboratory. Tritium operations are planned for termination by June 30, 1990. No future krypton processing in Building 3033 is planned. Krypton loading operations in Building 3026-C are planned to continue until September 30, 1991.

The general status of the facility is summarized in Table A.2.5.1.

Table A.2.5.1. Building 3033 - general status of facility

Facility/area	Comments
Building	General condition good, considering age of facility.
Type	Steel frame with aluminum siding.
Roof	Replaced in 1988.
Exterior walls	Cocooned with polyurethane foam; need maintenance every 2 to 6 years.
Building containment and ventilation	Building sealed; building operates in a "contained" state to maintain a >0.3 in. w.g. negative pressure relative to the outside environment. (In practice, building operates at about 0.45 in. negative pressure.)
	Both building ventilation and cell ventilation are on the isotopes area cell ventilation system and exhaust to the 3039 stack. No HEPA filters are present because only radioactive gases are handled in the building.
	Chronic steam leak.
Liquid waste systems	Processes do not generate liquid wastes.
	Cell drain to tank WC-10; drain kept open but has not been used in 17 years (or longer).
Cells and hoods	
North hood system in tritium room	Uncontaminated; tritium has never been introduced to system; the two uranium traps have never been activated (i.e., never used for tritium storage).
South hood system in tritium room	Operating facility; tritium inventory stored in uranium traps. After shutdown and removal of inventory, the equipment and cubicle will be highly contaminated with tritium. Tritium exchanges with water-oxide coating on surface of the metal.

Table A.2.5.1 (continued)

Facility/area	Comments
Cells and hoods (continued)	
South hood system in tritium room (continued)	Three uranium traps used for storing and purifying tritium. One trap was poisoned by an inleakage of air and taken out of service. All three traps are pyrophoric.
Krypton cell/ system	Minimal contamination of equipment after shutdown due to inert nature of krypton. Relatively new system.

A.2.6 Building 3033-A - Actinide Fabrication Facility

A.2.6.1 Description

Building 3033-A (Annex) was used to house and contain the facilities for the production, loading, welding, and decontamination of neutron dosimeter materials, as well as the weighing and packaging of milligram to gram quantities of actinide materials for research applications.

Building 3033-A is located in the central portion of the Isotope Circle, south of Building 3047. It is a metal structure erected by bridging the space between Buildings 3033 and 3034 and using their walls for support. Floor space is about 242 ft^2, with a free-space volume of about 718 ft^3. Personnel access is through gasketed, air-lock entries. The building layout is presented in Fig. A.2.6.1.

The building does not contain a hot cell and was used only for low-level radioactive operations in glove boxes and one hood. Special radioactive materials are stored in the building. It is equipped with an intrusion alarm system.

The building is maintained at a pressure of -0.25 in. w.g. relative to the outside atmosphere. The exhaust is to the 3039 stack via the Isotopes Area cell ventilation system. The air leaving Building 3033-A passes through roughing and HEPA filters,which are routinely tested. Air leaving the glove boxes passes successively through in-box filters and tested HEPA filters prior to discharge to the cell ventilation system.

A.2.6.2 History

Building 3033-A, which was constructed in approximately 1960, included two operating areas: a small one for ^{14}C production at the south end of the building operated by the Radioisotope Department and the larger, main operating area for research materials preparations performed by Isotope Research Materials Laboratory (IRML) personnel. In the early 1980s, IRML personnel decontaminated and decommissioned the ^{14}C facility, including removal of the underground dissolver tank, and converted this area for storage.

This building has been used almost exclusively for the preparation and distribution of highly enriched actinide isotopes (and for a period, ^{14}C) for the Isotopes Program. Among the operations performed were:

1. fabrication of ceramic oxide wires,

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Building 3033-A

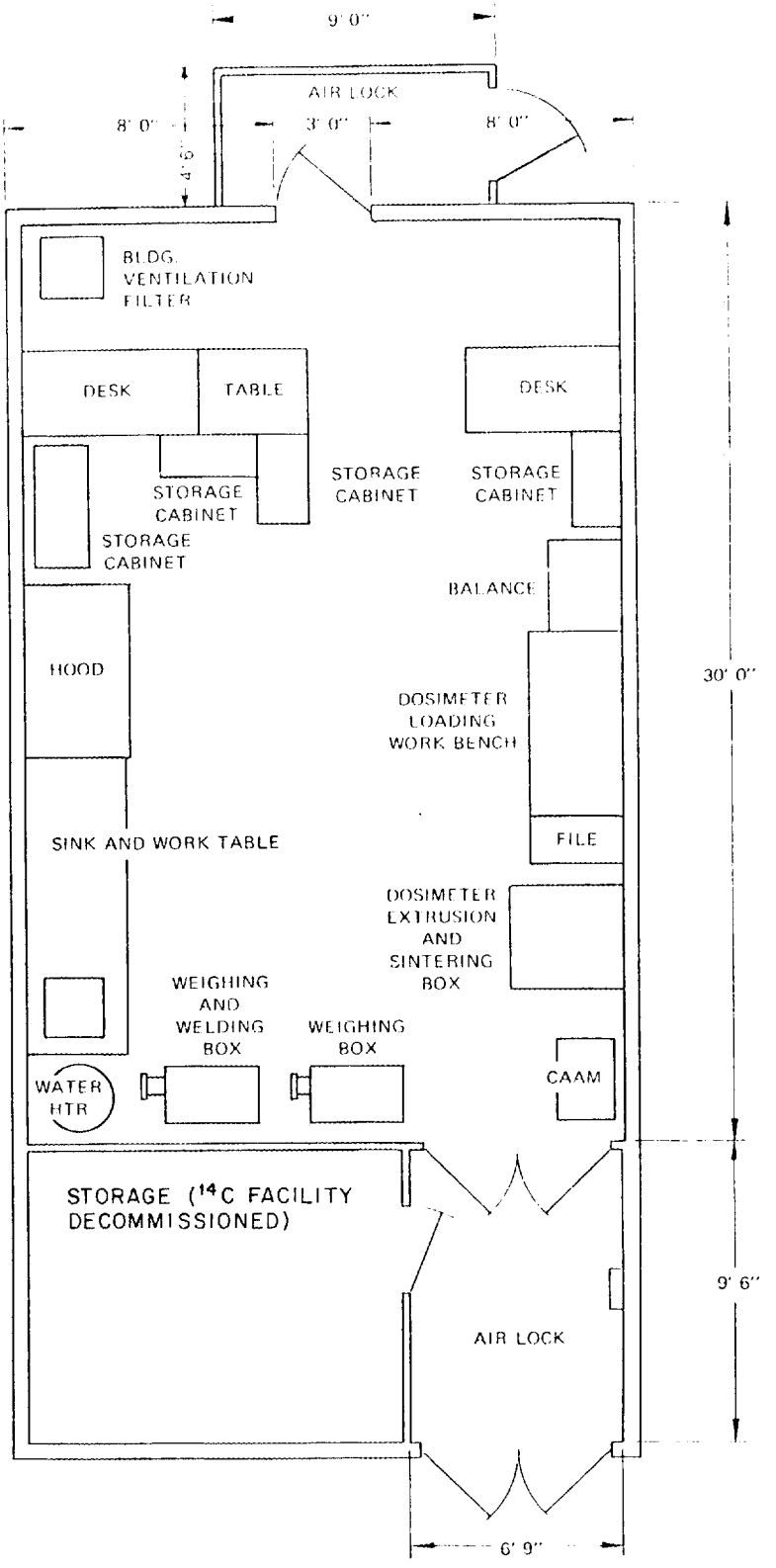


Fig. A.2.6.1. Floor plan of Building 3033-A - Actinide Fabrication Facility.

2. loading of ceramic oxide wires, oxide powder, or metal into small metal capsules for use as in-core reactor neutron dosimeters;
3. fabrication of ^{244}Cm-^{13}C monoenergetic gamma sources;
4. weighing and packaging of milligram to gram quantities of actinide materials;
5. preparation of nanogram to milligram actinide samples for alpha counting;
6. decontamination of nuclear material shipping containers; and
7. storage of radioactive materials.

Over the years, many other small special projects have been performed in this facility, including, for example, the packaging of actinide materials for disposal or shipment as a service to the Safeguards and Security Department.

A.2.6.3 General Status

All production operations in Building 3033-A were halted in January 1990 because of funding problems. Storage of radioactive materials and general cleanup was performed until the technician assigned to that building (and others) was transferred in early March 1990.

The general status of this facility is summarized in Table A.2.6.1.

Table A.2.6.1. Building 3033A - general status of facility

Facility/area	Comments
Building	
Type	Steel frame with metal siding; shares common load-bearing wall columns with adjacent buildings.
Roof	Leaks (set buckets).
Exterior walls	Cocooned; need maintenance to seal leaks.
Building containment and ventilation	Building cocooned; air locks; leakage problems; building is maintained at a nominal negative pressure of 0.25 in. w.g. relative to the outside atmosphere but cannot be assured of operating at -0.30 in. w.g. because it is located at the end of the Isotopes Area cell ventilation system and because of the condition of the building. Building ventilation: roughing and HEPA filters (filter house inside building); exhaust to Isotopes Area cell ventilation system and 3039 stack. Glove box: in-box roughing filter; in-house filter box with dual series of HEPA filters valved so that one set may be isolated and bypassed during changeout; exhaust to isotopes area cell ventilation system and 3039 stack. Hood: HEPA filter, exhaust to isotopes area cell ventilation system and 3039 stack.
Liquid waste systems	Drain in hood, west wall (normally sealed): drains to tank WC-10. Laboratory sink, one hood drain, building floor drain: process waste treatment system.
Security	Facility locked when personnel are not present; intrusion alarm system operated by Laboratory Protection Division.

Table A.2.6.1 (continued)

Facility/area	Comments
Building (continued)	
Radioactive and nuclear materials	Highly enriched actinides stored in locked and security-sealed cabinet in main operating area. Batches of material stored in shipping containers in main area. Actinides stored in cabinets or waste drums in storage room at south end of building. Two actinide-contaminated glove boxes, one connected to cell ventilation and one disconnected in preparation for moving (now canceled).

A.2.7 Building 3036 - Isotope Area Storage and Service Building

A.2.7.1 Description

Building 3036 is located in the east area of the Isotope Circle. The building is a steel-frame structure with corrugated aluminum siding. The building houses the Stable Isotopes Laboratory with a $40 million inventory and is used for storage of shipping containers. The Isotope Distribution Office (IDO) uses the second level (balcony) for records storage.

A.2.7.2 History

The building was constructed about 1950 as a decontamination facility for ORNL, but the main use was by the Isotopes Program. It included a facility for decontaminating tractor trailers. The building was converted to storage (1965) with a new concrete floor poured over the contamination. About 1970, the Stable Isotopes Laboratory moved into the building. Stable isotopes are a full-cost-recovery operation. The storage in the building is for isotope shipping and the IDO.

A.2.7.3 General Status

The Stable Isotopes Laboratory and storage use of the building are ongoing. The building is also the stores drop-off point for the area. It is planned to relocate the Stable Isotopes Laboratory to another ORNL facility by September 30, 1991, under the Isotope Program. This relocation is not part of this plan.

The general status of the building is summarized in Table A.2.7.1.

Table A.2.7.1. Building 3036 - general status of facility

Facility/area	Comments
Building	
Type	Steel frame with metal siding.
Roof and exterior walls	Acceptable for use.
Building ventilation	Building is not sealed.
	No ventilation system.
Liquid waste systems	None.
Stored materials	$40 million inventory of stable isotopes (nonradioactive), dead storage of isotopes distribution records, shipping containers.
	Used tritium cylinders containing a "heel" of residual contamination; if cylinder leaked, could release contamination.
Other	Contamination under concrete floor; contaminated tank may be under floor with concrete poured over, but that has not been proven.

A.2.8 Building 3038 - Isotope Research Materials Laboratory (IRML), Isotope Shipping, Isotope Technology, and Alpha Handling Facility

A.2.8.1 Description

Recent uses of Building 3038 include the study of transuranic elements, fabrication of alpha- and neutron-emitting targets and sources, shipment of radioisotopes, and production of ^{90}Y for medical uses. The building, which is located on the southwest corner of Isotope Circle, is a masonry structure with a total of floor area of 7250 ft^2 and a total free space volume of 130,000 ft^3. It is divided by concrete block interior walls into three separate facilities: 3038-E, 3038-M, and 3038-AHF.

The building rooms and equipment are maintained in a "contained" condition using the Isotopes Area cell ventilation and process off-gas systems and a local ventilation system. Various heating and cooling systems are provided in the different operating areas. The cell ventilation system exhausts air from the IRML area and equipment and from the Isotope Technology process area in 3038-E (including the manipulator cell) to an unshielded filter house on the roof, which discharges to the 3039 stack. The Isotopes Area process off-gas system provides exhaust for the manipulator cells in the Alpha Handling Facility (AHF) and the glove boxes in the AHF Annex with local HEPA filters prior to discharge. The local ventilation system provides room exhaust for Isotope Shipping, the AHF, the AHF Annex, and the Isotope Technology Low-Level Laboratory. The exhaust goes to a filter house on the roof where an exhaust fan draws air through the HEPA filters and discharges up a short roof stack. The filters in the various cells, glove boxes, and hoods are given in the description of the individual laboratories.

The IRML in 3038-E is provided with an air lock for personnel access. The personnel access to isotope shipping in 3038-M also has an air lock. Other personnel access entries and equipment access doors are <u>not</u> provided with air-lock capability, which results in upsets to the "contained" condition desired. The combination of local and process off-gas systems presents a potential for reversed flows and contamination if one of these systems should fail.

The drains in the east and middle sections of the building, which were once connected to the liquid low-level waste (LLLW) system, have been sealed to prevent use because of leaks in the underground transfer lines. This includes, in addition to the hot

cell in 3038-E, several bench and sink operations. There is no provision for washdown to decontaminate the hot cell or for cleanup in the event of a spill in the barricade area. The hot drains for the alpha handling cells in 3038-W are on the WC-2 tank system.

A.2.8.1.1 Isotope Research Materials Laboratory

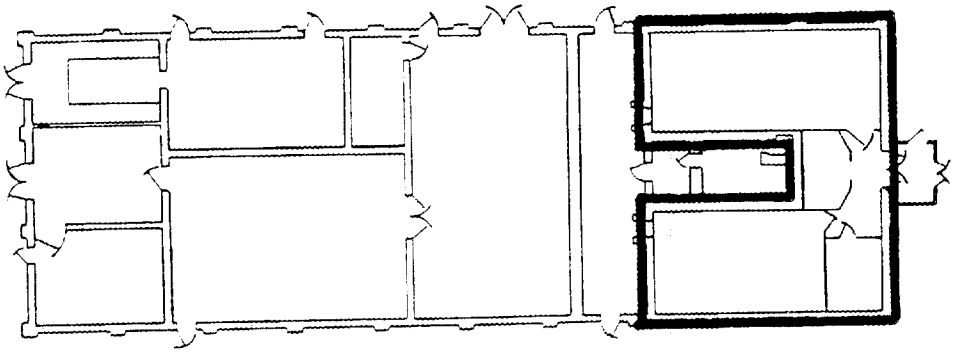
The IRML facility, located in the east portion of Building 3038, consists of glove boxes, hoods, and counting equipment (Fig. A.2.8.1). The glove boxes contain equipment for the fabrication of radioactive targets, and the examination of materials by both destructive and nondestructive tests. The glove boxes and hoods have one stage of HEPA filtration in the box or hood, a second stage of HEPA filtration in the filter house on the roof, and then discharge to the cell ventilation system. Nonradioactive liquid wastes are discharged to the process waste system. There is no provision to valve off the process waste system in the IRML area. There is no LLLW system in the IRML facility. There is a storm drain for cooling water from diffusion pumps and electrical equipment that have no potential for radioactive contamination.

The principal radioactive materials in the IRML are uranium, transuranic elements, and ^{147}Pm. Primary containment is provided by the glove boxes and hoods. The glove boxes are operated at a negative pressure $\geq$ 0.35 in. w.g. relative to the laboratory.

A.2.8.1.2 Isotope Shipping

The isotope shipping area is located in the central portion of Building 3038 and consists of the concrete barricade for storage of isotope products, the pipetting station, the canning and packaging station, an area for health physics inspection, and an area for labeling the package (Fig. A.2.8.2). The barricade consists of a concrete wall with lead brick shielding stacked 2 ft high, two lazy-susan-type storage holders behind the shielded wall, a remote manipulator, and an overhead viewing mirror. The products are stored as liquids in glass bottles. Handling the bottles is difficult because it requires the use of manipulators and an overhead mirror. Some of the product is old, and the glass containers have become brittle due to radiation damage. The shipping area operates under the low-negative-pressure, high-air-flow principle. Air flow passes from the least hazardous areas over the barricade through a single stage of roughing filters followed by a single stage of HEPA filters on the roof and discharges to the atmosphere through a roof vent. There

ORNL DWG 90-594



Building 3038

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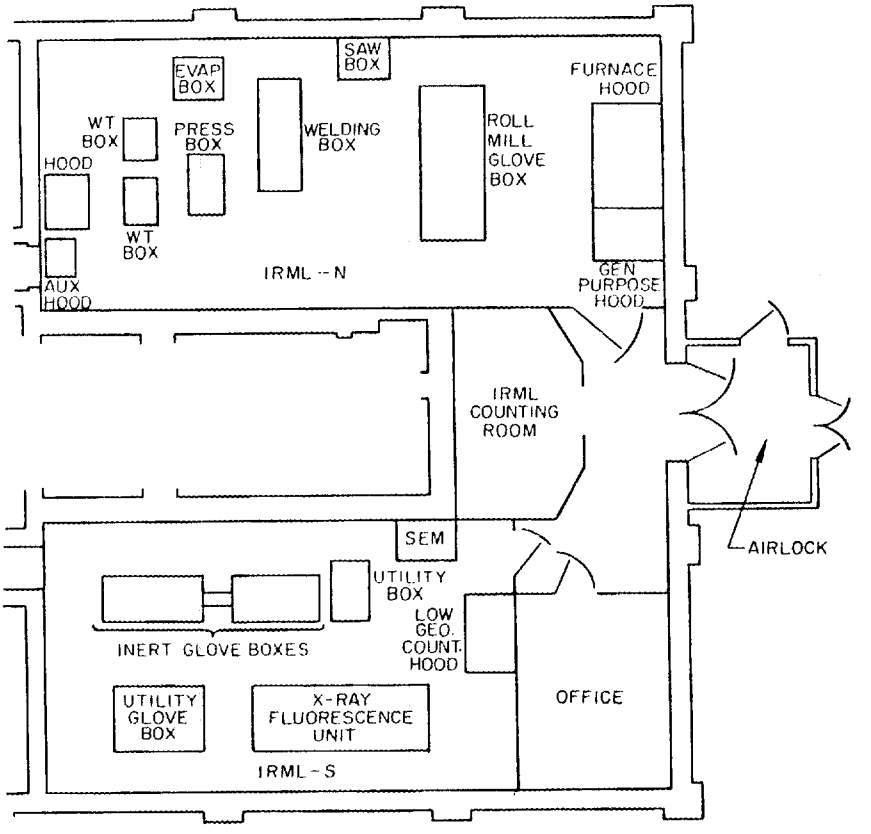

Building 3038-E

Fig. A.2.8.1. Floor plan of Isotope Research Materials Laboratory in Building 3038.

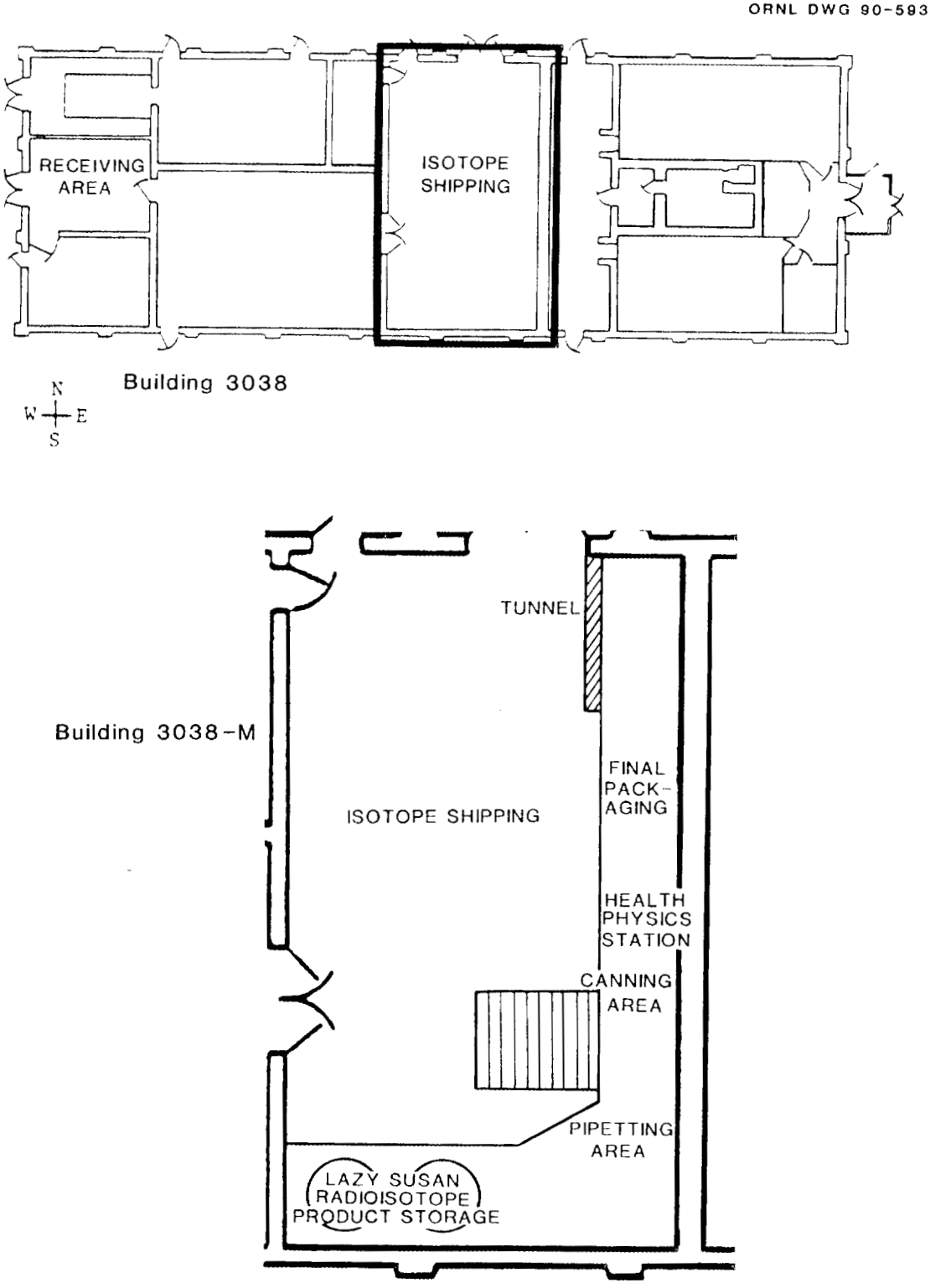

Fig. A.2.8.2. Floor plan of Isotope Shipping and Receiving in Building 3038.

is no provision for washdown behind the barricade in the event of a spill because the hot drain has been sealed.

A.2.8.1.3 Isotope Technology

Isotope Technology has two laboratories - - a process cell area in the east end of the building and a low-level laboratory in the west end.

The process cell area has one manipulator cell, hoods, and a shielded counting room, (Fig. A.2.8.3). The cell is constructed of 4-in. steel plate on all sides with a mineral-oil-filled, leaded-glass viewing window and a 10-in.-square access port. It is supported on concrete pillars. This cell is being used for separating ^{90}Y from ^{90}Sr and is highly contaminated. There is no provision for washdown since the hot drain was sealed. A shielded counting room is adjacent. There is single-stage roughing filtration in the cell. Exhaust from the cell, hoods, and room is routed to a filter house on the roof (single-stage HEPA filtration) and discharged to the 3039 stack.

The low-level laboratory includes a laboratory bench, hoods, and an adjacent storage room (Fig. A.2.8.3). The hoods and sinks drain to the process waste system. There is no way to valve off this system. The only radioactive materials handled in this laboratory are tracer-level quantities of alpha and beta-gamma materials. Room air exhausts to the local system with single-stage HEPA filtration and is discharged through the roof stack.

A.2.8.1.4 Alpha Handling Facility

The Alpha Handling Facility (AHF) in the west end of Building 3038 consists of five hot cells. A separate room, the AHF Annex, occupies the southwest corner of the building and includes seven glove boxes for weighing, packaging, and welding capsules. The floor plan of these two rooms is shown in Fig. A.2.8.4.

The hot cells are shielded by water-filled, steel tanks. The operating face of each cell has 3 ft of shielding, is 6 ft wide by 8 ft high, and contains a viewing window and manipulator ports. Each cell is 10 ft deep. The cell tops are unshielded except for the liner. One foot of water shielding is provided between cells. The building wall consisting of 1 ft of concrete forms the back of the cells. These cells can be used as glove boxes by replacing the front shielding tank and manipulators with an approved window equipped with glove ports and a loadout station. The alpha cells drain to the WC-2 tank system.

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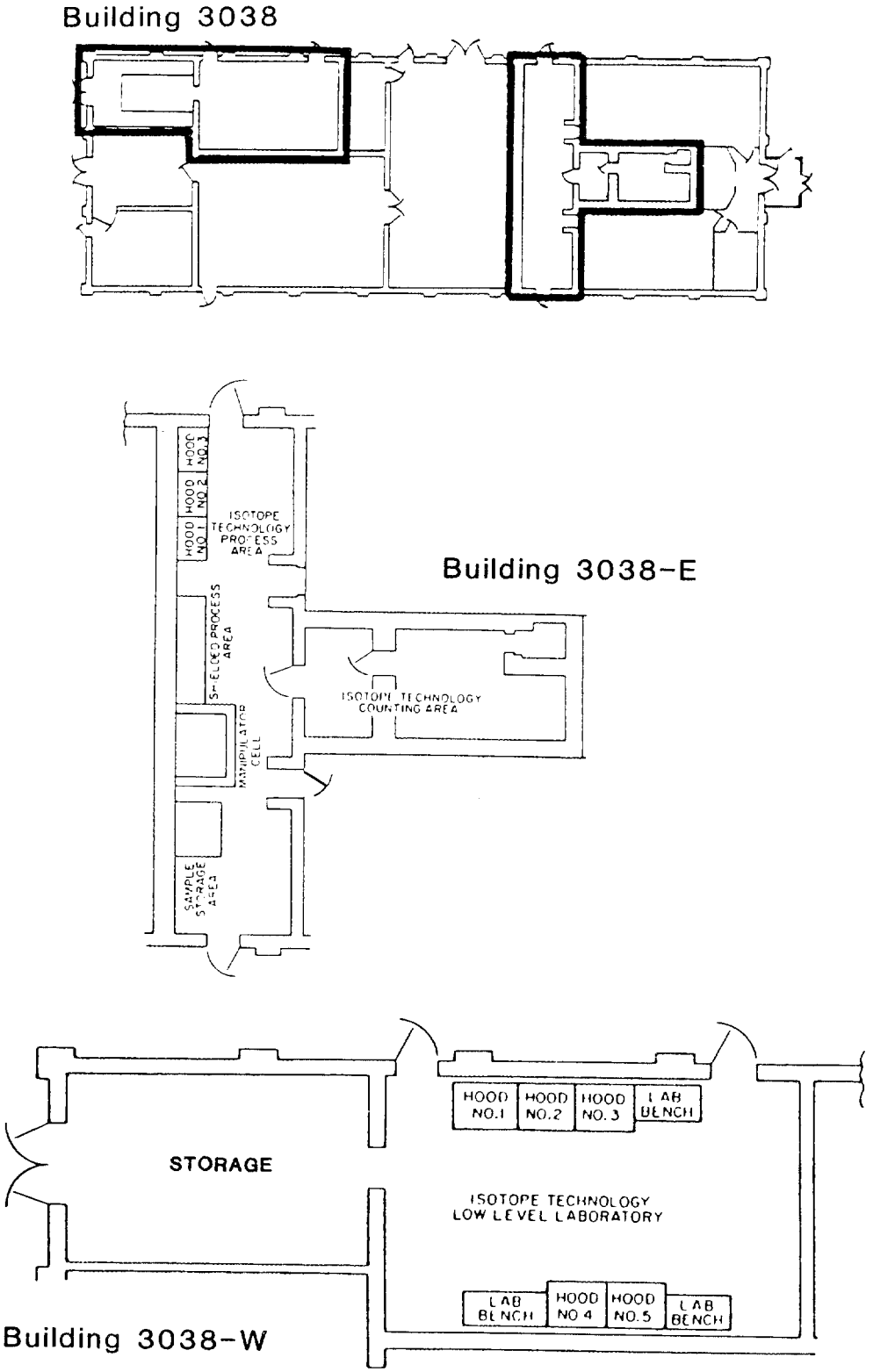

Fig. A.2.8.3. Floor plan of Isotope Technology Laboratories in Building 3038.

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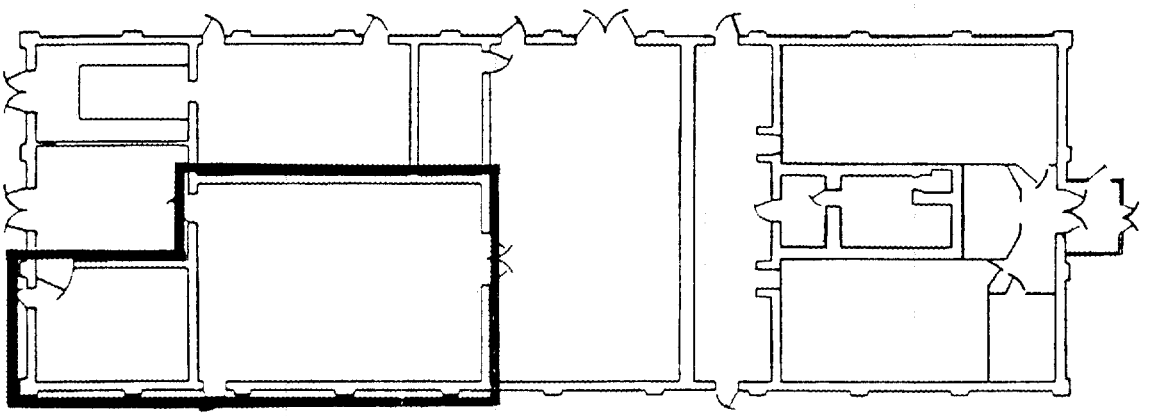
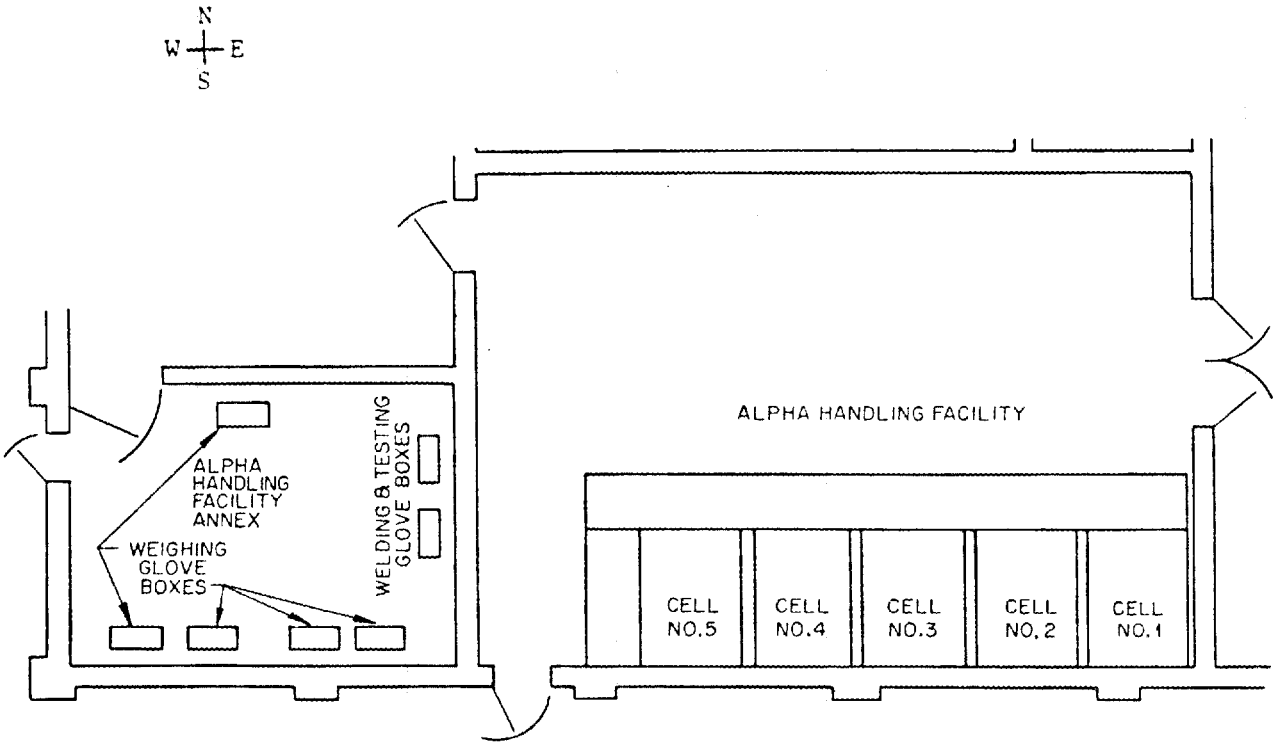


Building 3038



Building 3038-AHF

Fig. A.2.8.4. Floor plan of Alpha Handling Facility in Building 3038.

The cells are ventilated by the process off-gas system. The maximum negative pressure available to the cells is limited to -4.0 in. H_2O (gauge) by a vacuum breaker in the off-gas header. There are single-stage HEPA filters in the cells and glove boxes and a second stage of HEPA filtration before discharge to the process off-gas system. Additional treatment is provided at the 3039 stack. The room air exhaust from the AHF and the AHF annex has single-stage HEPA filtration in the duct and a second stage in the filter house on the roof before discharge through a short roof stack.

A.2.8.1.5 Receiving Area

This area serves as the receiving depot for all radioactive materials which are delivered to the central ORNL site (Fig. A.2.8.2).

A.2.8.2 History

Building 3038 was constructed to house all the radioisotope shipping activities for ORNL. The building has been in operation since 1949. Originally, the entire facility was dedicated to radioisotope shipping as follows: the east portion (3038-E) contained the analytical chemistry laboratory to perform analyses of short-lived radioisotopes prior to shipment; the middle section (3038-M) housed the radioisotope handling and transfer barricade; and the west section housed the packaging, inspection, and shipping activities.

As the volume of radioisotopes being shipped decreased in the 1960s, the shipping area was reduced. In 1968, the west portion was converted into the AHF by adding water-shielded hot cells and glove boxes for fabrication of targets.

The section of the building called 3038-M has always been the radioactive shipping operation for ORNL. Most of the shipments were for the isotopes sales program, but shipments of radioactive materials from other ORNL groups were also handled here. The glove boxes in the AHF Annex were used for loading out of isotopes for sales.

The analytical chemistry laboratories supporting isotopes sales were located in the east end until 1976. When the analytical function was transferred to other ORNL facilities, the IRML converted 3038-E into an isotope production and development facility. In the late 1970s and early 1980s, IRML, in conjunction with the Chemical Technology Division, conducted a research program on plutonium alloys and compounds which was funded by the DOE Office of Basic Energy Sciences. The same glove boxes were used in the mid-1980s to perform research with the Solid State Division on ^{147}Pm-doped crystals and glasses for

laser development studies funded by Lawrence Livermore National Laboratory. With these two exceptions, all work in this end of the facility has been dedicated to isotopes efforts.

A.2.8.3 General Status

Packaging, shipping, and receiving are ongoing activities in Building 3038. However, the plan is to relocate these activities to other ORNL facilities. Yttrium-90 production, which is currently in operation, is planned for termination by September 30, 1990. There are some operations in the IRML laboratories. The plan is to relocate the IRML to other ORNL facilities by December 31, 1990. The IRML relocation is being addressed under separate funding and is not covered by this plan. Barricade operations are continuing to dispense existing inventory for sale by the isotope program.

The general status of the facilities is summarized in Table A.2.8.1.

Table A.2.8.1. Building 3038 - general status of facility

Facility/area	Comments
Building	
Type	Main structural components are cast, reinforced concrete connected by girders with unreinforced masonry walls. Building interior is subdivided by concrete block walls into separate facilities.
Roof and exterior walls	Good condition.
Building containment and ventilation	The building rooms and equipment are maintained in a "contained" condition; for the operating areas of the building, a minimum of 0.25 in. w.g. negative relative to the outside atmosphere is required. ORNL cell ventilation system: room air, glove boxes, hoods, and the $^{90}Y/^{90}Sr$ cell in the IRML area and the Isotopes Technology Process Area (i.e., 3038-E). Glove boxes and hoods in IRML equipped with single-stage HEPA filter on exhaust; single-stage roughing filter on $^{90}Y/^{90}Sr$ hot cell; no filters in duct from Isotopes Technology area hoods. Exhaust air routed to unshielded filter house on roof equipped with parallel banks of testable HEPA filters (single-stage filtration) with bypass provisions during maintenance. Exhaust to 3039 stack. Local ventilation system: room air exhaust from 3038-M and 3038-W, and hood exhaust from Isotope Technology low-level laboratory. In the shipping area, ventilation air sweeps from the room over the barricade and through one stage of roughing filters before discharge to filter house on the roof. Room exhaust from the Alpha Handling Facility (AHF) and the AHF annex equipped with single-stage HEPA filters in the duct. Exhaust to filter house on roof equipped with parallel banks of testable HEPA filters (single-stage filtration). Discharge via short stack on roof. ORNL process off-gas system: Cells 1, 2, 3, 4, and 5 and glove boxes in alpha handling facility (AHF) annex; HEPA filter in each cell and glove box. Exhaust passes through second-stage of HEPA filters in the AHF before discharge to Isotopes Area process off-gas system; scrubber and additional HEPA filtration at 3039 stack facility.

Table A.2.8.1 (continued)

Facility/area	Comments
Building (continued)	
Building containment and ventilation (continued)	Air locks: IRML has air locks; personnel access to isotope shipping also has an air lock; other access entries do not have air locks; leads to upsets in contained condition.
	Heating and cooling: several systems.
	Chilled water unit that serves alpha handling facility annex may have some contamination in it. System still in use.
Liquid waste systems	3038-E and 3038-M have no functioning "hot" drains; drains to LLLW system sealed to prevent use. Includes small hot cell in the west end, the barricade, and several bench and sink drains.
	3038-W: alpha handling cells drain to WC-2 system; low-level laboratories on process waste system.
Monitoring	Facility Radiation and Contamination Alarm System, central system for building; monitored at Waste Operations Control Center.
	Vacuum-tube-type beta-gamma monitor; unreliable non-domestic source for spare parts.
IRML	Nuclear materials stored in a locked safe or in metal containers inside glove boxes. Efforts in progress to remove materials from glove boxes. Inventory will be relocated to another ORNL facility by December 31, 1990. This activity is being addressed under separate funding and is not part of this plan.
IRML North Laboratory	Rolling-mill box: highly alpha-contaminated and weighs several tons. Requires the removal of several corner blocks of a nearby wall for adequate clearance if the glove box is removed.
	Reduction distillation box: relatively new box (1 year old), highly contaminated with ^{244}Cm and ^{241}Am. Includes a cryogenic high-vacuum pump and oil-filled roughing pump.

Table A.2.8.1 (continued)

Facility/area	Comments
IRML (continued)	
IRML North Laboratory (cont'd)	Press box: highly alpha-contaminated and contains a hydraulic press connected to a hand pump outside the box. Can be disposed of at any time.
	Loading box: small Lexan box used for loading ^{147}Pm-doped crystals and glasses into quartz spectrophotometer cells. Box contains very slight beta contamination.
	East general-purpose hood: highly alpha-contaminated and also contains some beta contamination. A high-vacuum system is mounted external to the hood with a feedthrough into the hood for a bell jar. The damper on this hood must be operated manually.
	East furnace hood: ORNL fabricated sheet-metal hood enclosure with horizontally sliding metal doors. Contains a low-temperature (1000°C) and a high-temperature (1500°) furnace for ceramic work. Moderately contaminated with ^{233}U and ^{237}Np.
	West general-purpose hood: highly alpha-contaminated; also contains possible old, beta contamination. A rolling-mill drive train is mounted outside the hood to accommodate a small rolling mill in the hood.
	^{252}Cf hood: Small table-top fiberglass hood containing a small gold sputtering vacuum system used to overcoat ^{252}Cf targets with gold. Moderate levels of ^{252}Cf contamination are present.
IRML South Laboratory	Weigh box: small, highly alpha-contaminated glove box containing an analytical balance for weighing out Pu, Am, and Cm.

Table A.2.8.1 (continued)

Facility/area	Comments
IRML (continued)	
IRML South Laboratory (continued)	Pu/Pm glove boxes: two glove boxes joined together by a gloved antechamber. The east box contains a high-temperature vacuum furnace mounted in the floor with an externally mounted, sealed vacuum system. Cooling water is supplied by a recirculating chiller system. Boxes were capable of operating on an inert-gas recirculation system. The west box once contained an elaborate high-temperature, vacuum experimental apparatus which has been stripped out. These boxes were used for Pu oxide and metal studies in the late 1970s and early 1980s. In the mid-1980s, they were used for ^{147}Pm-doping studies and are, therefore, highly contaminated with alpha and pure beta emitters. Unfortunately, the boxes would be very difficult to separate, making removal of the entire assembly very difficult. East hood: alpha and beta contamination is present from a variety of handling operations and from counting. Stainless steel vacuum chambers used for alpha counting extend through the floor of the hood and are evacuated by an oil-filled roughing pump. X-ray unit: A slightly alpha-contaminated X-ray diffraction and fluorescence unit is located in this laboratory. It was disconnected from its power source several years ago rather than make excessive, expensive safety upgrades. Upgrade requirements have moderated somewhat, but the unit has not been upgraded because there was no immediate need for it. It is a valuable and operational unit, however. Potential for inadvertent spread of ^{90}Sr/^{90}Y contamination from adjacent ^{90}Y laboratory. Sole personnel access to ^{90}Y laboratory. Only contamination monitor for ^{90}Y personnel located in east foyer of IRML area, which could result in spread of ^{90}Sr/^{90}Y contamination before it was detected. Personnel monitors removed from ^{90}Y laboratory because of high background levels near ^{90}Y laboratory exit to south IRML laboratory.

Table A.2.8.1 (continued)

Facility/area	Comments
^{90}Y Laboratory (Isotope Technology Process Area)	Manipulator cell: highly beta/gamma-contaminated with ^{90}Sr/^{90}Y; hot drain shutdown; no washdown provision; shine through manipulator boot opening on top of cell.
	Appendage to manipulator cell: used to store old cyclotron plates.
	Glove box: contaminated -- no washdown provision.
	Two hoods: used for tritium trap decontamination; medical (short-lived) isotopes.
Isotope Shipping	Barricade has a large inventory of old product (beta/gamma emitters in aqueous solutions) stored in glass bottles. Some material is so old that radiation has made the glass brittle. The necks of two bottles are known to be broken. There is no drain (capped off) for decontamination in the event of a spill. The barricade area is open to the room air.
Alpha Handling Facility	Five alpha cells: contaminated; contain inventory of ^{241}Am, plutonium isotopes, ^{235}U, and Cf; windows heavily clouded brown from microorganism growth.
	Hot drains: drain to tank WC-2.
	West wall: alpha glove boxes were once located there but have been removed.
Alpha Handling Facility Annex	Five boxes are highly alpha-contaminated; some contain actinide products (^{241}Am, ^{237}Np, and ^{238}Pu).
	Two glove boxes used for welding and inspection; no powder handling.
	Glove boxes constructed with rubber gaskets (rather than welded stainless steel construction).
Receiving Area	Chilled water unit contaminated; system connected to room air conditioners.

A.2.9. Building 3047 - Radioisotope Development Laboratory

A.2.9.1 Description

The Radioisotope Development Laboratory, Building 3047, is a three-story structural steel-frame building with concrete block exterior and interior walls. It is located in the north-central area of Isotope Circle. Building 3047 is joined to the Isotopes Technology Building, Building 3047-A. Because they have individual ventilation systems and are separated by at least two sets of double doors, they are considered separate buildings. (Building 3047-A, which contains administrative offices, is not part of the shutdown plan.)

The Radioisotopes Development Laboratory houses four high-level beta-gamma cells, one alpha hot cell, seven laboratories for handling low-level materials, a decontamination room, offices, and service areas. The building plan is shown in Fig. A.2.9.1.

A.2.9.1.1 Beta-gamma Cells and Support Areas

The four beta-gamma manipulator hot cells (Cells A, B, C, and D), the operating area (Room 109), the cell access area (via rear access doors into the cells; Room 113), and the decontamination room (Room 105) are located on the first floor in the center of the building. The cell access area (via roof hatches into the cells; Room 215) is on the second floor. The walls and tops of Cells A, B, and D are fabricated of 3 ft of barytes concrete. The roof plug and front and rear walls of Cell C are fabricated of 2 ft 3 in. of barytes concrete and 9 in. of steel plate. All interior walls between the cells are of 16-in.-thick laminated steel plate. Cell C has a 21-in.-thick laminated steel access door. The cells are lined with stainless steel. Each cell has a mineral-oil-filled, lead-glass window arranged to give shielding equivalent to the cell walls. Windows are accessible for maintenance only from the hot side of the cell. Small quantities of materials and some equipment limited to less than 50 lb and 12 x 12 x 12 in. size can be transferred using a conveyor system, which terminates in loading/unloading cubicles at the east and west ends of the cell block. The transfer cubicles have a viewing window. Roof plugs in the top of the cells are located on the second floor to allow the movement of heavier equipment into and out of the cells. Equipment and materials may be transferred between Rooms 113 and 215 through a gasketed hatch. Steam, air, electrical, and water services are headered off the utilities services above the operating corridor and penetrate the cell operating face with an isolating

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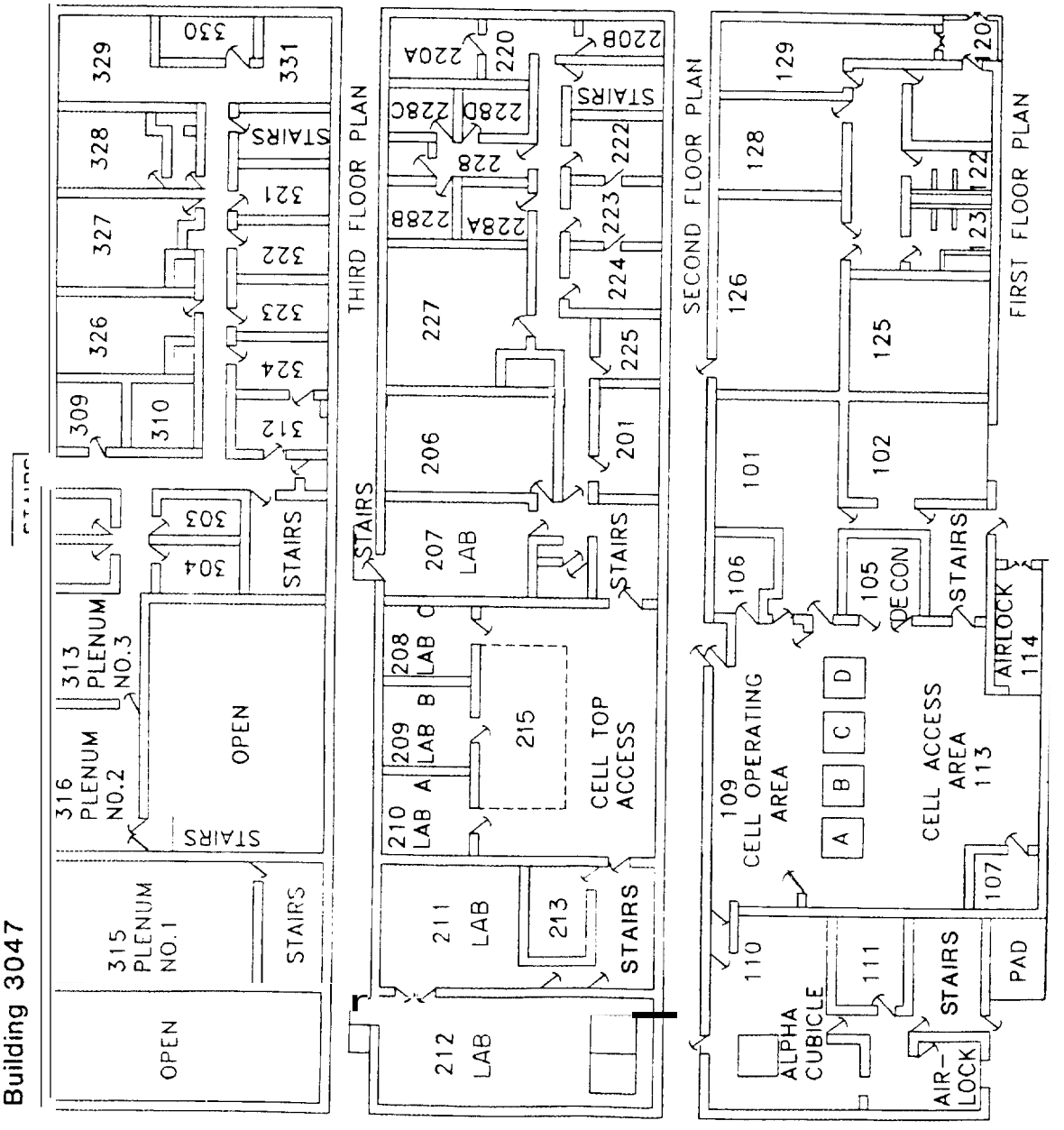

Fig. **A2.9.1.** Floor plan of Building **3047** - Radioisotope Development Laboratory

valve or switch provided. Radioactive services - cell exhaust, hot drain, and process off-gas - penetrate the cell block through underground headers.

A.2.9.1.2 Alpha Hot Cell

A manipulator hot cell for handling alpha emitters is located in Room 110. The cell is shielded by water-filled reinforced steel tanks that provide water shielding on all four sides and the top. The cell has a welded stainless steel liner and a water-filled viewing window. A glove box attached to the vacuum access port provides bag-in/bag-out capability for introducing/removing materials. The cell may be evacuated and operated under an inert atmosphere. The shield tank on the rear (west) side of the cubicle is movable to permit access to an opening equipped with a removable cover that contains glove ports and a viewing window.

A.2.9.1.3 Second-Floor Laboratories

There are six laboratories on the second floor; four are used for nuclear medicine research, one (Room 211) for ^{14}C and one laboratory (Room 212) was in the process of renovation when the decision was made to shut down the facility.

A.2.9.1.4 Building Containment and Ventilation

The building is divided into three zones: the west-end (alpha) containment zone, the middle (beta-gamma) containment zone, and the east (office) zone, which does not have containment. Each zone has a separate ventilation system with individual blowers for each system.

The manipulator cells, glove boxes, and hoods constitute the primary containment of radioisotopes, with the designated "containment" areas within the building providing secondary containment. All entries to "contained" areas are provided with an air lock and are gasketed to minimize inleakage. There are also air locks between the alpha and the beta-gamma containment zones.

The west-end containment zone includes the three alpha laboratories - Rooms 110, 211, and 212. These laboratories are maintained in a "contained" condition of at least 0.30 in. w.g. negative pressure with respect to the outside atmosphere. Room air is filtered and recirculated with a limited discharge to the atmosphere. The exhaust goes to a filter house on the roof where an exhaust fan draws air through HEPA filters (single-stage filtration) and discharges to a short stack on the roof.

The middle (beta-gamma) containment zone includes the hot cell operating and access areas (Rooms 109, 113, and 215), the decontamination room (Room 105), and three low-level laboratories (Rooms 208, 209, and 210). The middle section of the building operates at a small negative pressure relative to the outside atmosphere and automatically goes into containment (-0.3 in. w.g.) if the instrumentation detects radioactivity. Room air exhaust is routed to a filter house (single-stage HEPA filtration) on the roof and is discharged to a short roof stack.

The east end of the building does not have containment, and there are no filters on the room air exhaust to the atmosphere. This area includes offices, changerooms, service areas, and one low-level laboratory (Room 207).

Ventilation for the beta-gamma cells is provided by the Isotope Area's cell ventilation system and the 3039 stack. There are one stage of HEPA filters in each cell and a second stage of HEPA filters in the shielded filter house on the south wall of the first floor. Ventilation for the alpha cell is provided by the process off-gas system. There are one stage of HEPA filtration in the alpha cell, a second set of HEPA filters in Room 110, and a scrubber and additional HEPA filters at the 3039 stack. The ventilation for hoods and gloveboxes is outlined under the individual laboratories in Sect. 2.9.3.

2.9.2 History

Building 3047 was constructed about 1962 to conduct research and development and to produce radioisotopes. The Medical Isotopes Section of the Health and Safety Research Division uses four laboratories for nuclear medicine research.

2.9.3 General Status

Isotopes (CTD) activities are shut down, except for waste removal from the beta-gamma hot cells. Use of the nuclear medicine laboratories is ongoing. The base-line assumption for the shutdown plan is that the nuclear medicine activities will be terminated in Building 3047.

The general status of this facility is summarized in Table A.2.9.1.

Table A.2.9.1. Building 3047 - general status of facility

Facility/area	Comments
Building	
Type	Steel frame with concrete block walls and interior partitions.
Roof and exterior walls	Good condition.
Building containment and ventilation	Three building areas - the west (alpha) containment zone, the middle (beta-gamma) containment zone, and the east (office) area, which does not have containment. Separate blowers for each zone. Air locks provided at entrances to containment zones and between the middle and west zones. West (alpha) containment zone: (a) Includes Laboratories 110, 211, and 212. (b) Operates continuously in a "contained" condition of at least 0.30 in. w.g. negative pressure with respect to outside atmosphere. (c) Air is filtered and recirculated with limited room air exhaust. (d) Local system exhaust for room air to filter house on roof (single-stage HEPA filtration); discharge to short roof stack. Middle (beta-gamma) containment zone: (a) Includes cell operating area (Room 109), cell access area (Room 113), cell top access (Room 215), the decontamination room (Room 105), and three low-level laboratories (Rooms 208, 209, and 210). (b) Operates under a small negative pressure with respect to outside atmosphere; is automatically placed into "containment" if instrumentation detects radioactivity. (c) Local system exhaust to filter house on roof (single-stage HEPA filtration); discharges to short roof stack.

Table A.2.9.1 (continued)

Facility/area	Comments
Building (continued)	
Building contamination and ventilation (continued)	East (office) wing; not "contained": (a) Includes offices, changerooms, service areas, and one low-level laboratory (Room 207). (b) Not equipped for "containment"; no filters on building air exhaust; local ventilation system. Beta-gamma cells: Isotope Areas cell ventilation system; single-stage HEPA filtration in cells, exhaust to filter house (single-stage HEPA filtration; total of two stages of filtration) on south wall of first floor and 3039 stack. Alpha hot cell: process off-gas system; in-cell single HEPA filtration, second set of HEPA filters in Room 110, exhaust to scrubber and additional filters at 3039 stack.
Liquid waste systems	Cell floor drains and some hoods: drain to tank WC-10. Some hoods: process waste system.
Monitoring	Facility Radiation and Contamination Alarm System: locally alarming monitors, central alarm panel for building; monitored at the Waste Operations Control Center.
First floor	
Cells A and B (beta-gamma cells)	Cells are relatively "clean"; contamination levels below 3000 counts/min, average; radiation levels below 300 mR/h average; can open back doors of cells A and B to transfer large items. Ventilation: Isotopes Area cell ventilation system; single-stage HEPA filtration in cell; exhaust to filter house (single-stage HEPA filtration; total of two stages) and 3039 stack. Hot drain to tank WC-10.

Table A.2.9.1 (continued)

Facility/area	Comments
First floor (continued)	
Cells A and B (continued) (beta-gamma cells)	HEPA-filtered process off-gas service.
	Electrical services.
	Lighting good.
	1-ton air hoist.
Cell C (beta-gamma cell)	Contamination and radiation levels assumed to be high (^{152}Eu, ^{154}Eu, and ^{153}Gd).
	Ventilation: Isotopes Area cell ventilation system; single-stage HEPA filtration in cell; exhaust to filter house (single-stage HEPA filtration) and 3039 stack.
	Hot drain to tank WC-10.
	HEPA filtered process off-gas service.
	Electrical services, poor condition.
	Lighting poor.
	Cell window cloudy; oil in window leaking.
	Air hoist (1-ton) nonfunctional.
Cell D (beta-gamma cell)	Highly contaminated with ^{60}Co; contamination level below 30,000 counts/min radiation level range 1 to 900 R/h.
	Ventilation: Isotopes Area cell ventilation system; single-stage HEPA filtration in cell; exhaust to filter house (single-stage HEPA filtration) and 3039 stack.
	Hot drain to tank WC-10.

Table A.2.9.1 (continued)

Facility/area	Comments
First floor (continued)	
Cell D (continued) (beta-gamma cell)	HEPA filtered process off-gas service.
	Electrical services nonfunctional; through cell penetrations only.
	Lighting fixtures nonfunctional due to radiation damage; "drop cord" only.
	Cell window cloudy and leaking oil.
	Bottom of pit (cell ventilation sump) is located 14 ft below working area and contains sludge (900 R/h); current manipulators cannot reach into pit; need special tools and equipment.
	Air hoist (1-ton) nonfunctional.
Alpha hot cell (Room 110)	Contamination level above 1,000,000 dis/min; radiation level unknown.
	Ventilation: process off-gas system; in-cell single-stage HEPA filtration with bypass provision during maintenance; routed to second stage of HEPA filters in Room 110; exhaust to scrubber and additional HEPA filters at 3039 stack.
	Hot drain to tank WC-10.
	Glove ports in rear of cell.
	No lights in cell.
	Entry box attached with electrical services; electrical not leaktight; use care to keep entry box dry during cell wash-down. In addition, gaskets leak where entry box is attached to cell.

Table A.2.9.1 (continued)

Facility/area	Comments
First floor (continued)	
Alpha hot cell (Room 110) (continued)	Attached entry box can be vented through the alpha cell to the process off-gas system by opening the door (current practice) or to the cell ventilation system (valved closed).
^{153}Gd glove box (Enclosed hood; Room 113)	Used for ^{153}Gd powder pressing. Ventilation: Isotopes Area cell ventilation system; single-stage HEPA filtration on box; exhaust to filter house (single-stage HEPA filtration) and 3039 stack. Manipulators installed in lead-shielded box face. Lighting good.
One hood (Room 113)	Contamination level below 200 dis/min. Ventilation: local area ventilation system; exhaust to filter house on roof (single HEPA filtration) and short roof stack. Drain to process waste system. Electrical service. Lighting good.
Decontamination facility	Shower: (a) Contamination level below 200 dis/min. (b) Drain to tank WC-10. Enclosed sink: (a) Contamination level below 2800 dis/min. (b) Ventilation: isotope area cell ventilation system; exhaust to filter house (single-stage HEPA filtration) and 3039 stack. (c) Drain to tank WC-10.

Table A.2.9.1 (continued)

Facility/area	Comments
First floor (continued)	
Decontamination facility (continued)	Sample hood: (a) Contamination below 200 dis/min. (b) Ventilation: isotope area cell ventilation system; single HEPA filtration on hood; exhaust to filter house and 3039 stack. (c) Drain to tank WC-10. (d) Electrical service. (e) Lighting good.
Stored materials	Large quantities of ^{137}Cs, ^{152}Eu, and ^{154}Eu and small quantities of ^{153}Gd are stored in casks on the first floor. Small quantities of ^{14}C are stored in Room 107.
Second-floor laboratories	
Room 207	Laboratory used for nuclear medicine research. Four hoods, three with process waste system drains and one with hot drain to tank WC-10. Ventilation: east (office) wing local ventilation system; no filters on room air exhaust; status of hoods could not be confirmed.
Room 208	Laboratory used for nuclear medicine research. One enclosed hood with glove ports and hot drain to tank WC-10. One standard hood with process waste drain. Ventilation: middle (beta-gamma) containment zone; local ventilation system; room air and hoods exhaust to filter house with single-stage HEPA filtration and short roof stack.
Room 209	Laboratory used for nuclear medicine research.

Table A.2.9.1 (continued)

Facility/area	Comments
Second-floor laboratories (continued)	
Room 209 (continued)	One enclosed hood with glove ports and hot drain to tank WC-10. One standard hood with process waste drain. Ventilation: middle (beta-gamma) containment zone; local ventilation system; room air and hoods exhaust to filter house with single-stage HEPA filtration and short roof stack.
Room 210	Laboratory used for nuclear medicine research. Three hoods: one with process drain, one with hot drain to tank WC-10, one three-fourths enclosed with no services. Ventilation: middle (beta-gamma) containment zone; local ventilation system; room air and hoods exhaust to filter house with single-stage HEPA filtration and roof stack.
Room 211	Equipment contaminated with ^{14}C; small quantity of ^{14}C stored in room. May be residual alpha contamination. Four modified glove boxes; two with hot drains to tank WC-10. Ventilation: west (alpha) containment zone; local ventilation system; room air and glove boxes exhaust to filter house (single-stage HEPA filtration) and short roof stack.
Room 212	Laboratory under construction; worked stopped. Four new hoods and bench tops stored in room (but not installed). One old hood disconnected from ventilation system.

Table A.2.9.1 (continued)

Facility/area	Comments
Second-floor laboratories (continued)	
Room 212 (continued)	Ventilation: west (alpha) containment zone; local ventilation system; room air exhausts to filter house (single-stage HEPA filtration) and short roof stack.

A.2.10 Building 3517 - Fission Product Development Laboratory

A.2.10.1 Description

Building 3517, the Fission Product Development Laboratory (FPDL), was constructed (1) to recover long-lived fission products (e.g., ^{90}Sr, ^{137}Cs, ^{144}Ce) from aqueous wastes generated in reprocessing irradiated reactor fuel elements, (2) to purify feed materials from other DOE sites, and (3) to prepare radioactive sources. It is located in the central ORNL site, southwest of the Isotope Circle facilities.

Building 3517 is a three-story, braced steel framework structure with metal deck roofs and 12-in. unreinforced-concrete masonry walls on the lower two stories. The building is about 120 ft long (east-west), and the first two stories are about 60 ft wide (north-south) and 27 ft high. A third story, about 27 ft wide by 16 ft high, runs the length of the building east-west. This third story, referred to as the crane bay, supports a 20-ton bridge crane and services the top access plugs to hot Cells 1 through 15. The crane bay has aluminum siding.

A.2.10.1.1 Cells

The FPDL contains manipulator and process cells for producing radioactive sources and associated operating, service, office, and personnel access areas. The general layout of the first and second floors is presented in Fig. A.2.10.1, and a description of the cells is given in Table A.2.10.1. The main cell block, Cells 1 through 15, is a double cell block located on the first level. These hot cells are massive, steel-bar reinforced concrete boxes with wall thicknesses of 3 and 4 ft. The access to the cells consists of removable reinforced concrete blocks in the tops of the cells. Each individual cell within the hot-cell structure is isolated by 2-ft-thick concrete walls. Both the hot cells and the building are founded either on rock or on graded gravel close to rock. The four tank farm cells, 21 through 24, are located underground adjacent to the building. There is no Cell 19; it was removed before the electropolisher was installed. The process cells, storage cells, and high-level manipulator cells are shielded from the nearest accessible area by the equivalent of 4 ft of ordinary concrete. The low-level manipulator cells and service areas have less shielding (see Table A.2.10.1). Cells 1 through 15 have stainless steel linings to facilitate decontamination. Cells 16 and 17, the service cells, and the tank farm cells have Amercoat coatings.

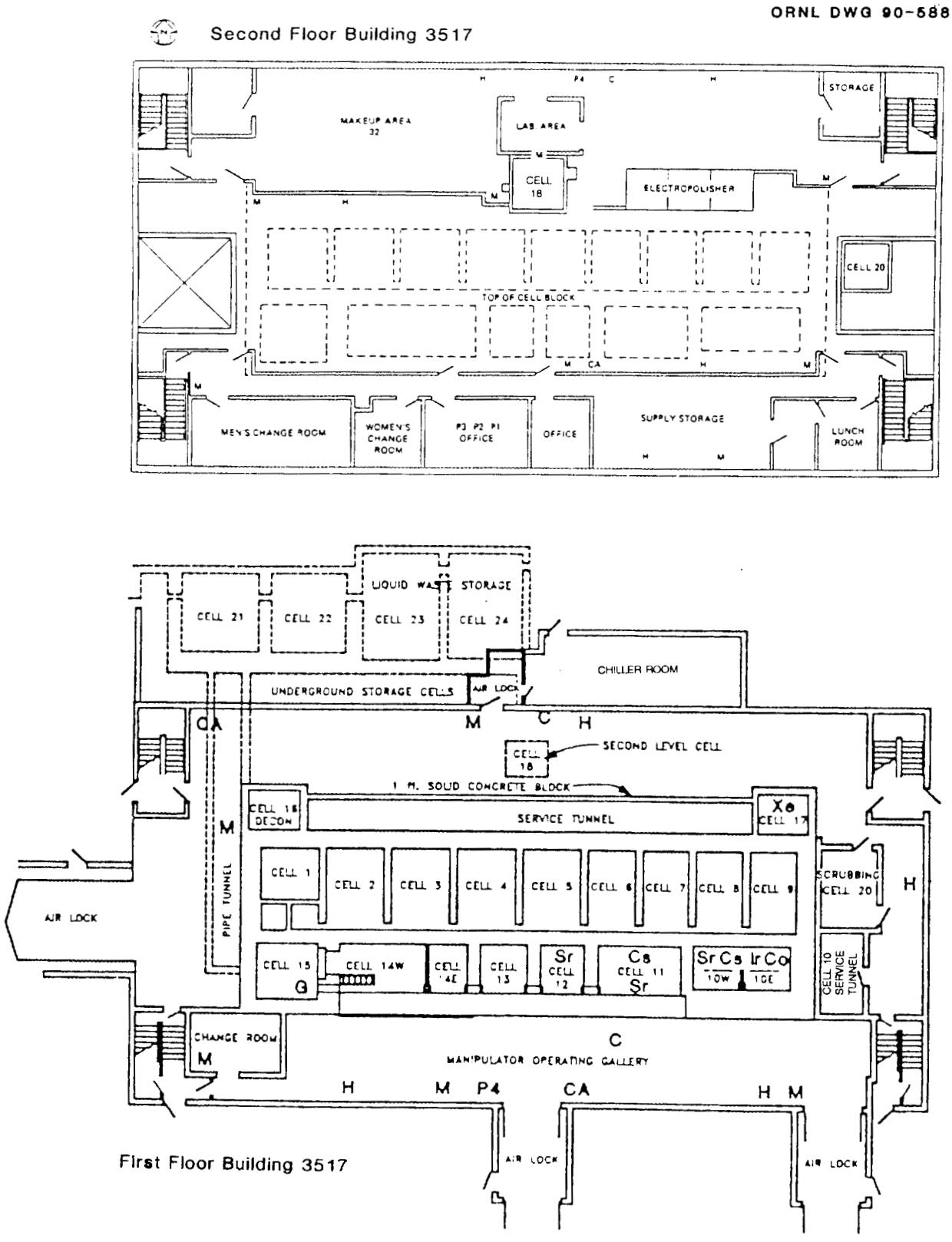

Fig. A.2.10.1. Floor plan of Building 3517 - Fission Product Development Laboratory.

Table A.2.10.1. Building 3517 - cell descriptions

Cell type	Cell No.	Dimensions (ft)			Minimum equivalent standard concrete shielding for walls (ft)[b]
		L[a]	W[a]	D[a]	
Process	1	9	12.5	12	3
Process	2	9	12.5	12	4.5
Process	3	9	12.5	12	4.5
Process	4	9	12.5	12	4.5
Process	5	9	12.5	12	4.5
Process	6	7.5	12.5	12	4.5
Process	7	7.5	12.5	12	4.5
Process	8	7.5	12.5	12	4.5
Process	9	7.5	12.5	12	4.5
Manipulator	10	7.5	7	14	4
Manipulator	11	13	8	11	4
Manipulator	12	7	8	11	4
Manipulator	13	7	8	11	4
Manipulator	14	6.5	8	12	4.5
Manipulator	15	10	4	16	2
Manipulator	16	8	6	14	1
Service	17	8	6	14	1
Manipulator	18	6	6.5	10.5	1.5
Service	20	6.5	7.5	12	1
Tank farm	21	25	12	14	4
Tank farm	22	25	12	14	4
Tank farm	23	30	12	14	2
Tank farm	24	30	12	14	2.5

[a]L = length; W = width; D = depth.

[b]Cells 1-9, 10W, and 11-13 have two layers of 2-ft-thick, reinforced-concrete blocks in the top of the cell; total thickness of top equivalent to 4 ft of concrete. Cell 10E has one layer of 4 ft thick blocks; Cell 14, one layer of 3-ft-thick blocks; and Cell 15, one layer of 2-ft-thick blocks.

Cells 1 through 9 in the north row of the main cell block were process cells with no viewing windows. Except for the north side of Cell 1, which has been used for decontamination, these cells have been inactive since 1975. Some equipment has been removed, but Cells 4 through 7 still contain a variety of tanks, piping, samplers, services, and instrumentation. A service tunnel runs along the north side of the cell bank.

Cells 10 through 15, the south row of the main cell block, are manipulator cells for handling high-level beta-gamma radioisotopes. They are equipped with viewing windows. Cells 10 and 14 are divided by steel plate into Cells 10E and 10W and Cells 14E and 14M. The manipulator cells have interconnecting shielded doors to enable materials to be passed from one cell to another. All except the large door between Cells 14 and 15 can be operated from the manipulator operating gallery. The large door is handled by the overhead crane. (However, the small door between Cells 14 and 15 is operated from the manipulator gallery.) Cask transfers or transfers of large items in or out of the cell block are handled via the cell top plugs using the overhead 20-ton crane. Cell 10W has a water-cooled well for storage of radioisotope capsules. The well is cooled with chilled water with backup from once-through process water. Radioisotope processing was conducted in the manipulator cells until April 1989, when the facility was placed on standby.

The building contains four additional cells:

1. Cell 16 - a manipulator cell used for decontaminating equipment,
2. Cell 17 - used for storage of fission product xenon,
3. Cell 18 - a manipulator cell (once an analytical cell but piping stripped out), and
4. Cell 20 - inactivated off-gas scrubber used when process Cells 1-9 were operational.

There is also a glove box, containing an electropolisher, which was installed for decontaminating equipment but is inactive because the ORNL central LLLW tank farm will no longer accept the phosphoric acid waste generated by the process.

There are four underground cells adjacent to the building. Cells 21 and 22 at one time housed storage tanks for fission product solutions. Cell 21 is empty; the tanks and piping have been removed. Cell 22 still contains a tank (inactive) and associated piping. Cells 23 and 24 contain collection tanks for liquid low-level wastes (see Sect. A.2.10.1.3).

A.2.10.1.2 Building Containment and Ventilation

The building ventilation is operated in a "containment" mode (at least -0.3 in. w.g. relative to the outside atmosphere), and the cells are maintained at a pressure of at least - 0.3 in. w.g. relative to the building pressure. The building is sealed and equipped with air-lock entries for personnel and a truck air lock. Air-lock doors are gasketed. Each operating area is enclosed and can be isolated from other areas of the building, except where piping and conduit come through floor and wall openings. Air flows from areas with lesser potential for contamination to areas of higher potential. Thus ventilation air flows from the operating areas to the inleakage openings into the cells and the service tunnel. There are roughing filters on the inlets in the service tunnel and Cell 15. Ventilation exhaust flows in reinforced concrete ducts underground to a filter pit outside the building containing a set of DOP testable HEPA filters, to an above-ground enclosure containing a second set of DOP testable filters, and then through to the new filter house containing a third stage of testable HEPA filters. The exhaust is then discharged to the ORNL Building 3039 stack cell ventilation system. All of the exhaust fans are in the 3039 system. Additionally, there are in-cell HEPA filters on the manipulator cells, but these cannot be DOP tested.

A.2.10.1.3 Liquid Waste Systems

Radioactive liquid waste drains from the cells and the electropolisher glove box are routed through a common header to stainless steel collection tanks, S-223, S-324, and S-523. These tanks are located in shielded underground storage vaults, Cells 23 and 24, located adjacent to the building. The wastes are jetted from the Building 3517 tanks to the ORNL LLW evaporator facility through a double-containment stainless steel line after it leaves the outside wall of the building. These tanks are in good condition and are contained in a concrete vault; they are vented to the process off-gas system.

The process waste system receives normal effluent from building sinks and floor drains in operating areas, steam condensate traps, and emergency cooling water from the storage well in Cell 10W and provides disposal of nonradioactive liquids (except sanitary waste). The waste is monitored before it is discharged to the ORNL central process waste system. If radioactivity is detected at levels above the limits for process waste, the material is diverted to the liquid low-level waste system.

A.2.10.2 History

The FPDL went on-line in 1958 to separate kilocurie amounts of fission products from Redox- and Purex-type waste streams. The fission product recovery program was successfully demonstrated during the first 2 years of operation, and kilocurie quantities were made available for worldwide distribution. Radioisotopes separated during the early days (late 1950s and early 1960s) included ^{144}Ce, ^{137}Cs, ^{90}Sr, ^{147}Pm, ^{106}Ru, and ^{99}Tc.

In the early 1960s, the advent of the Systems for Nuclear Auxiliary Power (SNAP) program increased the demand for ^{137}Cs gamma sources, as well as the requirements for ^{137}Cs, ^{90}Sr, and ^{144}Ce sources to megacuries. To meet this demand, fission product concentrates were shipped from the Hanford Atomic Products Operation to the FPDL for preparation of the sources for the SNAP program. Under this program, there were three product streams, as follows:

1. Semipure ^{137}Cs was purified, converted to cesium chloride powder, cold-pressed into pellets, and the pellets encapsulated.
2. Purified ^{90}Sr was converted to strontium titanate, compacted by vacuum hot-pressing into pellets, and the pellets encapsulated,
3. Cesium-144 was separated from a mixed rare-earth fraction by solvent extraction and converted to cerium oxide. The powder was cold-pressed and sintered and then sealed in a compatible container.

A total of 10 MCi of fission product material was processed at the FPDL during this operational period. At the conclusion of that program in 1975, the chemical processing cells were shut down and maintained in protective storage. Some initial decontamination was performed, but subsequent funding restrictions limited the scope of this effort. The initial program included the encapsulation and storage of approximately 500,000 Ci of ^{90}Sr titanate powder, and hot chemical flushes of process equipment and piping within all nine process cells. Some equipment has been removed, but Cells 4 through 7 still contain processing tanks, piping, and equipment and are considered to be very high radiation areas.

Radioisotope processing continued in the manipulator cells after 1975 at a reduced level of operation until April 1989 when the building was placed in standby. The principal operations during this period involved the production of ^{90}Sr and ^{137}Cs sources from separated product from Hanford.

Other special operations (various short-term periods) include: (1) processing of ^{60}Co, ^{192}Ir, and ^{235}U (2) ^{241}Am target preparation, (3) $^{152/154}Eu$ purification, and (4) separation of ^{99}Tc from crude concentrate received from the Paducah Gaseous Diffusion Plant.

A.2.10.3 General Status

No radioactive operations are being conducted in Building 3517 except the removal and disposal of some solid and liquid low-level wastes. Daily surveillance is carried out. A programmed maintenance is being conducted. The general status of the facility is summarized in Table A.2.10.2. The estimated quantity of contaminated materials (excluding inventory) requiring removal/disposal is given in Table A.2.10.3.

Table A.2.10.2. Building 3517 - general status of facility

Facility/area	Comments
Building	
Type	Steel frame; first two levels, masonry walls; crane bay, aluminum siding; hot cells, massive steel-bar reinforced concrete boxes.
Roof and exterior walls	Good condition; interior shows signs of neglect.
Building containment and ventilation	Building sealed; air locks with gasketed doors; building operates in a "contained" state to maintain at least 0.3 in. w.g. negative pressure relative to the outside atmosphere; air flows from operating areas into the cells; cells exhaust through underground ducts to filter pit outside the building with single-stage HEPA filtration (testable); second-stage HEPA filtration (testable) in above-ground filter house; third-stage HEPA filtration in new filter house; exhaust to 3039 stack.
Liquid waste systems	Cell floor drains and electropolisher glove-box drain: drain to stainless steel collection tanks (S-223, S-324, and S-523) located in shielded underground cells adjacent to building; wastes jetted to ORNL LLW evaporator facility as necessary.
	Building floor drains and sinks, steam condensate, and emergency cooling water for storage well: monitored at Manhole 209 before discharge to ORNL process waste system; if contaminated, divert to LLLW system.
Monitoring	Facility Radiation and Contamination Alarm System: locally alarming monitors; central alarm panel for building; monitored at Waste Operations Control Center.
Cask handling	20-ton bridge crane; truck air lock, forklift trucks.
Process Cells	Cells 1-4 used to process $^{90}Sr/^{90}Y$ (out of service); Cells 5-8 used to process ^{137}Cs (out of service).
Cells 1, 2, 3, 8, and 9	High radiation area; contamination area.

Table A.2.10.2 (continued)

Facility/area	Comments
Process Cells (continued)	
Cells 1, 2, 3, 8, and 9	Cells stripped of tanks and lines; Cells 1 and 9 contain equipment; Cells 2, 3, and 8 are empty.
Cells 4, 5, 6, and 7	Very high radiation area; contamination area.
	Cells contain processing tanks, piping, and equipment.
Manipulator Cells	
General comments for Cells 10-15	Very high radiation area; contamination area. Manipulator boots require frequent changes to maintain confinement.
Cell 10E	Used as a transfer cell; material normally entered into manipulator cells and manufactured sources removed via Cell 10E top hatch using the overhead crane.
	Past experience manipulators were contaminated with ^{90}Sr when removed for maintenance.
	Removable plug in manipulator room wall to pass small items in.
	Electrically operated hoist (500 lb)
	Empty.
Cell 10W	Used as storage cell.
	Inventory: ^{90}Sr, ~460,000 Ci; ^{137}Cs, ~330,000 Ci; ^{60}Co, ~33,000 Ci; ^{244}Cm, ~600 g.
	Past experience shows that manipulators were contaminated with ^{90}Sr when removed for maintenance.
	Water-cooled storage well for storage of radioisotope capsules; chilled-water cooling with backup from once-through process water.

Table A.2.10.2 (continued)

Facility/area	Comments
Manipulator Cells (continued)	
Cell 10W (continued)	Air-operated hoist (1000 lb).
	Capsule welding machine.
Cell 11E and 11W	Highly contaminated with ^{90}Sr and ^{137}Cs. Past experience shows that manipulators were contaminated with ^{90}Sr and ^{137}Cs when removed for maintenance.
	East and west windows are cloudy.
Cell 12	Highly contaminated with ^{90}Sr and ^{137}Cs. Past experience shows that manipulators were contaminated with ^{90}Sr and ^{137}Cs.
	Window in good condition; water lines cut off; no electrical service; hot drain may be plugged with glass and/or lead shot, and/or trash but could not be confirmed.
Cell 13	Highly contaminated with ^{137}Cs.
	Window leaking; hot drain may be plugged with glass and/or lead shot, and/or trash but could not be confirmed.
Cell 14E	Highly contaminated with ^{137}Cs; may find ^{137}Cs-glass.
	Window leaks and is cloudy; no electrical service.
	Left manipulator presently shielded with lead blankets around through tube opening. In 1979 manipulator repair, ^{137}Cs powder observed in pull bag and manipulator at high radiation readings. Manipulator will probably need to be pushed into cell and replaced.
Cell 14M and 14W	Used as waste transfer cell.

Table A.2.10.2 (continued)

Facility/area	Comments
Manipulator Cells (continued)	
Cell 15	Used to load solid wastes out of the manipulator cell block. Solid wastes normally removed via cell top hatch using the overhead crane.
	Lower contamination.
	Electric hoist for operating small door between Cells 14 and 15.
Cell 16	Decontamination cell (inactive).
	Can be entered by personnel. Limited transferable contamination; may find alpha contamination in cracks.
Cell 18	Former analytical cell; all piping removed; still a very high radiation area; contamination area.
	Empty.
Service Cells and Service Tunnels	
Cell 17	Used for storage.
	Inventory of stored xenon isotopes contaminated with trace levels of ^{85}Kr; stored in gas cylinders.
Cell 20	Off-gas scrubber (inactive) used when all cells were operational.
	Roughing filters (operational) for cell ventilation system located in pump compartment.
	Pump compartment: general area of 200 mR/h.
	Scrubber compartment: very high radiation area.

Table A.2.10.2 (continued)

Facility/area	Comments
Service Cells and Service Tunnels (continued)	
Service tunnel (for process cells)	High radiation area; airborne radioactivity area; contamination area (but can work in area with protective equipment); almost all ^{90}Sr; airborne radioactivity generated with any activity in area; "hot" spot (8000 mR/h at 1 in.; 2000 mR/h at 1 ft); levels behind lead brick shielding could be much higher. Installed pipe, valves, and equipment are deteriorated. Insulation (probably asbestos) is loose. Many lights nonfunctional.
Service tunnel for Cell 10	Gamma radiation (300 mR/h at 1 in.) from overhead tank.
Cell 21 (tank farm)	Empty. At one time, housed storage tanks (fission product solutions); tanks and piping removed.
Cell 22 (tank farm)	Inactive. Contains storage tank (S-122) and piping. At one time, used to store fission product solutions.
Operating and Service Areas	
Manipulator operating gallery	Fixed contamination on cell face area; lead installed to cover nontransferable contamination and provide additional shielding. Most of dose rate is radiation from manipulator through tubes and hot spots covered with lead.
First level north	Chiller room and air-lock: air lock floor contaminated (300 mR/h on contact) from past pipe leak; covered by lead sheet; chiller room floor contaminated; nontransferable.

Table A.2.10.2 (continued)

Facility/area	Comments
Operating and Service Areas (continued)	
High bay area	Radiation sources are penetrations and fixed contamination on floor; transferable contamination presently low but can change with any operation involving cell.
General	Spots of nontransferable contamination at various places.
Outside	
"Old" filter house and filter pit area	Filters inside house, 8 to 15 R/h. Top of house is high radiation area (gamma) due to less shielding on top than sides. Pit penetrations covered with lead shield.
Pump (solid waste)	Transfer pump for old product recovery from waste tank. No longer used; removal and disposal desirable. ^{90}Sr-contaminated; base reads 2 R/h at 1 in.; sits in rusted box; plywood overpack. Box shields most of radiation.

Table A.2.10.3. Building 3517 - estimated quantity of contaminated materials (excluding inventory) requiring removal/disposal

Location	Material/status	Estimated quantity (ft^3)
Cell 1	One vacuum hot press and other miscellaneous items	~100
Cell 2	Empty	-
Cell 3	Empty	-
Cell 4	Processing tanks and equipment	~430
Cell 5	Processing tanks and equipment	~430
Cell 6	Processing tanks and equipment	~430
Cell 7	Processing tanks and equipment	~430
Cell 8	Empty	-
Cell 9	Armor plate	~60
Cell 10E	Empty	-
Cell 10W	Canned waste, tools, and equipment	~7
Cell 11E	Empty	-
Cell 11W	Canned waste, tools, and lights	~7
Cell 12	Vacuum hot press, ejection press, equipment	~100
Cell 13	Press RAM, tools, and equipment	~7
Cell 14E	Contaminated lead and left manipulator	~30
Cell 14M	Contaminated lead (sheet and shot), vacuum pump	20
Cell 14W	Miscellaneous waste	~7
Cell 15	Drum rack	27
Cell 16	Ladder and bucket	7
Cell 17	Metal rack and wooden box	100
Cell 18	Empty	-
Crane bay area	Movable lift and miscellaneous items	160
Outside	Contaminated pump in rusted box with plywood overpack	100

A.2.11. Building 7025 - Tritium Target Fabrication

A.2.11.1. Description

Building 7025 is located about 1.4 miles northeast of the central ORNL site. It is within the perimeter fence of the ORNL 7000 area but isolated from other buildings. The structure is a prefabricated, metal-sided building with a total floor area of 590 ft^2 and a total free space volume of approximately 6000 ft^3.

The building was used for fabricating titanium tritide targets, for preparing metallurgical samples for helium embrittlement studies by diffusing tritium into the samples and allowing it to decay to helium, and for preparing thin films of ThO_2/UO_2 by vacuum evaporation. No aqueous wastes were generated by these processes.

The building layout is shown in Fig. A.2.11.1. The tritium equipment is housed in a 26-ft-long stainless steel hood which is exhausted by a 2000-ft^3/min fan. The tritium hood exhaust is not filtered because there are no solid radioactive species to be filtered. A high-vacuum evaporator system is also located in the building for the preparation of uranium and thorium targets. The vacuum evaporator is located in a HEPA-filtered hood for contamination control. Bench-top quantities were handled. The ThO_2/UO_2 evaporator and the titanium evaporator will be relocated before the building is vacated.

A forced-air exhaust system that runs continuously is located at the rear of the building. A forced-air input system for heating and cooling is located on the opposite side of the building. The two systems maintain a continuous, high-volume air flow through the building, preventing the buildup of any concentration of tritium gas in the occupied areas of the building in the event of any leakage or spill.

A.2.11.2 History

Building 7025, which is a TVA surplus building, was installed in the late 1960s to house a tritium target fabrication system. It was programmatically funded into the early 1980s by the Lawrence Livermore National Laboratory (LLNL) to produce titanium tritide accelerator targets for the Rotating Target Neutron Source facilities at LLNL. Since that time, tritium targets have been prepared for customers on a custom-order basis through the Isotope Distribution Office. The tritium system has also been used to prepare metallurgical samples for helium embrittlement studies related to fusion energy materials

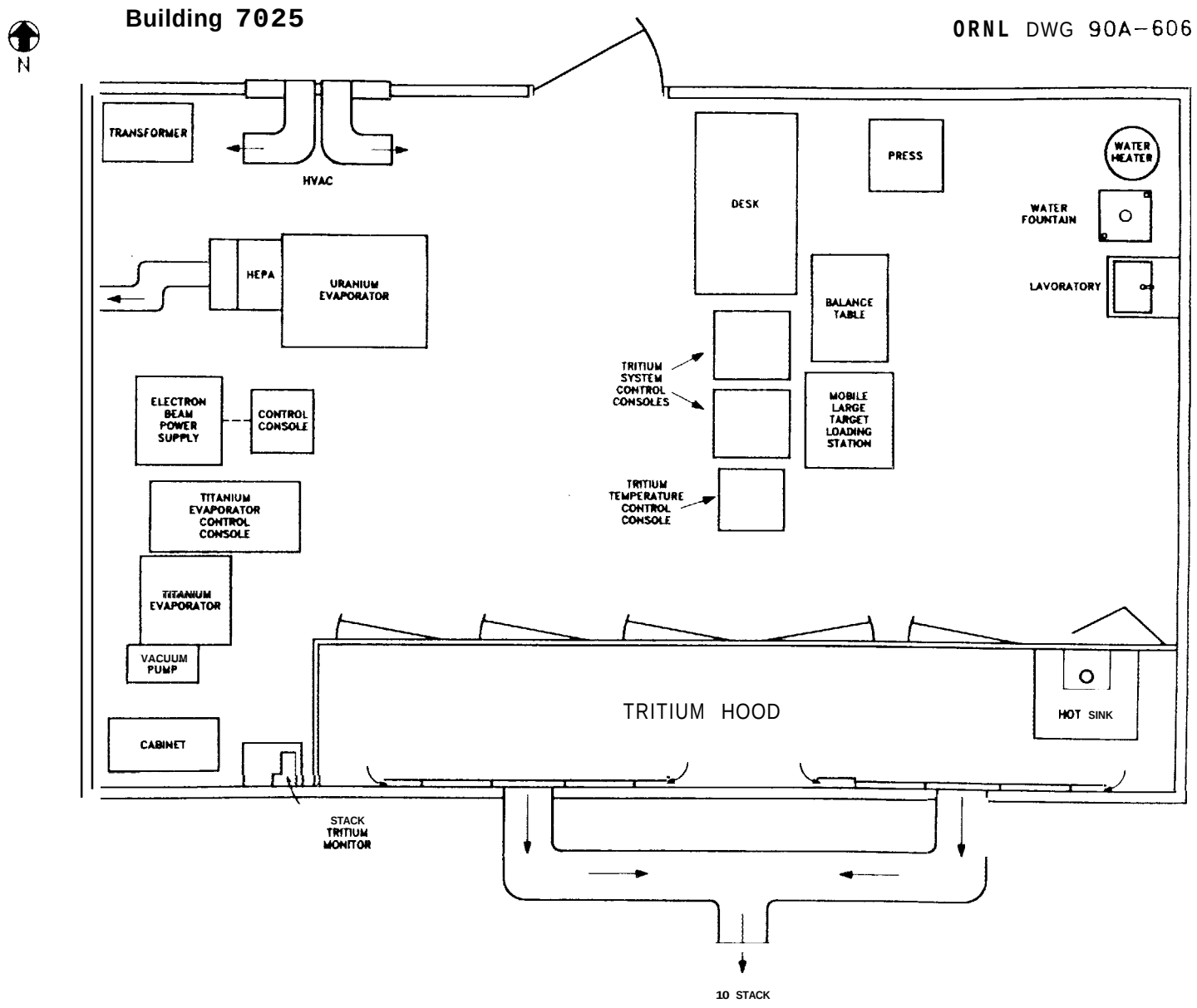

Fig. **A.2.11.1.** Floor plan of Building **7025** - Tritium Target Fabrication.

research. Samples were prepared, primarily for ORNL's Metals and Ceramics Division, by diffusing ^3H into metallurgical samples and allowing it to decay to helium. After the desired helium loading was achieved, the remaining ^3H was removed from the samples. This process, known as the tritium trick process, was last performed for two groups of researchers in Germany and California during the fall of 1989.

As a result of overcrowding in Building 3550, the ThO_2/UO_2 evaporator was moved to Building 7025 in the late 1970s and has been used to prepare hundreds of oxide thin films for a variety of customers around the world.

A.2.11.3 General Status

All tritium processing activities in this facility were halted in October 1989. The facility currently contains an inventory of tritium stored in traps and in a gas cylinder, both of which are located inside the tritium-contaminated hood. Plans are in progress to remove the tritium traps and cylinder from the hood and transfer them to Building 3033, which has a better system for unloading traps.

Operation of the ThO_2/UO_2 high-vacuum system was continued until January 1990, when it was halted because of funding problems. The plan is to relocate this system along with the titanium evaporation system to Building 9204-3.

The general status of Building 7025 is summarized in Table A.2.11.1.

Table A.2.11.1. Building 7025 - general status of facility

Facility/area	Comments
Building	
Type	Prefabricated metal.
Roof and exterior walls	Good condition.
Building ventilation	Forced-air exhaust system that runs continuously; local stack at rear of building; forced air input system for heating and cooling is located on opposite side of building and operates continuously as a backup for ventilation (at reduced flow) in the event the exhaust fan should fail. HEPA filter on alpha hood. No filter on tritium hood because no solid radioactive particulates that could be filtered were handled (i.e., only gases).
Liquid waste systems	No liquid wastes generated by process. Lavatory sink for hand washing and floor drain discharge to the environment. Little used. Sanitary facilities at the 7000 Area. Hot drain in east end of tritium hood. Drains to underground tank (inactive) outside. Not used.
Monitoring	Stack monitor for tritium operated by ORNL Environmental Monitoring Group. Smoke detectors monitored by ORNL fire department. No sprinkler system.
Hoods	
Tritium hood	Tritium inventory stored on uranium traps and in gas cylinder. After removal of inventory, the equipment and hood will be highly contaminated with tritium. There will be a residual release of tritium, as the tritium imbedded in the equipment slowly diffuses from the metal. If any uranium traps remain after the inventory is removed they should be regarded as pyrophoric.
Alpha hood	Contaminated with uranium and thorium; HEPA filter on hood.

Table A.2.11.1 (continued)

Facility/area	Comments
Stored materials	Tritium stored in uranium traps and gas cylinder; to be relocated to Building 3033.
	Uranium and thorium oxides stored in HEPA-filtered hood or in sealed metal containers in locked, security sealed cabinet.
	Thorium metal in plywood box stored in adjacent building.

A.2.12 Building 9204-3 - Actinide Area

A.2.12.1 Description

A small area, designated as the Actinide Area, within Building 9204-3 at the Y-12 site is included in the shutdown plan. Building 9204-3 contains 114,600 ft^2 in a basement, first and second floors, and a mezzanine. Most of the building is devoted to isotope production. The area of interest for the shutdown plan is located at the east end of the second floor of the building. It consists of (1) the calutron operations area where the electromagnetic separation of actinide isotopes was performed and (2) components wash and service area where the actinide isotopes were removed from the calutron receivers and the calutron receivers were prepared for use (Fig. A.2.12.1). The calutron area is approximately 2700 ft^2 and the wash area about 1800 ft^2. Most of Building 9204-3 is used for stable isotopes work and is planned to remain operational.

The actinide processing facility is in a contained area within the building. The components wash area operates at -0.15 in. w.g. and the other areas at -0.1 in. w.g. relative to the surrounding building areas. Glove boxes and enclosures have HEPA filters on the air inlet and prefilters and HEPA filters on the exhaust. Air is then routed through a common duct system to a second stage of HEPA filters. Exhaust fans are supplied with emergency power. Entries are provided with air locks. In addition to the two rooms on the shutdown list, the containment area also houses the actinide chemical processing area (a series of glove-box operations), changeroom, and locker room.

The actinide processing facilities have been on standby since 1980. The equipment and enclosures were cleaned and readily dispersable material removed when it was placed in standby. The equipment has been maintained and, in general, is considered to be in good condition.

A.2.12.2 History

The electromagnetic separation facilities were originally constructed to separate uranium isotopes and recover uranium enriched in ^{235}U. With the successful operation of the gaseous diffusion process, the calutrons were phased out as a production operation for enriching uranium. About 1962, the area of Building 9204-3 now known as the actinide processing area was modified to separate actinide isotopes for research purposes. This was

ORNL DWG 90-626

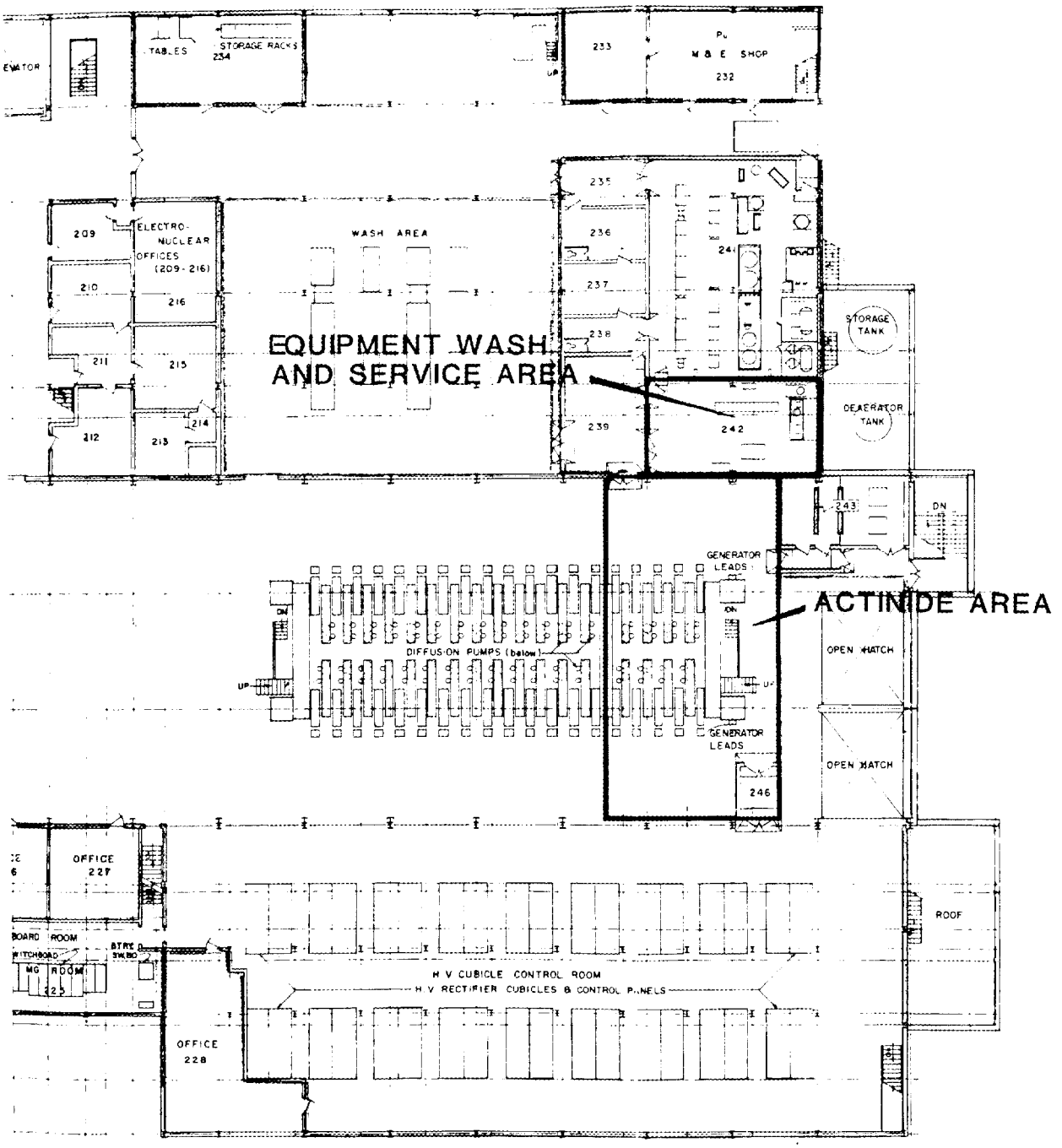

Fig. A.2.12.2. Floor plan of Actinide Area in Building 9204-3, second floor east, showing the calutron operations and the equipment wash and service areas.

new construction, except for the calutron itself. The calutron was modified so that only a portion of the machine was used to accommodate smaller samples. The actinide facility operated continuously until the mid-1970s, was in standby for a short time, was operated again in the late 1970s to isolate ^{242}Pu, and then placed in standby again in 1980. The facility has been maintained in such a condition that it could be restarted. Two glove boxes in the chemical processing area are still being used for weighing and packaging actinides. This part of the facility is planned to remain operational.

A.2.12.3 General Status

The actinide operations area and components wash and service area in Building 9204-3 were placed in standby in 1980. The general status of the facility is summarized in Table A.2.12.1.

Table A.2.12.1. Actinide area of Building 9204-3 - general status of facility

Facility/area	Comments
Facility	
General condition	Small area within a building; most of building is planned to remain operational.
	Good condition; contaminated, but relatively clean (i.e., relatively free of dispersable materials).
Facility containment and ventilation	Rooms are inside a contained area within a building; air locks.
	Components wash area maintained at -0.15 in. w.g. and other areas at -0.1 in. w.g. relative to the surrounding building areas.
	Enclosures and glove boxes have one stage of HEPA filtration in the enclosure/glove box; routed to filter house with second stage of HEPA filtration.
Liquid waste systems	No liquid waste is expected during shutdown.
	Actinide facility, when operated, was equipped with a dedicated liquid waste evaporator; condensate was monitored for radioactivity; if acceptable for discharge, it was routed to the waste tank that serves the building. No hot or process drains except to recovery system. No floor drains. Evaporator in standby.
	Building in general (current operations): liquid waste routed to waste tank; neutralized; transferred to Y-12 Plant tank farm.
Inventory	None.

APPENDIX B

Table B.1. Radioactive materials inventory for facilities

Program	Radioactive material	Quantity	Location	Form
Building 3026-C				
NE	964 tritium-containing tubes	17,000 Ci	Laboratory 7	Elemental, gas
NE	62 tritium-containing tubes	2,300 Ci (known leakers)	Laboratory 7	Elemental, gas
NE	12 tritium-containing tubes	4,500 Ci (known leakers)	Laboratory 7	Elemental, gas
NE	544 tritium-containing wands and panels	64,000 Ci	Laboratory 16	Elemental, gas
NE	678 tritium-containing tubes	24,000 Ci	Laboratory 16	Elemental, gas
NE	Kr-85E	2,817 Ci	Krypton Cell	Elemental, gas
NE	Kr-85	5,313 Ci	Krypton Cell	Elemental, gas
Building 3028				
ER	Pu-238 (#Pu-5)	4.53 g	Cell 2	Oxides, solid
ER	Pu-238 (#SNM-21454)	8.337 g	Cell 2	Oxides, solid
ER	Pu-238 (#409HP-2)	85.125 g	Cell 2	Oxides, solid
NE	Cm-244	.255 g	Cell 2	Oxides, solid
NE	Ca-41	Ampules, unknown amount	Cask (SRO-5) West Wing	
NE	Sr-90 (Source 72SR-19)	34.86 Ci	Sugarman cask	Oxides, solid
NE	Sr-90 (Source 72SR-20)	34.86 Ci	Sugarman cask	, solid
NE	Sr-90 (Source S.W.44318)	Unknown	Sugarman cask	, solid
NE	Cs-137 (81Cs-12)	831 Ci	Cask SWC-1	Chloride, solid
NE	Cs-137 (81Cs-11)	831 Ci	Cask SWC-1	Chloride, solid
NE	Cs-137 (81Cs-9)	831 Ci	Cask SWC-1	Chloride, solid
NE	Cs-137 (81Cs-33)	831 Ci	Cask SWC-1	Chloride, solid
NE	Cs-137 (81Cs-8)	831 Ci	Cask SWC-1	Chloride, solid
NE	Cs-137 (81Cs-10)	831 Ci	Cask SWC-1	Chloride, solid
NE	Cs-137 (80Cs-103)	Unknown	Cask SWC-1	Chloride, solid
NE	Cs-137 (81Cs-101)	Unknown	Cask SWC-1	Chloride, solid

Table B.1 (continued)

Program	Radioactive material	Quantity	Location	Form
Building 3029				
DP	Sr-90 source	1,093,000 Ci	Carrier, east of Bldg. 3029	Fluoride, solid
NE	Cs-137 sources	51-S.S. capsules Amount unknown	Carrier PWC 8M1	Chloride, solid West Wing
NE	Cs-137 sources	42-S.S. capsules	Cell 2	Chloride, solid
NE	Sr-90 source	1-S.S. capsules	Cell 2	, solid
NE	Tc-99 (salt)	4773.2 g	File cabinet, East Wing	Pertechnetate, solid
NE	Tc-99 (metal)	581.97 g	File cabinet, East Wing	Metal, solid
NE	Ir-192 (pellets)	Unknown Amounts	two-casks, West Wing	Metal, solid
Building 3030				
NE	Ir-192	40 Ci	Hot cell	Metal, solid
NE	Pd-103	Unknown (1 bottle, liquid)	Hot cell	Oxides, solid
NE	Ni-63	10 Ci	Bench	Oxides, solid
NE	Gd-153	6 Ci	Bench	Oxides, solid
NE	Pd-103	1 Ci	Bench	Oxides, solid
NE	Po-209	150 micro Ci	Cabinet	Oxides, solid
NE	Cs-137	Unknown solid	(Class A pkg.), floor	Chloride, solid
NE	Te	Unknown source to be irradiated	Floor	Oxides, solid
Building 3031				
	No radioactive material		Hot cell	

Table B.1 (continued)

Program	Radioactive material	Quantity	Location	Form
Building 3118				
	Am-241	44 g	Containers	Oxides, solid
	Cl-36	Unknown (see 3038 AHF)	Containers	Chloride, solid
	Sr-90	Unknown	Containers	Carbonate, solid
	C-14	Unknown	Containers	Carbonate, solid
	Sr-90	Unknown	Containers	Oxides, solid
	Savannah River nuclides	Unknown	Containers	Oxides, solid
	Eu, Gd radioisotopes	Unknown	Containers	Oxides, solid
	Gd-153	Unknown	Two drums	Oxides, solid
Building 3033				
NE	Tritium	30,000 Ci	Tritium Facility	Elemental, gas
Building 3033A				
NE	U-233	36.332 g		Oxides, solid
NE	Depleted uranium	2807.854 g		Oxides, solid
NE	U-234	0.180 g		Oxides, solid
NE	U-235	170.108 g		Oxides, solid
NE	Pu-242	7.514 g		Oxides, solid
NE	Cf-252	0.022 μg		Oxides, solid
NE	Pu-240	26.888 g		Oxides, solid
NE	Pu-239	78.459 g		Oxides, solid
NE	Pu-241	6.498 g		Oxides, solid
NE	Normal U	1147.497 g		Oxides, solid
NE	Np-237	52.902 g		Oxides, solid
NE	Th-232	18761.616 g		Oxides, solid
NE	Tritium	0.0004 g		, solid
Building 3036				
No significant radioactive materials.				

Table B.1 (continued)

Program	Radioactive material	Quantity	Location	Form
Building 3038-AHF				
	Am-241	12.127 g	Annex	Oxides, solid
ER	Np-237	8.164 g	Annex	Oxides, solid
ER	Pu-238	4.314 g	Annex	Oxides, solid
ER	Cm-248	~3 mg		Oxides, solid
	Ac-227	5 Ci	AHF	Oxides, solid
	Pu-238	~150 g	AHF	Oxides, solid
	Cl-36	~10.5 g	AHF and 3118	, solid
Building 3038-E				
ER	Cm-248	~15 mg		Chloride, liquid
ER	Pm-147	<1 Ci		, solid
ER	U-235	46 g		Oxides, solid
ER	Pu-242	2 g		Oxides, solid
ER	Am-241	58 g		Oxides, solid
	Cm-244	1.3 g		Oxides, solid
ER	Cf-252	7 μg		1 μg solution, 6 μg solid
ER	Pu-239, -240, -241	93 g		Oxides, solid
ER	Np-237	10.6 g		Oxides, solid
ER	Pu-238	1.2 g		Oxides, solid
ER	Th-232	2719 g		Oxides, solid
Building 3038-M				
NE	I-129	80,665 μCi	Barricade	Liquid
NE	Ba-133	0.3 Ci	Barricade	Liquid
NE	Bi-207	0.001 Ci	Barricade	Liquid
NE	Ce-144	0.00003 Ci	Barricade	Liquid
NE	Cs-137	25.3 Ci	Barricade	Liquid

Table B.1 (continued)

Program	Radioactive material	Quantity	Location	Form
Building 3038-M (continued)				
NE	Co-60	0.5 Ci	Barricade	Liquid
NE	Eu-152	0.056 Ci	Barricade	Liquid
NE	Eu-154	0.057 Ci	Barricade	Liquid
NE	Mn-54	0.112 Ci	Barricade	Liquid
NE	Ni-63	97.524 Ci	Barricade	Liquid
NE	Ru-106	1.566 Ci	Barricade	Liquid
NE	Se-75	0.069 Ci	Barricade	Liquid
NE	Sr-85	0.202 μCi	Barricade	Liquid
NE	Sr-90	180.597 Ci	Barricade	Liquid
NE	Tc-99	0.849 Ci	Barricade	Liquid
NE	Cl-36	0.604 Ci	Barricade	Liquid
Building 3047				
NE	C-14	5.4 Ci	Room 211	Carbonate, solid
NE	Gd-153	1,060 Ci	Cask (14 UC-2)	Oxides, solid
NE	Eu-154	33,150 Ci	Cask (14 UC-2)	Oxides, solid
NE	Eu-152	25,830 Ci	Cask (14 UC-2)	Oxides, solid
NE	Cs-137	40,000 Ci	Cask (6M-1)	Chloride, solid
NE	C-14	40 Ci	Cell D	Carbonate, solid
NE	Gd-153	9.831 Ci	Pellet Box	Oxides, solid
NE	Gd-153	16.4118 Ci	Storage Vault	Carbonate, solid
NE	C-14	6.26 mCi	Room 107	Carbonate, solid
NE	C-14	2.96 g	Room 107	
Building 3517				
	Co-60 (Source # 5280')	16635 Ci	Cell 10W Storage Well	Metal, solid
	Co-60 (Source # 5281')	16635 Ci	Cell 10W Storage Well	Metal, solid
Teledyne	Sr-90 (Source # S-112)	89283.7 Ci	Cell 10W Storage Well	Fluoride, solid
Teledyne	Sr-90 (Source # S-471)	95815.7 Ci	Cell 10W Storage Well	Fluoride, solid
Teledyne	Sr-90 (Source # S-094)	91372.7 Ci	Cell 10W Storage Well	Fluoride, solid
	Sr-90 (Source # S-083)	98713.5 Ci	Cell 10W Storage Well	Fluoride, solid

Table B.1 (continued)

Program	Radioactive material	Quantity	Location	Form
Building 3517 (continued)				
	Cs-137 (Source 79Cs P-1,-2,-3,-4)		Cell 14E	Chloride, solid
	Cs-137 (Source 79Cs P-7)		Cell 14E	Chloride, solid
	Cs-137 (Source 79Cs P-8)		Cell 14E	Chloride, solid
	Cs-137 (Source 79Cs P-9)		Cell 14E	Chloride, solid
	Cs-137 (Source 79Cs P-10)		Cell 14E	Chloride, solid
	Cs-137 (Source 79Cs P-11)	13,353.9 Ci		Cell 14EChloride,
solid				
	Cs-137 (Source 79Cs P-12)		Cell 14E	Chloride, solid
	Cs-137 (Source 79Cs P)		Cell 14E	Chloride, solid
	Cs-137 (Source 79Cs P)		Cell 14E	Chloride, solid
	Cs-137 (Source 79Cs P)		Cell 14E	Chloride, solid
	Cs-137 (Source 79Cs P)		Cell 14E	Chloride, solid
	Cs-137 (Source PDR-1,2,3,4)		Cell 14E	Chloride, solid
NE	Kr-85-Xenon (cylinder 12)	<1 Ci	Cell 17	Elemental, gas
NE	Kr-85-Xenon (cylinder 5B)	<1 Ci	Cell 17	Elemental, gas
NE	Kr-85-Xenon (cylinder 13)	<1 Ci	Cell 17	Elemental, gas
NE	Kr-85-Xenon (cylinder 3)	<1 Ci	Cell 17	Elemental, gas
NE	Kr-85-Xenon (cylinder 6)	<1 Ci	Cell 17	Elemental, gas
NE	Kr-85-Xenon (cylinder 7B)	<1 Ci	Cell 17	Elemental, gas
NE	Kr-85-Xenon (cylinder 11)	<1 Ci	Cell 17	Elemental, gas
NE	Kr-85-Xenon (cylinder 5)	<1 Ci	Cell 17	Elemental, gas
NE	Kr-85-Xenon (cylinder 3B)	<1 Ci	Cell 17	Elemental, gas
NE	Kr-85-Xenon (cylinder 4B)	<1 Ci	Cell 17	Elemental, gas
NE	Kr-85-Xenon (cylinder 8)	<1 Ci	Cell 17	Elemental, gas
NE	Kr-85-Xenon (cylinder 1B)	<1 Ci	Cell 17	Elemental, gas
NE	Kr-85-Xenon (cylinder 4)	<1 Ci	Cell 17	Elemental, gas
	Cm-244 (Source 72 CM-1)	119.872 g	Cell 10W Storage Well	Oxides, solid
	Cm-244 (Source 72 CM-2)	10.887 g	Cell 10W Storage Well	Oxides, solid
	Cm-244 (Source 72 CM-5)	5.472 g	Cell 10W Storage Well	Oxides, solid
	Cm-244 (Source 72 CM-6)	3.836 g	Cell 10W Storage Well	Oxides, solid
	Cm-244 (Source 77 CM-5)	47.509 g	Cell 10W Storage Well	Oxides, solid

Table B.1 (continued)

Program	Radioactive material	Quantity	Location	Form
Building 3517 (continued)				
NE	Sr-90 (Source 86 Floor Sweepings)	7888.3 Ci	Cell 10W Storage Well	Fluoride, solid
NE	Sr-90 (Source 86 Sr. Floor Sweepings)	2921.6 Ci	Cell 10W Storage Well	Fluoride, solid
NE	Sr-90 (Source 82 Sr. Floor Sweepings)	5551.0 Ci	Cell 10W Storage Well	Fluoride, solid
NE	Sr-90 (Source 82 Sr. Floor Sweepings-2)	2337.2 Ci	Cell 10W Storage Well	Fluoride, solid
NE	Sr-90 (Source 81 Sr. F. WST)	2434.6 Ci	Cell 10W Storage Well	Fluoride, solid
NE	Sr-90 (Source 81 Sr. F. WST-2)	1558.3 Ci	Cell 10W Storage Well	Fluoride, solid
DP	Sr-90 (Source SrF Standards)	11881.1 Ci	Cell 10W Storage	Fluoride, solid
DP	Sr-90 (Source 88 SrF-1)	17419.1 Ci	Cell 10W Storage	Fluoride, solid
DP	Sr-90 (Source 88 SrF-2)	17439.1 Ci	Cell 10W Storage	Fluoride, solid
DP	Sr-90 (Source 88 SrF-3)	16798.0 Ci	Cell 10W Storage	Fluoride, solid
NE	Cs-137 (Source C-1542-1)	12,461 Ci	Cell 10W Storage	Chloride, solid
NE	Cs-137 (Source C-1542-2)	12,461 Ci	Cell 10W Storage	Chloride, solid
NE	Cs-137 (Source C-1542-3)	12,461 Ci	Cell 10W Storage	Chloride, solid
NE	Cs-137 (Source C-1099-1)	14,004.6 Ci	Cell 10W Storage	Chloride, solid
NE	Cs-137 (Source C-1099-2)	14,004.6 Ci	Cell 10W Storage	Chloride, solid
NE	Cs-137 (Source C-1099-3)	13,862.6 Ci	Cell 10W Storage	Chloride, solid
	Cs-137 (Source C-1134)	40,542.8 Ci	Cell 10W Storage Well	Chloride, solid
	Cs-137 (Source C-548)	48,802.7 Ci	Cell 10W Storage Well	Chloride, solid
	Cs-137 (Source C-549)	45,072.6 Ci	Cell 10W Storage Well	Chloride, solid
	Cs-137 (Source C-551)	48,405.9 Ci	Cell 10W Storage Well	Chloride, solid
	Cs-137 (Source C-703)	44,660.9 Ci	Cell 10W Storage Well	Chloride, solid
NE	Cs-137 (Source Cs Floor Sweepings-A)	1638.9 Ci	Cell 10W Storage	Chloride, solid
NE	Cs-137 (Source Cs Floor Sweepings-B)	9257 Ci	Cell 10W Storage	Chloride, solid
NE	Cs-137 (Source Cs Floor Sweepings-C)	9691 Ci	Cell 10W Storage	Chloride, solid
NE	Cs-137 (Source Cs Floor Sweepings-D)	2435 Ci	Cell 10W Storage	Chloride, solid

Table B.1 (continued)

Program	Radioactive material	Quantity	Location	Form
Building 3517 (continued)				
	Cm-244 (Source 80 CM-1)	19.808 g	Cell 10W Storage Well	Oxides, solid
	Cm-244 (Source 80 CM-2)	42.840 g	Cell 10W Storage Well	Oxides, solid
	Cm-244 (Source 80 CM-3)	13.938 g	Cell 10W Storage Well	Oxides, solid
	Cm-244 (Source CMC-74)	30.133 g	Cell 10W Storage Well	Oxides, solid
	Cm-244 (Source CMRCP-74)	28.583 g	Cell 10W Storage Well	Oxides, solid
	Cm-244 (Source PCM-33)	18.180 g	Cell 10W Storage Well	Oxides, solid
	Cm-244 (Source PCM-34)	11.303 g	Cell 10W Storage Well	Oxides, solid
	Cm-244 (Source SRO-00)	55.054 g	Cell 10W Storage Well	Oxides, solid
	Cm-244 (Source SRO-17)	28.699 g	Cell 10W Storage Well	Oxides, solid
	Cm-244 (Source SRO-21)	72.566 g	Cell 10W Storage Well	Oxides, solid
	Cm-244 (Source SRO-23)	83.463 g	Cell 10W Storage Well	Oxides, solid
	Cm-244 (Source SRO-31B)	42.783 g	Cell 10W Storage Well	Oxides, solid
	Cs-137 (Source # 4-88Cs-1)	8643.5 Ci	'U' Carrier Building 3019	Chloride, solid
	Cs-137 (Source # 4-88Cs-2)	7628.5 Ci	'U' Carrier Building 3019	Chloride, solid
	Cs-137 (Source # 4-88Cs-3)	9386.5 Ci	'U' Carrier Building 3019	Chloride, solid
	Cs-137 (Source # 4-88Cs-4)	7348.5 Ci	'U' Carrier Building 3019	Chloride, solid
	Cs-137 (Source # 4-88Cs-5)	6721.1 Ci	'U' Carrier Building 3019	Chloride, solid
	Cs-137 (Source # 4-88Cs-6)	1455.8 Ci	'U' Carrier Building 3019	Chloride, solid
	Cs-137 (Source Mixed-1)	2693.9 Ci	'U' Carrier Building 3019	Chloride, solid
	Cs-137 (Source 4-88Cs-Rec-1)	4415.7 Ci	'U' Carrier Building 3019	Chloride, solid
NE	Cs-137 (Source 88F1 Sweepings)	1570.6 Ci	'U' Carrier Building 3019	Chloride, solid
	Cs-137 (Source Puerto Rican)	5262.7 Ci	Pierce Carrier Building 3019	
	Sr-90 (Source # Sr-25)	Unknown	Double Envelope Carrier-Bldg. 3019	, solid
	Sr-90 (Source # Sr-26)	Unknown	Double Envelope Carrier-Bldg. 3019	, solid
	Sr-90 (Source # Sr-27)	Unknown	Double Envelope Carrier-Bldg. 3019	, solid
	Sr-90 (Source # Sr-28)	Unknown	Double Envelope Carrier-Bldg. 3019	, solid
	Sr-90 (Source # Sr-29)	Unknown	Double Envelope Carrier-Bldg. 3019	, solid
	Sr-90 (Source # Sr-30)	Unknown	Double Envelope Carrier-Bldg. 3019	, solid
	Sr-90 (Source 74 SR-RE)		Double Envelope Carrier-Bldg. 3019	, solid

Table B.1 (continued)

Program	Radioactive material	Quantity	Location	Form
Building 3550				
	Depleted U	4276 g		Oxides, solid
ER	U-235	248 g		Oxides, solid
NE	U-235	10 g		Oxides, solid
	Th-232	66,703 g		Oxides, solid
	Lithium	1962 g		, solid
Building 7025				
ER	Depleted uranium	2016 g		Oxides, solid
ER	U-235	175 g		Oxides, solid
ER	Th-232	238076 g		Oxides, solid
ER	Tritium	120,000 Ci		Elemental, gas
Building 9204-3				
No transferable radioactive materials.				

6/05/90

APPENDIX C

Policy for Decontamination and Decommissioning Within the Office of Nuclear Energy

1. PURPOSE

The purpose of this policy is to define 1) the responsibilities for decontamination and decommissioning (D&D) of any Office of Nuclear Energy (NE) contaminated facilities and sites, and 2) the requirements for acceptance of such facilities and sites into the Office of Remedial Action and Waste Technology (NE-20).

2. SCOPE

This NE policy is applicable to any DOE-owned, contractor-owned, or privately-owned facilities and sites that have been wholly or partly contaminated with radioactive or hazardous materials as part of NE specific program activities.

This policy provides for NE-20 funding and/or managing of NE-contaminated facilities from all NE programs except Naval Reactors (NE-60) programs and Uranium Enrichment (NE-30) programs. NE-60 facilities and sites are excluded from this policy because they are funded under defense appropriations, have a currently established D&D policy, and involve national security. NE-30 facilities and sites are excluded at this time because of pending agreements under negotiation with the Office of Defense Programs concerning D&D responsibilities for the uranium enrichment plants, and because the funding for NE-30 is separately legislated and involves offsetting revenue generated by the commercial sale of enrichment services.

3. BACKGROUND

In the past, general policy regarding this subject was covered by DOE Order 5820.2. That policy resulted in the "last user" being responsible for the D&D of contaminated facilities and it provided little guidance for contaminated sites that are not facility-specific. Recent practice has evolved towards more fairly proportioning D&D responsibility based on previous program use, especially when the "last user" made a nominal contribution to the contamination or inadvertently "inherited" the problem.

In addition, since the issuance of DOE Order 5820.2 in 1984, the magnitude and complexities surrounding facility D&D have grown significantly. Various policies, interpretations, and practices have evolved within each secretarial office and further within each program office. Programs performing research and development (R&D) that caused contamination have been terminated without providing

funds necessary to perform final D&D of the facilities or site. This is counterproductive to the Secretary of Energy's environmental initiative that has elevated the scope and priority of the D&D environmental efforts. As a result there is a need to establish a new, definitive DOE policy on D&D and specifically, an NE policy on D&D that is consistent with the Secretary's initiative. A DOE policy on D&D is being pursued by the development of a new version of DOE Order 5480.2.

An important element of D&D policy is the benefit of centralized management of D&D responsibilities. Centralized management within NE focuses D&D funding in one program area such that the R&D programs need not establish D&D funding from within their currently available funding profiles. In addition, it avoids having each NE program element establish an independent and potentially redundant remedial action program. Centralized management increases outside visibility of NE D&D actions necessary to satisfy the intent of Congress and the Secretary to aggressively respond to environmental concerns. Also, it is important to apply uniform D&D standards and practices within NE, and this is most effectively accomplished by centralized D&D program management. Utilizing established experience and focusing it in a single NE office optimizes available resources and staff within NE. Having a single D&D office within NE permits other groups outside NE to have an easily identifiable point of contact and assure better coordination in interagency negotiations.

NE POLICY

Final facility D&D and site remedial actions from nuclear development sponsored by current or predecessor NE programs, subject to the exceptions noted in Section 2, will be centralized within the Office of Remedial Action and Waste Technology (NE-20). This policy covers DOE, non-DOE, and multiprogram-use facilities and sites. Facilities and sites will be considered for acceptance by NE-20 when they are made surplus, orphaned, or abandoned. Surplus ancillary facilities or sites may be considered if they are clearly no longer part of or needed by the operating program. It is not the intent of this policy that NE-20 assume caretaker or restoration responsibilities similar to those of an operator for facilities to be used in continued or future radioactive operations. Those responsibilities remain with the operator or identified future user.

A tabular form of the D&D policy for NE-contaminated facilities and sites is presented in Table 1. It identifies the policy for NE-20 funding and/or management of the D&D for facilities or sites that are NE-contaminated at any level of responsibility.

Table 1
POLICY FOR FUNDING AND MANAGING
D&D OF NE-CONTAMINATED FACILITIES

Extent of NE Responsibility for Facility/Site (1)	Transition Period Funding and Management (2)	Final D&D Management and Funding
I. NE-contamination of facility/site, with identifiable current or successor NE program office		
A. 100% NE-contaminated	NE program office funds and manages turnover activities, and funds any S&M required; NE-20 manages S&M after turnover	NE-20 manages and funds
B. Greater than 50% NE-contaminated with other users	NE program office funds and manages turnover activities, and funds any S&M required; NE-20 manages S&M after turnover	NE-20 manages and funds; NE-20 negotiates cost-sharing with other users
C. Less than 50% NE-contaminated, and		
1. NE is site landlord, and no user is responsible for more than 50% contamination, or	NE program office funds and manages turnover activities, and funds any S&M required; NE-20 manages S&M after turnover; cost-charing is negotiated with other users	NE-20 manages and funds; NE-20 negotiates cost-sharing with other users
2. Greater than 50% contamination by a non-NE user, or	NE-20 negotiates cost-sharing and timing with primary user	Primary user manages; NE-20 negotiates cost-sharing with primary user and funds NE share
3. NE is not the site landlord and no user is responsible for more than 50% contamination.	NE-20 negotiates cost-sharing and timing with landlord	Landlord manages; NE-20 negotiates cost-sharing with landlord and funds NE share
II. NE-contamination, but no responsible current or successor NE program office can be identified	NE-20 takes immediate management and funding responsibility	NE-20 manages and funds

Notes: (1) Percent responsibility for contamination will be determined using the most appropriate method, to be established on a case-by-case basis.
(2) Transition period activities include placing the facility or site in an acceptable condition for turnover. S&M may also be required before or after turnover.
(3) "Landlord" is the operator of the facility or site.

Referring to Table 1, in cases where a facility or site is NE-contaminated and a responsible NE program office (current or successor) can be identified, NE-20 will take responsibility for funding and management of D&D if 1) the facility or site is from 50% to 100% NE-contaminated, or 2) NE is the facility or site landlord. If the facility or site has been contaminated more than 50% by another single "user", NE-20 will negotiate and provide for funding the NE share of D&D costs, but the management of D&D will be the responsibility of the non-NE primary user. Similarly, if the facility or site is less than 50% NE-contaminated and NE is not the landlord, NE-20 will negotiate and provide for funding the NE share of D&D costs, but the management of the D&D will be the responsibility of the landlord.

In cases where a facility or site was NE-contaminated but "orphaned" (i.e., no reasonably responsible NE program office or landlord can be identified), NE-20 will assume responsibility for D&D of the facility or site.

With respect to the source of funds for D&D of facilities or sites where NE is not the only "user" or contributor to the contamination, NE-20 will assume NE responsibility, but will negotiate cost-sharing for D&D activities with other responsible contributors to the contamination. In cases where the other contributors to the contamination are organizations outside of NE or extenuating circumstances or sensitivities are involved, the Assistant Secretary for Nuclear Energy (ASNE) will decide the policy for cost-recovery on a case-by-case basis. This may be the case for some Office of Space and Defense Programs situations.

When a facility or site is accepted by NE-20 for D&D, there will be a "transition period" of up to 3 years to allow for time required to appropriate funds for the D&D and to provide for the orderly integration of the project into the NE-20 program. During this transition period, it will be necessary to place the facility or site into an acceptable condition for "turnover" to NE-20. This is discussed in the following sections and includes the removal of stored fuel and stored hazardous material from the facility or site. Any immediate actions needed to protect public health and safety during the transition period will remain the responsibility of the NE program office. The transition period may extend beyond 3 years, if necessary to complete activities required for turnover. In addition, surveillance and maintenance (S&M) of the facility or site will be needed during the transition period to maintain the facility or site in an acceptable condition. Activities required for turnover to NE-20 during the transition period will be funded and managed by the NE program office. On a case-by-case basis, it may be in the Department of Energy's best interest to defer some immediate activities required for turnover and continue S&M. In

this situation, alternative turnover requirements and schedules will be negotiated between NE-20 and the program office. This may permit turnover prior to fuel removal, deferred turnover, or NE-20 funding of turnover activities if funds are available and it is in the best interest of the Department. NE-20 will manage S&M during the transition period, as soon as the facility or site is in an acceptable condition for turnover. Once the facility or site meets the physical condition requirements for turnover, NE-20 will manage and fund the D&D, as well as any additional S&M that may be required before D&D is initiated. Final D&D activities will be scheduled on the basis of established priorities, including health and safety requirements. The responsibilities of the program office and NE-20 during the transition period, as described above, are illustrated in Figure 1.

5. ACCEPTANCE PROCESS

The process for NE-20 acceptance of a facility or site for D&D is presented in Figure 2. A discussion of each of the steps in the process is provided in the following.

The process usually starts with the identification, by a DOE Operations Office, of a surplus or abandoned facility or site for which NE may be responsible for some radioactive or hazardous materials contamination (step 1). The operations office attempts to identify the NE Headquarters program office that is or was responsible for the facility or site. If such a program office can be identified (step 2), the operations office requests the program office to accept D&D responsibility. If the program office accepts responsibility, the operations office prepares an application for the facility or site (step 3) that provides information needed by NE-20 for acceptance evaluation and planning. (A general outline of the information requested by the application is provided in Attachment A to this policy. An application form is available from NE-20 upon request.) The responsible NE program office then submits the application and a request to NE-20 for acceptance of the facility or site (step 4). NE-20 evaluates the request and, upon satisfactory completion of the application and establishment of NE responsibilities for D&D, formally accepts the facility or site (step 5) into the NE-20 program.

If a responsible program office cannot be established for the facility or site (step 2), then NE-20 will evaluate this "orphan" facility or site to determine the extent of NE responsibility and whether to accept the facility or site into the NE-20 program (step 6). If NE-20 accepts responsibility for the facility or site, the operations office prepares an application (see Attachment A) and submits a request to NE-20 for formal acceptance (step 7).

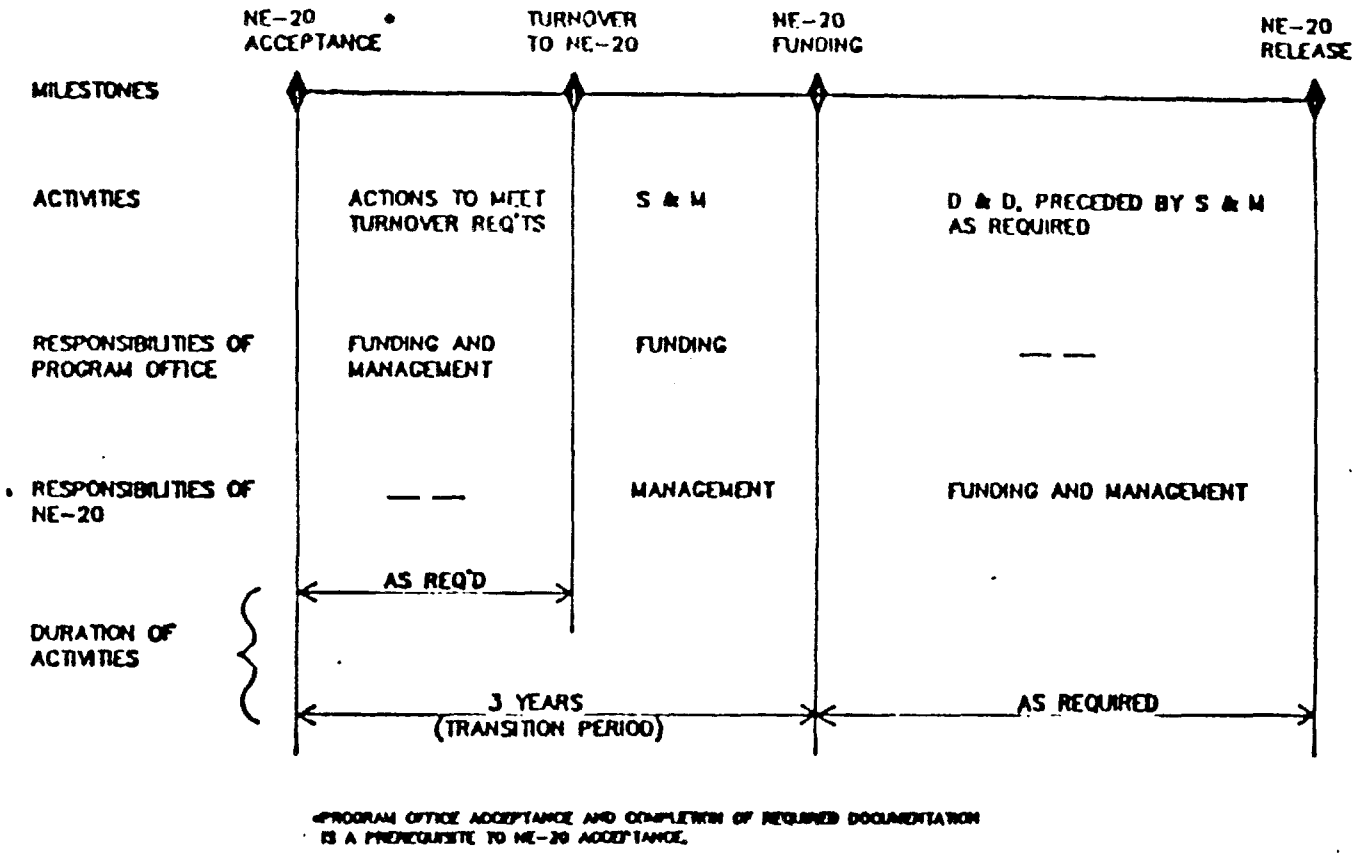

Figure 1. Responsibilities of Program Office and NE-20 After Acceptance of a Facility/Site for D&D

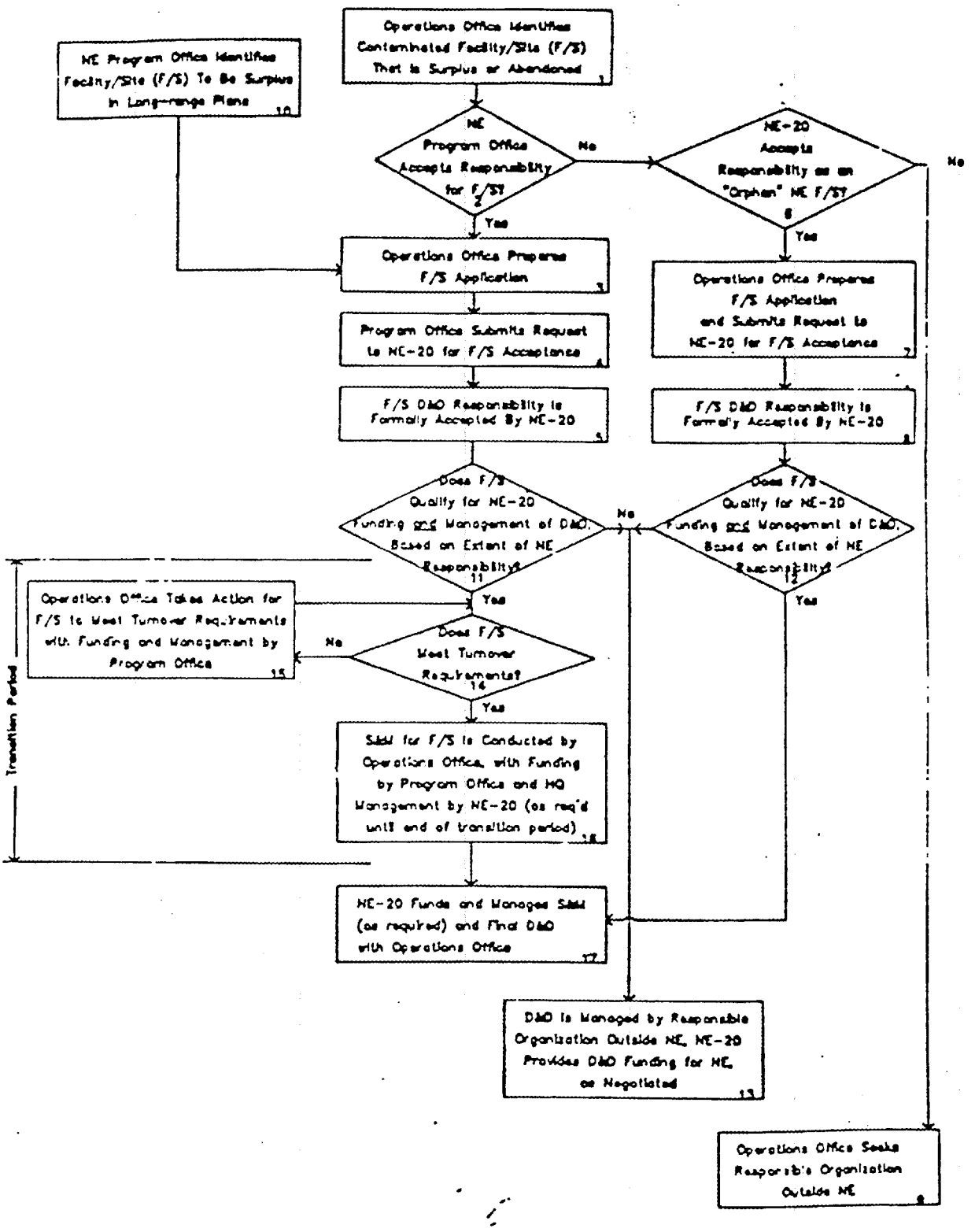

Figure 2. SFMP Acceptance Process

NE-20 then formally accepts responsibility for D&D (step 8). If NE responsibility cannot be established (step 6), then the facility or site will not be accepted by NE-20, and the operations office will have to satisfy its responsibility for D&D through some other responsible organization (step 9).

The acceptance process can also start with the identification, by a NE program office, of a facility or site that is expected to become surplus, according to long-range plans (step 10). The operations office that is responsible for the facility or site then works with the program office to gain NE-20 acceptance as described above (steps 3, 4, and 5).

A facility or site that is formally accepted by NE-20 follows one of two paths through the process, depending on whether an NE program office is involved. On either path, NE-20 evaluates the extent of NE responsibility for contamination and decides whether the facility or site qualifies for funding and management of D&D (steps 11 and 12). As explained in Section 4, NE-20 will fund and manage the D&D if 1) the facility or site is from 50% to 100% NE-contaminated, or 2) NE is the facility or site landlord. If the facility or site does not qualify, then the D&D is managed by an organization outside NE, and NE-20 will provide the NE-contribution to D&D funding (step 13).

For a facility or site that qualifies for NE-20 management and where an NE program office has accepted responsibility. NE-20 will evaluate the facility or site against the turnover requirements (step 14), described in Section 6, and, if necessary, reach agreement within the program office that the operations office will take whatever actions are necessary to place the facility or site in an acceptable condition for turnover to NE-20 (step 15). After the turnover requirements have been met, the program office will provide S&M (step 16) until completion of the transition period (3 years), i.e., until such time as NE-20 assumes full funding responsibility for the facility or site (step 17).

For an "orphan" facility or site that qualifies for NE-20 management (step 12), NE-20 will assume full management and funding responsibility for the D&D of the facility or site (step 17), immediately after acceptance.

TURNOVER REQUIREMENTS

Before a facility is turned over to NE-20 for D&D by a program office, it must be put into an acceptable condition by meeting the following physical condition requirements:

a) The final deactivation/shutdown of the facility shall have been completed and documented (see Section 6.1);

b) The facility shall be in a safe condition with respect to radioactive and hazardous materials (see Section 6.2); and

c) The facility and its systems shall be structurally sound so as to permit deferred final D&D for up to 8 years after turnover.

There are no specific turnover requirements for sites with no facilities (i.e., contaminated properties). The intent of the requirements for facilities, as outlined above and below, will be applied in establishing site-specific turnover requirements on a case-by-case basis.

6.1 Facility Deactivation/Shutdown Status

In order for a facility, including surplus ancillary facilities, to be considered finally deactivated/shut down, the following conditions must be met:

a. The facility operations will have been terminated programmatically and a determination documented that no future use of the facility is either planned, or intended that results in recontamination. This documentation requires Field Office and Headquarters Program Office signature.

b. Final radiological/hazardous materials survey records, final configuration and maintenance surveillance requirements, available drawings, specification, procedures, manuals, and unplanned occurrences records applicable to the facility shall be available for review and supplemented as necessary to support shutdown and D&D.

c. A surveillance and maintenance plan, including cost estimates, shall have been prepared, if necessary. Funding arrangements shall be made by the proposing organization or most recent NE program user for up to 3 years until NE-20 funding is provided through the normal budgeting process.

6.2 Radioactive/Hazardous Materials Condition

For a facility to be considered safe with respect to radioactive and hazardous materials, the following conditions must be met:

a. The structure(s) and radiation monitoring systems shall be in a physical condition adequate to contain and monitor any radioactive contamination, in accordance with DOE Order 5480.1a

(Environmental Protection, Safety, and Health Protection Program for DOE Operations). A current radiation contamination/hazardous materials survey of the facility and surrounding areas shall be available.

b. Security systems and procedures shall be adequate to prevent unauthorized entry, as appropriate.

c. All special nuclear materials, reactor fuels, high-level waste, contaminated liquid wastes, and hazardous chemicals or materials that have been stored at the facility shall have been removed from the facility.

APPLICATION
FOR ACCEPTANCE IN THE
SURPLUS FACILITIES MANAGEMENT PROGRAM
OFFICE OF REMEDIAL ACTION AND WASTE TECHNOLOGY (NE-20)
OFFICE OF NUCLEAR ENERGY

Prepared by:

Operations Office: _____

Field Office (if applicable): _____

Responsible Individual/Office: _____

Facilities included in this application:

	Name	Designation
A.		
B.		
C.		
D.		
E.		
F.		

Site/Location: _____

Date of Application: _____

Instructions

This application is intended to include one or more facilities at one site. The overall characteristics of the site are described first (Part I), followed by the characteristics of each facility (Part II). Part I should be completed once for the site. Part II should be completed once for each facility included in the application. A facility is a building, a portion of a building, or some other structure that requires D&D. A site without a facility may also be covered by this application.

PART I - SITE INFORMATION

1. Site Name: _____

2. Location: _____

State: _____ County: _____

3. Attach map(s) showing site plan and geographic location.

4. Land area (acres): _____

5. Land ownership: _____

6. Fencing (type, height, condition, locations): _____

7. Site security and surveillance: _____

8. Offsite population:

Closest population center: _____
Population: _____
Distance from site (km): _____
Other information, if available:

Distance from site	Population	% downwind of prevailing wind
1 km	_____	_____
5 km	_____	_____
50 km	_____	_____

9. Surface and subsurface conditions: Attach available information describing climate and meteorology, surface water bodies on and near the site, ground-water conditions, and soil and rock conditions.

10. Environmental compliance status of site (e.g., permits, compliance agreements): _____

PART II - FACILITY INFORMATION
(complete this part for each facility)

A. Facility Description

1. Facility name: _____

   Designation: _____

2. Type/purpose of facility: _____

3. Ownership of facility: _____

4. Attach plan view (layout) of facility. Indicate areas of NE responsibility.

5. Facility description (include all components of facility for which NE has responsibility, specify type of construction and physical condition): _____

6. Major equipment in facility: _____

7. Current use of facility: _____

8. Close-out contractual commitments regarding facility: _____

   Attach additional information as required.

9. Environmental compliance status of facility: _____

   Attach any available environmental reports.

A. Facility Description (continued)

10. History of facility use and contamination: Provide below, or in a separate attachment, a historical narrative of facility use that provides a basis for establishing responsibility for D&D of the facility. Describe previous and current "users" of the facility, both "operators" and "customers", including organizations outside DOE, inside DOE but outside NE, and programs within NE. Be as specific as possible and corelate the users with the dates of use and the type of contamination that may have resulted from that use. Provide an estimate of the percent of contamination attributed to each of the users.

B. Radiological Data

1. Facility name: _____

   Designation: _____

2. Radioactive contamination:

Type	Isotope	Quantity (Curies)	Date of Inventory

   Attach copy of most recent radiological survey.

3. Potential for release:

Contamination Type	Current Mode of Containment and Potential Modes of Release

4. Extent of offsite contamination: _____

C. Hazardous Materials Data

1. Facility name: _____

   Designation: _____

2. Stored hazardous materials:

Type	Quantity	Mode of Storage

   Note: All hazardous materials must be removed before transfer of the facility to the SFMP.

3. Hazardous materials contamination:

Type	Description

4. Extent of offsite contamination: _____

D. Surveillance and Maintenance

1. Facility name: _____

   Designation: _____

2. Surveillance:

Type of Survey	Frequency	Man-hrs/yr	$/yr	Man-rem/yr
radiological				
maintenance				
security				

3. Maintenance required: _____

   Utilities required for maintenance: _____
   Man-hours/yr: _____
   $/yr: _____
   Man-rem/yr: _____

4. Surveillance or maintenance reports currently required: _____

5. Other surveillance and maintenance costs:

Items	$/yr

6. Attach any existing surveillance and maintenance plans.

E. Decontamination and Decommissioning Planning Data

1. Facility name:_____

   Designation:_____

2. Planned disposition/use:_____
   _____
   _____

3. Previous D&D planning:_____
   _____
   _____

   Attach any existing plans.

4. Volume of radioactive waste resulting from D&D:

Type of Waste	Volume (ft3)
low-level	_____
> low-level	_____
transuranic	_____
mixed	_____

5. Estimated cost of D&D: _____ (attach basis for estimate)

F. Additional Environmental Considerations

Provide below, or in a separate attachment, any additional information that will provide a basis for judging the relative risk that the facility currently poses to the environment and the public. Such information is needed to prioritize the decommissioning of this facility relative to others in the SFMP.

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