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**ENVIRONMENTAL
RESTORATION
PROGRAM**

**Final Deactivation Project Report
on the High Radiation Level
Analytical Facility, Building 3019B
at Oak Ridge National Laboratory,
Oak Ridge, Tennessee**

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LOCKHEED MARTIN ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

Advanced Integrated Management Services, Inc.

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

**Final Deactivation Project Report
on the High Radiation Level
Analytical Facility, Building 3019B
at Oak Ridge National Laboratory,
Oak Ridge, Tennessee**

Date Issued—September 1997

Prepared for the
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Environmental Management Activities at the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
managed by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

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PREFACE

This document is the *Final Deactivation Project Report on the High Radiation Level Analytical Facility, Building 3019B, at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (ORNL/ER-420). Although this element of work is not part of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), it was accomplished in accordance with the substantive requirements of the act. This work was performed under Work Breakdown Structure 1.6.6.2.10.1, Activity Data Sheet 6502-OR. This document provides the Environmental Management and Enrichment Facilities program with the final report on the deactivation of the High Radiation Level Analytical Facility, Building 3019B.

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ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
CAM	Continuous Air Monitor
CTD	LMER Chemical Technology Division
DOE	United States Department of Energy
EM-40	DOE Environmental Restoration Program
EM-60	DOE Nuclear Material and Facility Stabilization Program
ER	LMES Environmental Restoration Division
ERFUP	Environmental Restoration and Facilities Upgrade Program
FDPR	Final Deactivation Project Report
FIDS	Field Interface Device System
FY	Fiscal Year
HAD	Heat Actuating Device
HRFDP	High Ranking Facilities Deactivation Project
I&C	LMER Instrumentation and Controls Division
LLLW	Liquid Low Level Waste
LMER	Lockheed Martin Energy Research
LMES	Lockheed Martin Energy Systems
MOA	Memorandum of Agreement
MJR	LMER P&E Division Maintenance Job Request
ORNL	Oak Ridge National Laboratory
ORP	LMER Office of Radiation Protection
P&E	LMER Plant and Equipment Division
PUREX	Plutonium Uranium Extraction
RCRA	Resource Conservation and Recovery Act
RDF	Radiochemical Development Facility
SAR	Safety Analysis Report
SCFP	Surplus Contaminated Facilities Program
SFMP	Surplus Facilities Management Program
S&M	Surveillance and Maintenance
THOREX	Thorium Extraction
USQD	Unreviewed Safety Question Determination

EXECUTIVE SUMMARY

The purpose of this report is to document the condition of the High Radiation Level Analytical Facility (Building 3019B) at Oak Ridge National Laboratory (ORNL) after completion of deactivation activities. This report identifies the activities conducted to place the facility in a safe and environmentally sound condition prior to transfer to the Environmental Restoration EM-40 Program.

This document provides a history and description of the facility prior to the commencement of deactivation activities and documents the condition of the building after completion of all deactivation activities. Turnover items, such as the Post-Deactivation Surveillance and Maintenance (S&M) Plan, remaining hazardous materials inventory, radiological controls, safeguards and security, quality assurance, facility operations, and supporting documentation provided in the Nuclear Material and Facility Stabilization (EM-60) Turnover package are discussed.

Building 3019B will require access to perform required S&M activities to maintain the building safety envelope. Building 3019B was stabilized during deactivation so that when transferred to the EM-40 Program, only a minimal S&M effort would be required to maintain the building safety envelope. Other than the minimal S&M activities the building will be unoccupied and the exterior doors locked to prevent unauthorized access. The building will be entered only to perform the required S&M until decommissioning activities begin.

1. INTRODUCTION

1.1 PURPOSE

The purpose of this report is to document the condition of the High Radiation Level Analytical Facility (Building 3019B) at Oak Ridge National Laboratory (ORNL) after completion of deactivation activities. This report identifies the activities conducted to place the facility in a safe and environmentally sound condition prior to transfer to the Environmental Restoration EM-40 Program.

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1.2 SCOPE

This document addresses the activities performed during the deactivation of Building 3019B to place the facility in a safe and environmentally sound condition to await decommissioning, the status of the facility, and the activities required to maintain the facility following deactivation. These activities include all deactivation and stabilization activities performed since the facility was shut down in 1984.

Originally, several laboratories and offices to the east of the operating room were considered part of Building 3019B. Later, after the operations conducted in Building 3019B had been transferred to Building 2026, these offices and laboratories were transferred from the Analytical Chemistry Division to the Chemical Technology Division and were reclassified as part of Building 3019A. The scope of this Final Deactivation Project Report (FDPR) only covers work done within the present boundaries of Building 3019B. Appendix A includes the floor plans of Building 3019B and illustrates the physical boundaries of the facility.

2. BACKGROUND

2.1 FACILITY DESCRIPTION

Building 3019B is a concrete and masonry block building of over 3,000 ft² containing a hot cell bank with seven work cells equipped with manipulators and a central storage cell. To the east of the hot cell block lies the operating room (Room 15), where the cell viewing windows and manipulator controls are located. To the west of the hot cell bank lies the cell charging area (Room 14), which served as a staging area for large items being moved into or out of the cells. On the west end of the building is a loading dock. This dock was used to load and unload carriers and other equipment.¹

Building 3019B is attached to Buildings 3019A and 3135. The facility is accessed from and shares some utilities with Building 3019A. Building 3135 was a guard shack for the complex but is now inactive. All three buildings are located inside the ORNL security area on the northern end of Third Avenue where it intersects with Hillside Avenue. Building 3019B is currently inactive and unoccupied except for S&M activities.²

2.2 FACILITY HISTORY

Building 3019B was constructed in 1955.³ Building 3019B was used for separating, processing, and analyzing highly radioactive samples from many ORNL programs, including all those operating in Building 3019A. The samples handled in Building 3019B included fission products, activation products, uranium, plutonium, and other transuranic elements.

From 1955 to 1958, the analytical facilities of Building 3019B were primarily used to support the Thorium Extraction (THOREX) Program. From 1958 to 1960, the analytical capabilities of Building 3019B supported many programs from several ORNL divisions. These included the development of the Plutonium Uranium Extraction (PUREX) Process for the separation of plutonium from spent fuel and the development of the Materials Testing Reactor at ORNL. From 1960 through 1964, Building 3019B was used for analytical support in the Volatility and Kilorod Programs.⁴

In 1964, the High Radiation Level Examination Laboratory (Building 2026) was constructed to replace Building 3019B. From 1964 to 1976, Building 3019B was only used sporadically.⁵ The last programmatic work performed by Building 3019B supported the Light Water Breeder Reactor Program, which was conducted between 1969 and 1976.⁶

In 1985, Building 3019B was identified by the Environmental Restoration and Facilities Upgrade Program (ERFUP) as a surplus contaminated facility. Funding was allocated by the ERFUP to deactivate the facility.⁷ In FY 1990, Building 3019B was moved into the EM-40 Surplus Contaminated Facilities Program (SCFP), which funded several deactivation activities in FY 1991 and FY 1992. At the beginning of FY 1993, DOE determined that Building 3019B did not meet EM-40 acceptance criteria because it was part of a larger contaminated facility. This decision caused EM-40 funding to the facility to be terminated. From FY 1993 through FY 1995, funding for minimal S&M activities was provided by ORNL overhead. No funding for deactivation activities was provided.⁸

In FY 1994, DOE identified Building 3019B as a high risk ranking surplus facility through the Surplus Facility Inventory and Assessment (SFIA) Project. As a high risk ranking surplus facility, it was accepted into the EM-60 High Ranking Facilities Deactivation Project on October 1, 1995.⁹

3. FACILITY STATUS

3.1 PRE-DEACTIVATION FACILITY STATUS

3.1.1 Hazards Analysis

A safety analysis for Building 3019B, *Revised Safety Analyses for Building 3019-B* (ORNL/CF-82/260), was first issued in 1974 and revised in 1982. This report documents the hazards present after most operations in the facility had ceased, but before deactivation activities had been initiated. The major hazards identified were fires and explosions. The threat from radiation exposure was considered less severe.¹⁰

3.1.2 Internal Spaces

3.1.2.1 Operating Area (Room 15)

The operating area was located to the east of the hot cell bank. This room had an area of approximately 1600 ft². The viewing windows and remote manipulator controls were mounted on the west wall of the room. The windows of the work cells were filled with zinc bromide (ZnBr₂) solutions for shielding, while the window of the central storage cell consisted of 6 inch thick sections of lead glass sandwiched together.¹¹ The east side of the operating area contained four fume hoods, two lab tables with sinks, a calculator table, and a lavatory. Five instrument tables were located near the center of the room.¹² These installations were used for the preparation of reagents and glassware used within the hot cells.¹³ The floor of the room was covered with asbestos-containing floor tiles.

Radiation monitoring equipment in Room 15 included an alpha continuous air monitor (CAM), a beta-gamma CAM, two gamma monitrons, a neutron criticality monitor, an alpha laboratory monitor, and a beta-gamma laboratory monitor.¹⁴

Over time, the weather stripping on the two exterior doors entering the operating area deteriorated, especially around the north door. This allowed rainwater to enter the room from the outside. Foam diking was set up around the doors to prevent this intrusion of water.¹⁵

3.1.2.2 Charging Area (Room 14)

The charging area was located on the west side of the hot cell bank. It covered an area of approximately 860 ft². The large rear access doors to the working cells rolled back on rails into this area when they were opened. When not in use, the rear access doors were sealed shut by carefully tapping the latches into locked positions.¹⁶ A monorail hoist was installed to move heavy objects between the charging area and the loading dock. Radiation monitoring instrumentation in this room included an alpha CAM, a beta-gamma CAM, and two gamma monitrons.¹⁷

3.1.2.3 Work Cells (AC-1 through AC-7)

The hot cell bank contained seven working hot cells, with interior areas of approximately 30 ft² each. Cells AC-1, AC-3, AC-5, and AC-7 were located to the north of the central storage cell, while Cells AC-2, AC-4, and AC-6 area were located south of the storage cell. The walls of the working cells were three feet thick and composed of standard poured concrete.¹⁸ Materials and samples were

introduced to the cells from the operating area (Room 15) through two small sliding concrete drawers contained in a stainless steel duct.¹⁹ These ports were also used to transfer properly contained and shielded solutions measuring less than 500 mR/hr at contact from the cells into the operating area.²⁰ Two inter-cell conveyors provided a mode of sample transport between cells.²¹ One conveyor ran from the central storage cell, through cells AC-1, AC-3, and AC-5 to cell AC-7, while the other conveyor ran from the central storage cell, through cells AC-2 and AC-4, to cell AC-6. Entrance for decontamination and maintenance and the introduction of large items was provided through rear access doors constructed from stacked concrete blocks and mounted on rails. These doors weighed approximately 9 tons each.²² When not in use, the rear access doors were sealed shut by carefully tapping the latches into locked positions.²³ The viewing windows in the working cells were composed of cerium-stabilized glass filled with zinc bromide solutions for shielding.²⁴ Each working cell contained a steel grill covered with a stainless steel pan mounted three feet above the actual floor of each cell. These pans formed the working surface for the analytical operations conducted within the hot cells.²⁵

Cell AC-1 was used primarily for density measurements and non-routine analytical work.²⁶ Much of the equipment used in this cell was disassembled and removed after use. Permanent equipment in this cell included a densimeter mounted on the floor pan and a sample disposal unit mounted on the wall. A receptacle for catching empty sample bottles was mounted on a bracket attached to the rear access door.²⁷

Cell AC-2 was used primarily for acid titration and pH measurements.²⁸ Equipment installed in the cell included a free-acid titration unit, a temporary pipettor, a stainless steel remove pipettor, and a microelectrode unit for measuring the pH of one drop of solution.²⁹

Cell AC-3 was used primarily for titration and colorimetric analysis.³⁰ Equipment installed in this cell included a Beckman Model K automatic titrator, a filter photometer, and a stainless steel remote pipettor.³¹

Cell AC-4 was used primarily for titration, mercury polarography, filter photometry, and centrifugation.³² Equipment installed in the cell included a coulometric titration unit, three dropping mercury polarograph cells, a filter photometer, and a centrifuge.³³

Cell AC-5 was used primarily for liquid-liquid extractions, chloride distillations, colorimetric analyses, and weighing samples.³⁴ Equipment installed in the cell included a magnetic stirrer equipped with lucite holders to support the extraction vessels.³⁵

Cell AC-6 was used primarily for spectrography, spectrochemical analysis of samples for the Transuranium Process Plant (Building 5505).³⁶ Equipment installed in the cell included a Jaco-Varisource Spectrograph.³⁷ The HEPA filter above Cell AC-6 was grossly contaminated.³⁸

Cell AC-7 was used for analytical work requiring heat,³⁹ such as dissolution and fuming of samples and the machining of Peach Bottom graphite reactor samples to determine the depth of contamination penetration.⁴⁰ This cell was equipped with a small fume hood containing two hot plates.⁴¹

Prior to deactivation, the cells contained much analytical equipment, mechanical equipment, and highly radioactive materials. This material caused the radiation levels within the hot cells to be over 100 R/hr. The vinyl linings inside the cells were spalling, allowing radioactive contamination to

pervade the concrete block walls. The zinc bromide in the viewing windows developed leaks caused by corrosion of the steel frames. Hydrolysis products suspended in the shielding fluid made the windows essentially opaque.⁴²

3.1.2.4 Central Storage Hot Cell (Cell A)

The central storage cell was located near the middle of the hot cell bank, with Cells AC-1, AC-3, AC-5, and AC-7 located to the north and Cells AC-2, AC-4, and AC-6 located to the south. The central storage cell had an interior area of approximately 50 ft². The walls of the storage cell were three feet thick and composed of barytes concrete.⁴³ The viewing window of the storage cell was composed of several six inch thick slabs of leaded glass.⁴⁴

Prior to deactivation, the storage cell contained a number of five gallon and one gallon cans, known as lard cans and syrup buckets, respectively. These cans contained miscellaneous radioactive waste accumulated over the years. One manipulator was operational, along with the conveyer systems serving the cell.⁴⁵

3.1.2.5 Loading Dock Area (Room 13/13A)

The loading dock area is an appendage to the west side of the building. Room 13 consists of the original loading dock, while Room 13A is an addition constructed in the late 1970s. This dock was used to load and unload carriers being transferred to and from the charging area. A monorail hoist was installed to lift the carriers between the charging area and the loading dock. Radiation monitoring instrumentation in Room 13 consisted of one gamma monitor.⁴⁶

3.1.2.6 Room 12

Room 12 was a small office in the northeast corner of the building that entered into the operating area (Room 15). The room has an area of 85 ft². It normally contained two desks.

3.1.2.7 Airlock (Room 14A)

The airlock room is located in the southwest corner of Building 3019B between the charging area and the operating area. The airlock room has an area of approximately 65 ft². Radiation monitoring instrumentation included an alpha laboratory monitor and a beta-gamma laboratory monitor.⁴⁷

3.1.2.8 Room 11 (FIDS Room)

Room 11, known as the Field Interface Device System (FIDS) Room, is located in the southwest corner of Building 3019B, adjacent to Building 3135. There are no interior doors connecting it with either Building 3135 or the rest of Building 3019B. The room may only be entered from the outside. Security equipment is housed in this room and Laboratory Protection controls access to it. The FIDS room contains no radiological areas.

3.1.3 Building Structure and External Spaces

3.1.3.1 Building 3019B Roof

Prior to deactivation, the condition of the Building 3019B roof had deteriorated. Roof drains were positioned along the north/south axis of the building to prevent water from collecting on the roof. Over the years the roof settled, and the roof drains were no longer located at the low points of the roof. This allowed large pools of water to collect and eventually damage the roof. The roof also contained a contamination area, where contamination had leaked out of the THOREX conveyer onto the roof.⁴⁸

3.1.3.2 THOREX Conveyer

The THOREX conveyer was installed to transfer radioactive samples between Building 3019A and the central storage cell of Building 3019B. Some of the samples were spilled during transit, heavily contaminating the interior of the conveyer. Some of this contamination seeped out of the conveyer and created a contamination area on the Building 3019B roof. The conveyer represented a significant environmental risk since a major portion of the conveyer was routed outside secondary containment.⁴⁹

3.1.1.3 Building 3019B Exterior

On November 20, 1959, an explosion occurred in Cell 6 of Building 3019A, blowing out the back door of the cell and releasing plutonium and other radionuclides from the building.⁵⁰ The exterior walls of Building 3019B became radioactively contaminated during this accident. The alpha contamination deposited on the north and west walls of Building 3019B was less than 100 dpm/100 cm², while the contamination on portions of the south wall ranged from 100 to 2000 dpm/100 cm².⁵¹ Over the years, the condition of the paint immobilizing this contamination deteriorated, especially along the south and west walls. Large chunks of the paint peeled off these walls and fell to the ground.⁵²

3.1.4 Process, Utility, and Support Systems

3.1.4.1 Building Air Supply

A ventilation and air conditioning system in the West Attic of Building 3019A (Room 203) supplied fresh air to Building 3019B. Two electric fans discharged filtered outside air at the rate of 14,000 cubic feet per minute through two air conditioning units located in the west attic. "Start-stop" push buttons for operating these two fans were located in the attic of Building 3019B.⁵³

3.1.4.2 Laboratory Off-Gas System

The laboratory off-gas system maintained a negative pressure in the Building 3019B hot cells and the laboratory glove boxes in the western portion of Building 3019A. Air from the hot cells was drawn into a common header which took the air across the 3019 roof to the Building 3108 Filter House. In Building 3108, this exhaust passed through three parallel trains of roughing and 24 inch by 24 inch HEPA filters before being discharged to the Building 3020 stack.⁵⁴

Two large electric fans, EF-G01 and EF-G02, were available to force the exhaust through these filters. One fan was operating while the other was in standby. The fans were interlocked to prevent simultaneous operation and to automatically start the standby fan if the operating fan failed. These fans had a rated capacity of 20,000 ft³/minute at 10 inches of water. In the event of a power failure,

fan EF-G01 was supplied by a diesel generator in Building 3146, while a diesel generator in Building 3123 provided emergency power to fan EF-G02.⁵⁵

The laboratory off-gas system was connected to the cell off-gas system in Building 3019A. In the event of failure of the laboratory off-gas system, the exhaust could be diverted to the cell off-gas system. From the cell off-gas system, the exhaust would be directed through the filter bank in Building 3091 before being discharged to the Building 3020 stack.⁵⁶

Under normal conditions, the cell operating area (Room 15) was about 0.02 inches negative pressure and the cell charging area (Room 14) was at atmospheric pressure. The cell operating and charging areas were interconnected by an airlock (Room 14A).⁵⁷

Prior to deactivation, the exterior of the exhaust ductwork suffered corrosion and required frequent patching. Examples of this corrosion can be seen in ORNL photographs 3662-94, 3664-94, 3665-94, and 3674-94.

3.1.4.3 Building 3019B Drains

Building 3019B was equipped with both process and liquid low level waste (LLLW) drains. The process waste was routed through manhole 19, located on the south side of the building, to the process waste collection system. Wastes from the LLLW drains was routed to the W-1A tank located outside the building.⁵⁸

In March 1986, a leak was found in the Chem-Ware line to which the hot cell drains were connected. This Chem-Ware transfer line was connected to the ORNL Tank Farm System. It was determined that the Chem-Ware line could not be repaired and that the cost to replace the line with an approved double-contained stainless steel transfer line could not be justified based solely on its use for the 3019B hot cell decontamination effort.⁵⁹ To prevent the release of radioactive material into the environment through the leaking transfer line, the LLLW drains in the hot cells were placed out of service.

3.1.4.4 Fire Protection

Building 3019B was equipped with 28 Fenwal rate-compensation heat actuating devices (HADs). Activation of these devices was annunciated at the fire alarm control panel (Zone 17) located in Room 21 of Building 3019A. Such alarms were immediately transmitted to the ORNL Fire Department.⁶⁰

Building 3019B was protected by an automatic wet pipe sprinkler system. Flow to the Building 3019B sprinkler heads was controlled by Riser 1, a six inch wet pipe alarm check valve. This system also provided protection to the lunchroom, west laboratories, conference room, and administrative offices of Building 3019A.⁶¹ The arrangement of the fire protection piping and sprinkler heads is documented in ORNL Drawing D-55723. Activation of the sprinklers triggered a water flow switch, which transmitted an alarm to the Building 3019A fire alarm control panel (Zone 4). This alarm was immediately forwarded to the ORNL Fire Department.⁶²

3.1.5 Radioactive Material, Contamination, and Waste

Prior to deactivation, the central storage cell contained several five gallon "lard buckets" and one gallon "syrup buckets" filled with radioactive waste. The contents of these containers represented over fifteen years of accumulated waste.⁶³ Equipment and materials in the hot cells were grossly contaminated. The operating area and the cell charging area also contained lesser quantities of fixed and transferable contamination.

3.1.6 Hazardous Material, Contamination, and Waste

Before deactivation, the most significant quantities of hazardous materials present in the facility were the zinc bromide solutions in the working cell viewing windows. Other hazardous materials included lead shielding, asbestos insulation, mercury in mercury vapor lights within the cells, lead based paint, and PCB light ballasts.

3.2 POST-DEACTIVATION FACILITY STATUS

3.2.1 Deactivation End Point Completion

The end point criteria for deactivation activities performed at Building 3019B are defined in Attachment 4 of the *High Ranking Facilities Deactivation Project (HRFDP) End Point Determination - High Radiation Level Analytical Facility (3019B)*. Unless otherwise stated in the Memorandum of Agreement between EM-60 and EM-40 for the transfer of the facility, the end point criteria in this document will identify the state that the facility must be in to transfer into the EM-40 Program. The achievement of these end points is documented in *Building 3019B End Point Completion Report*. This report is an attachment to the Memorandum of Agreement (MOA) transferring the facility from EM-60 to EM-40. The signatures of the EM-60 and EM-40 representatives on the MOA indicate their concurrence with the end point completion report.

3.2.2 Hazards Analysis

There is currently no hazard screening document covering Building 3019B alone. Instead, Building 3019B is covered by the safety documentation for the entire Radiochemical Development Facility Complex (RDF). The RDF is classified as a Category II Nuclear Facility. The current facility authorization basis documents for the RDF are listed in Table 3.1.

3.2.3 Internal Spaces

3.2.3.1 Operating Area (Room 15)

The hoods, lab benches, sink, and other equipment installed on the east wall of Room 15 have been removed, along with the instrument tables in the center of the room and all loose, excess equipment. The zinc bromide solutions have been drained from all of the working cell windows and removed from the building. Lead plates have been installed over the working cell viewing windows to reduce the dose rate in the operating area. The floor drains leading to the process waste system have been plugged and a level detector has been installed at the low point of the room.⁶⁴ Diking approximately three inches high has been installed at the two emergency exits on the north and south ends of the room.⁶⁵ The safety shower in Room 15 has been removed.⁶⁶ Asbestos floor tiles have been

removed. The floor has been decontaminated to remove transferable contamination. The floor and cell faces have been bonded with two layers of epoxy sealant to immobilize the remaining contamination.

Door seal attachments were applied to the two exterior doors entering into Room 15 from the north and the south to block the intrusion of water in the building during heavy rains.⁶⁷

Room 15 contains two radiation areas, one directly in front of Cell AC-1 and the other in front of Cells AC-2, AC-4, and AC-6. Room 15 contains no detectable transferable contamination. The radiological conditions in the operating room are documented in ORP survey 3019-97-0629. A copy of this survey is provided in Appendix B.

3.2.3.2 Charging Area (Room 14)

Most excess equipment and material have been removed from Room 14. Items remaining include a half ton hoist, a monorail hoist used to transfer carriers to and from the loading dock, several health physics instruments, and six empty shielded carriers. These carriers were opened in May 1994 under RWP 92781 to determine the transferable contamination levels on the carriers' interior and exterior surfaces and to measure the radiation dose levels.

Smears on Carrier #1 found 6000 dpm/100 cm² of transferable beta-gamma contamination on the carrier exterior. Transferable alpha contamination was below 20 dpm/100 cm². The radiation dose at contact with the top of the carrier with the lid off was 6,000 mR/hr.⁶⁸

Carrier #2 had 310 dpm/100 cm² and 2900 dpm/100 cm² of transferable beta-gamma contamination on the exterior and interior of the carrier, respectively. Less than 20 dpm/100 cm² of transferable alpha contamination was found on the carrier exterior, though 125 dpm/100 cm² was found on the interior surfaces. With the lid off, the dose rates at contact with the top of the carrier were measured at 80 mR/hr.⁶⁹

Access to Carrier #3 was obtained through a door rather than a lid. Smear surveys revealed the transferable beta-gamma contamination levels were 2200 dpm/100 cm² on the outside of the body of the carrier, and 2700 dpm/100 cm² on the outside of the shield door. Transferable alpha contamination was 35 dpm/100 cm² on both the exterior body of the carrier and on the shield door. The dose rate at contact with the top of the carrier was 550 mR/hr with the shield door open.⁷⁰

The outside of Carrier #4 was found to contain 900 dpm/100 cm² of transferable beta-gamma contamination, but less than 20 dpm/100 cm² of transferable alpha contamination. With the carrier lid removed, the dose rates at contact with the top of the carrier were 65 mR/hr.⁷¹

Transferable beta-gamma contamination levels on Carrier #5 were 2800 dpm/100 cm² and 6300 dpm/100 cm² on the exterior and interior of the carrier, respectively. Smearable alpha contamination was below 20 dpm/100 cm² on the carrier interior and exterior. With the carrier lid off, the radiation dose level was 10 mR/hr at contact.⁷²

Carrier #6 was a plywood box shielded with a quarter inch of lead. Transferable beta-gamma contamination was between 225 and 500 dpm/100 cm² on the exterior surfaces, and 200 dpm/100 cm² on the interior surfaces. Transferable alpha contamination was below 20 dpm/100 cm² on all surfaces. No radiation level above background could be detected on the material.⁷³

The charging area is designated as a radiation area and a contamination area. Radiation levels in the room are highest behind the central storage cell, where gamma radiation levels are as high as 15 mR/hr. Radiation levels behind the working cells are less than 1 mR/hr. The radiation levels in the room are documented in ORP survey 3019-97-0103. A copy of this survey is provided in Appendix B.

Room 14 contains both fixed and transferable radioactive contamination. The transferable contamination is primarily beta-gamma contamination. The locations of the transferable contamination are documented in ORP survey 3019-97-0681. The highest levels of fixed contamination on the floor of Room 14 are behind Cell AC-6. The floor in this area can contain up to 12,000 dpm/100 cm² of fixed alpha contamination.⁷⁴ Room 14 is equipped with an air sampler to monitor for any airborne contamination.

A door seal attachment was installed on the exterior door entering Room 14 from the west to prevent contamination from migrating out of the building in the event that water were released inside the facility.⁷⁵

3.2.3.3 Working Hot Cells

Radioactive waste and equipment have been removed from the cells. The vinyl lining on the interior of the cells has been removed. The zinc bromide solutions have been drained from the viewing windows, and lead plates have been installed over the windows. The manipulators are no longer functional. The cell access ports facing the operating area have been sealed. Significant amounts of transferable contamination remain in the cells, so the laboratory off-gas system continues to maintain the cells under a negative pressure. The radiation levels underneath the floor pans in some of the cells are listed in Table 3.2.

3.2.3.4 Central Storage Hot Cell

The containers of radioactive waste stored in the storage cell have been removed. The lead glass viewing window remains in place but is virtually opaque. Significant amounts of transferable contamination remain in the cells, so the laboratory off-gas system continues to operate and maintain a negative pressure within the cell.

3.2.3.5 Loading Dock Area (Rooms 13/13A)

All equipment has been removed from the loading dock area. Room 13 is a contamination area, while Room 13A is an RBA. The contamination consists primarily of strontium-90, cesium-137, and plutonium-239.⁷⁶ The levels of transferable contamination are documented in ORP survey 3019-97-0681, while the radiation levels are documented in surveys 3019-97-0103. Copies of these surveys are provided in Appendix B.

The LLLW drain in the loading dock area has not been plugged. Door seal attachments have been installed on the large exterior truck doors to prevent radioactive contamination from migrating from the building in the event of a water release within the facility.⁷⁷

3.2.3.6 Room 12

The office in Room 12 is now unoccupied. All furniture and other materials have been removed from the room. Fixed contamination on the floor has been bonded with epoxy sealant. One of the five fluorescent lights in the room has been placed out of service. The room contains no detectable transferable contamination. The radiological conditions in Room 12 are documented in ORP survey 3019-97-0629. A copy of this survey is provided in Appendix B.

3.2.3.7 Airlock (Room 14A)

The Room 14A airlock controls access to the cell charging area. Room 14A is posted as an RBA. Transferable contamination falls below the 20 dpm/100 cm² threshold for alpha contamination and the 200 dpm/100 cm² threshold for beta-gamma contamination.⁷⁸ The room contains an alpha and a beta/gamma laboratory monitor.

3.2.3.8 Room 11 (FIDS Room)

The status of the FIDS room has not changed from the pre-deactivation status described in section 3.1.2.8, except that a HAD has been installed in the room. The FIDS Room is not designated as a radiological area.

3.2.4 Building Structure and External Spaces

3.2.4.1 Building 3019B Roof

The old roof drains have been plugged and replaced with a new external guttering system on the south side of the building. The loose gravel, fungus, and other debris on the roof have been removed and disposed of as solid low level waste. A foam sealant has been applied to the roof to immobilize the contamination on the roof and to contour the roof so that rainwater is directed toward the new guttering system. Three layers of Dow Corning silicone weather barrier have been applied to protect the foam sealant.⁷⁹ An 840 ft² portion of the roof directly above the hot cells is designated as a radiation area. The radiation levels in this area are 7 mR/hr.⁸⁰

3.2.4.2 THOREX Conveyor

The rain shroud has been removed from the portion of the THOREX conveyor on the 3019B roof. The exterior of this portion of the conveyor has been decontaminated to reduced gross levels of transferable radioactive contamination. The remaining contamination has been immobilized with two coats of paint with contrasting colors. A final layer of Dow Corning silicone weather barrier has been applied on top of the paint to further ensure containment of the contamination.⁸¹

3.2.4.3 Building Exterior

The large chunks of peeling radioactively contaminated lead-based paint have been removed from the building exterior and properly disposed of. Two layers of paint with contrasting colors have been applied to the south and west walls of the building to immobilize the remaining radioactive contamination.⁸²

3.2.5 Process, Utility, and Support Systems

3.2.5.1 Building Air Supply

The supply and return air ducts entering Room 15 of Building 3019B from the Building 3019A west attic (Room 203) have been disconnected and blanked off. A ¼ inch steel plate was placed over each opening by LMER P&E millwrights. Fire caulking was used to seal the space between the metal and the wall.⁸³

3.2.5.2 Laboratory Off-Gas System

The laboratory off-gas system remains operational and continues to maintain the negative pressure in the Building 3019B hot cells and the laboratory hoods of the western portion of Building 3019A. The portion of the exhaust header on the roof of the building has been replaced. The original ductwork within the building above the hot cells remains in place. Corrosion has been observed on the exterior of these ducts, as shown in ORNL photographs 3662-94, 3664-94, 3665-94, and 3674-94. A remote inspection of the duct interior conducted in 1996 found no evidence of the corrosion penetrating through to the interior of the duct. LMES Engineering⁸⁴ and CTD⁸⁵ have examined the videotape and concur that there is little risk of imminent structural failure of the ductwork. However, CTD recommends conducting another inspection of the duct interiors around the year 2000 to assess the rate that the condition of the ducts is deteriorating.⁸⁶

Large quantities of a powdery substance have collected in the ventilation exhaust header. Besides being highly radioactive, this material has a perchlorate concentration of 0.3% by weight, exceeding the levels allowed by the ORNL Perchloric Acid Committee.⁸⁷ At the request of the Perchloric Acid Committee, four signs have been posted on the ductwork warning of the perchlorates.⁸⁸

3.2.5.3 Building 3019B Drains

The most recently updated engineering drawings showing the drain configuration in Building 3019B are drawings D-11611, C3D20330A002, and C3D20330A003. However, modifications have occurred that are not shown on these drawings. These modifications include plugging the floor drains in Room 15, installing diking around the emergency exits in Room 15, removing the safety shower from Room 15, installing a liquid level detector at the low point of Room 15, and capping the drain header from the drains in Room 14 immediately outside the building.⁸⁹

The LLLW and process waste drain lines that are suspected of leaking have not been repaired. To reduce the potential for radioactive contamination to migrate through these deteriorated drain pipes to the environment, all water sources to the facility were shut off by the end of FY 1997. Steam, steam condensate, and potable water lines passing through Building 3019B have been blanked off and drained at their points of entry.

3.2.5.4 Fire Protection

The portion of the automatic sprinkler system serving Buildings 3019B and 3135 has been isolated from the portion of the system that serves Building 3019A, drained, and converted to a manually activated dry system.⁹⁰ A rate compensation type heat detector was installed in Room 14A⁹¹ and the FIDS Room. These detectors were tied into the existing heat detector circuit protecting

Building 3019B. The portion of the automatic sprinkler system protecting Building 3019B has been drained and converted into a manually activated system.⁹²

3.2.6 Radioactive Material, Contamination, and Waste

Bulk quantities of radioactive material and waste have been removed from the facility. Only residual contamination remains. The highest levels of contamination are within the hot cells. The precise levels of contamination in the hot cells are unknown, since the high dose rates make surveys difficult.

The operating area is designated as a fixed contamination area. Room 15 contains no appreciable levels of transferable contamination, although fixed contamination immobilized underneath the epoxy sealant remains on the floor and on the faces of the hot cells.

The cell charging area is a contamination area. The floor of Room 14 contains both fixed and transferable radioactive contamination. The floor of the room contains less than 20 dpm/100 cm² of transferable alpha contamination. Most floor areas contain less than 200 dpm/100 cm² of transferable beta-gamma contamination. The highest levels of transferable beta-gamma contamination, up to 1,522 dpm/100 cm², are found behind working cells AC-1 and AC-3.⁹³ The highest levels of fixed contamination on the floor of Room 14 are behind Cell AC-6. The floor in this area can contain up to 12,000 dpm/100 cm² of fixed alpha contamination.⁹⁴ Room 14 also contains six contaminated shielded carriers.

The loading dock is a contamination area. In Room 13, transferable alpha and beta-gamma contamination are below 20 dpm/100 cm² and 200 dpm/100 cm², respectively. Transferable alpha contamination in Room 13A is also below 20 dpm/100 cm², while transferable beta-gamma contamination levels are as high as 453 dpm/100 cm² near the center of the room.⁹⁵

3.2.7 Hazardous Material and Mixed Waste

Large amounts of a powdery residue has collected within the ventilation header that removes the exhaust from the hot cells. This substance was analyzed and found to contain 0.3% perchlorates by weight. This exceeds the level allowed by the ORNL Perchloric Acid Committee.⁹⁶ Dry perchlorates have the potential to react violently when disturbed. The ventilation headers have been posted with signs warning of the perchlorate concentrations.⁹⁷ The powdery residue is also heavily contaminated with uranium, fission products, and transuranic radionuclides that have been used inside the hot cells.

The hot cells likely contain residual quantities of mercury from the mercury lamps employed in the cells. Small quantities of other hazardous materials may also be present within the hot cells, but the high radiation levels in the cells make sampling difficult.⁹⁸ Other residual quantities of hazardous materials potentially present in the facility may include lead oxide powder from shielding, PCBs within old fluorescent light ballasts and wiring insulation, asbestos piping insulation, and lead-based paint.

Table 3.1 Radiochemical Development Facility Authorization Basis

Document	Title	Date
BIO/3019-CTD/SSE/R0	<i>Basis for Interim Operation, Building 3019 Complex - Radiochemical Development Facility</i>	6/10/96
OSR/3019-CTD/R1	<i>Operational Safety Requirements for the Radiochemical Development Facility</i>	6/26/96
USQD/3019/SSE01/R0	<i>Unreviewed Safety Question Determination [Glovebox Off-Gas System Modification]</i>	8/16/94
USQD/3019-CTD/SSE/R1	<i>Unreviewed Safety Question Determination for the Receipt of U-233 from EG&G Mount Applied Technologies</i>	7/17/96
SA/3019-CTD/SSE-1/R0 USQD/3019-CTD/SSE-2/R0	<i>Safety Assessment, Radiochemical Development Facility (RDF), Building 3019 Complex UF₆ Trap Storage, with Unreviewed Safety Question Determination</i>	10/21/96
USQD/3019-CTD/SSE-3/R0	<i>Unreviewed Safety Question Determination for the Fabrication of Neptunium Test Targets</i>	10/22/96
USQD/3019-CTD/SSE-4/R0	<i>Unreviewed Safety Question Determination for the Temporary Storage of two UF₆ Traps in the Building 3019 Penthouse</i>	11/27/96
USQD/3019-CTD/SSE-6/R0	<i>Unreviewed Safety Question Determination for Physical Changes Related to the Abandonment of Building 3019B</i>	6/27/97

Table 3.2 Post-Deactivation Radiation Levels Under the 3019B Hot Cell Floor Pans

Cell	Front of Cell	Center of Cell	Rear of Cell
Central Storage Cell	Not Measured	Not Measured	Not Measured
AC-1	Not Measured	Not Measured	Not Measured
AC-2	1 R/hr	5.5 R/hr	1 R/hr
AC-3	100 mR/hr	200 mR/hr	100 mR/hr
AC-4	3 R/hr	8 R/hr	3 R/hr
AC-5	300 mR/hr	600 mR/hr	100 mR/hr
AC-6	100 mR/hr	600 mR/hr	200 mR/hr
AC-7	Not Measured	Not Measured	Not Measured

4. BUILDING 3019B DEACTIVATION ACTIVITIES

4.1 INTERNAL SPACES - ACCESS REQUIRED

4.1.1 Operating Area (Room 15)

Much of the cleanup of the operating area was completed in calendar year 1986 under the ERFUP Remedial Action Program. The radiochemical hoods, laboratory work benches, emission spectrometer, and other miscellaneous equipment were removed from the facility and sent to the burial grounds for disposal. Utilities and services to the operating area, except for electricity, lighting, and ventilation, were isolated at the point of entry. The chemical hood exhaust ducts were removed to within two feet of the interior wall and the remaining duct sections were provided with control dampers. Another exhaust duct with a control damper was installed between the operating area and the cell charging area to regulate the differential pressure between the areas. Holes in the interior walls and ceiling of the operating area were repaired and painted.⁹⁹

The zinc bromide solutions have been drained from the viewing windows of the working cells.¹⁰⁰ This action was necessary because the frames around the windows had cracked, allowing the zinc bromide to leak into the cells. These leaks into the cells had posed a serious problem because of the poor condition of the Chem-Ware lines connected to the hot cells' drains.

In FY 1992, activities performed under the EM-40 Surplus Contaminated Facilities Program included sealing the faces of the working cell viewing windows, removing 850 ft² of asbestos floor tiles, and removing a jammed access drawer from Cell AC-4. The cell windows were sealed by covering them with ½ inch thick lead plates, significantly reducing background radiation levels in the front of the cells. The jammed drawer was cut and pushed into the cell. The area where the cell AC-4 access drawer had been was covered with a ¾ inch thick lead plate to reduce dose levels in the area.¹⁰¹

The floor of Room 15 has been decontaminated to remove transferable contamination. The remaining fixed contamination on the floor and on the cell face was immobilized by bonding it with two layers of epoxy sealant.¹⁰²

In January 1997, door seal attachments were applied to the two exterior doors entering into Room 15 from the north and the south.¹⁰³ This action blocked the intrusion of water in the building during heavy rains.

4.1.2 Cell Charging Area (Room 14)

Excess contaminated equipment was removed from the charging area during the late 1980s and early 1990s.¹⁰⁴ Most surplus equipment was removed by the end of FY 1989.¹⁰⁵ During FY 1991, in addition to removing some remaining surplus equipment and debris from the area, some decontamination was performed. Funding for this work was suspended by DOE-HQ after it was determined that the facility did not meet EM-40 acceptance criteria.¹⁰⁶

On October 30, 1996, while the building was part of HRFDP, approximately 200 pounds of lead sheets were removed from the charging area and delivered to Manufacturing Sciences, Inc. for

recycling. The removal of this lead was performed in conjunction with the removal of larger amounts of lead from the Tower Shielding Facility.¹⁰⁷

In January 1997, a door seal attachment was installed on the exterior door on the west wall of the charging area.¹⁰⁸ This action will impede the migration of contamination out of the building in the event of a water release inside the facility.

4.1.3 Airlock (Room 14A)

A HAD was installed in the ceiling of the airlock on March 26, 1997.¹⁰⁹ This HAD was tied into the existing circuit of HADs protecting Building 3019B. All combustible materials were removed from the room.

4.1.4 Room 11 (FIDS Room)

A HAD was installed in the ceiling of the FIDS Room in September 1997. This HAD was tied into the existing circuit of HADs protecting Buildings 3019B and 3135.¹¹⁰

4.2 INTERNAL SPACES - NO ACCESS REQUIRED

4.2.1 Hot Cells

The major deactivation activity performed within the hot cells themselves was the removal of bulk quantities of radioactive waste and equipment. This removal was performed over an extended period and was completed by the end of FY 1990.¹¹¹ Before the removal of this material, the radiation levels within the cells were estimated to be greater than 100 R/hr.¹¹² After the equipment and waste was disposed of, the dose levels were measured beneath the floor pans in cells AC-2, AC-3, AC-4, AC-5, and AC-6 using a "stretch scope" (property number X177992). The results of these measurements are presented in Table 3.2. All readings were below 10 R/hr.¹¹³

In FY 1991, while the facility was in the SCFP, a survey was conducted over the area on top of the cells to identify possible asbestos.¹¹⁴ The asbestos was located, identified, and temporarily isolated.¹¹⁵ The highly contaminated HEPA filter above Cell AC-6 was removed, disposed of, and replaced.¹¹⁶

4.2.2 Loading Dock Area (Rooms 13/13A)

Excess material and equipment were removed from Rooms 13 and 13A in 1990.¹¹⁷ To eliminate the potential of a costly PCB spill, the oil in the hoist was drained by LMER P&E millwrights in February 1997.¹¹⁸ A used oil collection point (#142) was set up in Room 14 for the interim storage of the oil. The oil was removed from Building 3019B on April 8, 1997, and the used oil collection point was closed out on April 15, 1997.¹¹⁹

In January 1997, door seal attachments were installed on the large exterior truck doors.¹²⁰ This action will prevent radioactive contamination from migrating from the building in the event of a water release within the facility.

4.2.3 Room 12

All furniture and miscellaneous debris have been removed from Room 12. The floor has been decontaminated and bonded with two layers of epoxy sealant to immobilize any residual contamination.

4.3 EXTERNAL SPACES

4.3.1 Roof Repair

Roof drains were originally installed along the north/south axis of Building 3019B to prevent water from collecting on the roof. As the facility aged, the roof settled, and the roof drains became located at the high points of the roof where they were ineffective. This allowed large pools of water to collect, damaging the roof. The roof contained a contamination area where radioactive material had leaked out of the THOREX conveyer. The area above the cells was designated a radiation area.

The roof was repaired at the end of FY 1996. In August 1996, LMER P&E personnel installed roof scuppers and downspouts for a new guttering system on the south end of the building that would replace the existing roof drains. In late August 1996, CTD personnel began removing the existing loose gravel and fungus from the roof. This debris was collected and packaged for disposal as low level waste.

Hugh G. Brooks Industries, an outside subcontractor, was tasked to apply the foam sealant to the roof. The sealant was contoured to direct water toward the new guttering system on the south side of the building. After application of the foam, two layers of Dow Corning silicone weather barrier were applied to protect the foam. A third and final coat of silicone embedded with granular material was applied. The application of the final coat of silicone sealant was completed on September 30, 1996. After completion, the radiological status of the roof was downgraded from a radiation and contamination area to a radiation area.

This approach to repairing the roof was chosen because of the cost savings compared to traditional roofing. Additionally, the life expectancy is comparable to that of a conventional roof. When properly applied and cured, the Dow Corning 3-5000 Silicone Roof Coating provides one of the fastest, easiest, and most effective methods of keeping polyurethane foam roofs waterproof and weatherproof.¹²¹

4.3.2 THOREX Conveyer Decontamination and Encapsulation

In August 1996, CTD and ORP personnel removed the rain shroud covering the THOREX conveyer. Gross levels of contamination on the outside of the conveyer were removed. To ensure containment, this decontamination was performed in glove bags fabricated by the ORNL rubber shop. Two layers of paint with contrasting colors were applied to immobilize the residual contamination. In conjunction with the roof repair, an additional layer of silicone sealant was applied by personnel from Hugh G. Brooks Industries to further ensure encapsulation of the conveyer.¹²²

4.3.3 Exterior Paint Remediation

On November 20, 1959, an explosion occurred in Cell 6 of Building 3019A, blowing out the back door of the cell and releasing plutonium and other radionuclides from the building.¹²³ The exterior walls of Building 3019B became radioactively contaminated during this accident. In recent years, the condition of the paint immobilizing this contamination has deteriorated. Large chunks of the paint peeled off the south and west walls of the building. To prevent the release to the environment of the radioactive contamination, as well as to prevent the release of the lead from the paint, HRFDP removed the loose paint and immobilized the contamination on the exposed block walls in FY 1996.

Technicians from CTD scraped off and disposed of the loose paint. After the loose paint was removed, LMER P&E personnel bonded the exposed surfaces to immobilize the remaining radioactive contamination. Two layers of sealant with contrasting colors were applied to the walls. The bottom layer was magenta, while the top layer was a yellow-beige.¹²⁴

4.4 OPERATIONAL SYSTEMS

4.4.1 Laboratory Off-Gas System

The ventilation ductwork of the Laboratory Off-Gas System serving the Building 3019B cells suffered corrosion. During the 1980s, the ductwork was frequently repaired with temporary patching.¹²⁵ In the mid 1980s, the portion of the exhaust duct that ran outside the building was replaced.¹²⁶

The portion of the exhaust header located within the building remained in place. Corrosion was observed on the outside of the duct, as shown in ORNL photographs 3662-94, 3664-94, 3665-94, and 3674-94, but the depth that the corrosion had penetrated to was unknown. To assess the status of the ventilation header, a small robot equipped with a video camera was sent into the ventilation header. Examination of the videotape revealed no evidence that the corrosion observed on the exterior of the duct had penetrated through to the interior. The videotape was forwarded to the LMES Engineering Division for an assessment. Engineering concluded that no corrective action was necessary at this time and recommended that another inspection be done within four years to determine if the condition had deteriorated.¹²⁷ CTD¹²⁸ and HRFDP¹²⁹ concurred with this assessment.

The videotape revealed that numerous large piles of a powdery substance had accumulated in the ducts. A one liter sample was collected by vacuuming one of these piles. This sample was analyzed and found to contain 0.3% perchlorates by weight. This level exceeded the levels allowed by the ORNL Perchloric Acid Committee by a factor of six.¹³⁰ Four signs warning about the perchlorate concentrations in the ducts were fabricated and installed on the ducts in December 1996.¹³¹

4.4.2 Fire Protection

Because of the poor condition of the drain lines in Building 3019B, an uncontrolled release of water in the facility could spread radioactive contamination to the environment. To reduce the probability of such a release, the existing automatic wet sprinkler system was converted to a manually activated dry system. LMERP&E pipefitters reconfigured the sprinkler piping in the attic of Building 3019A so that the portion of the system serving Buildings 3019B and 3135 could be isolated

from the rest of the system. A valve was installed to allow manual activation of the Building 3019B/3135 sprinklers in the event of an emergency. The water remaining in the Building 3019B sprinkler lines was drained. One rate compensation type HAD was installed in Room 14A of Building 3019B, another was installed in the FIDS room, and three were installed in Building 3135. These HADs were tied into the existing circuit of 28 HADs monitoring Building 3019B. The installation and testing of the new HADs in Building 3135 and Room 14A were completed on March 26, 1997.¹³² The installation and testing of the HAD in the FIDS room was completed in September 1997.

These changes to the fire protection system were made with the approval of ORNL Fire Protection Engineering.¹³³ In accordance with DOE Order 5480.21, and Unreviewed Safety Question Determination (USQD) was prepared and approved to verify that these changes did not violate the authorization basis for the facility.¹³⁴ A copy of the USQD is provided in Appendix C.

4.4.3 Electrical System

The electrical system in Building 3019B remains operational to power the laboratory off-gas system, radiation monitors, lights, and other essential systems in the facility. ORNL Fire Protection Engineering has determined that the fire risk related to having power in Building 3019B is not significant enough to prohibit the conversion of the automatic wet sprinkler system to a dry manually activated system.¹³⁵

4.5 MOTHBALLED SYSTEMS

No systems within Building 3019B have been mothballed.

4.6 SYSTEMS ABANDONED IN PLACE

4.6.1 Building Air Supply

The building air supply system has been deactivated, isolated, and abandoned in place. The supply and return air ducts entering Room 15 of Building 3019B from the attic of Building 3019A have been blanked off. Quarter inch steel plates were installed over each opening. Fire caulking was used to seal the space between the metal and the wall. This task was completed on April 9, 1997.¹³⁶

4.6.2 Steam and Process Lines

To prevent contaminated liquids from entering the deteriorating drains in the facility, steam and process lines leading into the building were blanked off and drained in September 1997. These lines included two potable water lines, one process water line, one steam line, and one steam condensate return line.

4.6.3 Monorail Hoist

The hoist used to lift carriers between the loading dock and the cell charging area has been deactivated and abandoned in place. To prevent potential PCB spills, the oil from the hoist was drained from the system on February 23, 1997.¹³⁷ The oil was removed from the facility on April 8, 1997, and transferred to Used Oil Collection Point #141 in Building 3119.

5. TRANSITION ACTIVITIES

5.1 MEMORANDUM OF AGREEMENT

The Memorandum of Agreement documents the requirements agreed upon between EM-60 and EM-40. The signed MOA indicates acceptance by EM-40 that the criteria outlined in the MOA have been completed satisfactorily, with the exception of post-transition punchlist items, and that the level of deactivation of the facility is acceptable for transition to the EM-40 Program.

Post-transition punchlist items will be finished after deactivation is complete using EM-60 funding. The details of how the punchlist items will be completed and documented are addressed in the MOA.

5.2 REQUIREMENTS AND COMMITMENTS

5.2.1 Regulatory Requirements

Regulatory requirements for managing Building 3019B in its deactivated state are included in the ORNL Standards/Requirements Identification Document (S/RID).

5.2.2 Stakeholder Commitments

No stakeholder commitments have been identified pertaining Building 3019B.

5.3 POST-TRANSITION DEACTIVATION ACTIVITIES

No post-transition punchlist items have been identified for Building 3019B. All deactivation activities required to place Building 3019B in a safe, environmentally sound condition requiring minimal S&M have been completed prior to transfer to EM-40.

6. POST-DEACTIVATION S&M

The post-deactivation S&M plan for Building 3019B covers S&M activities associated with the interior spaces, operational systems, and external areas related to Building 3019B. The objectives of the S&M Program for Building 3019B include:

- Ensure adequate containment of radioactive contamination.
- Provide physical safety and security control for the facility.
- Maintain the facility in a manner that will minimize potential hazards to workers and the public.
- Provide a mechanism for the identification and compliance with applicable environmental, safety, and health requirements.

The post-deactivation S&M plan for Building 3019B details the specific S&M items to be performed and estimates the annual cost of performance. The S&M cost estimates are based on previous operational costs associated with similar S&M activities at ORNL.

The S&M activities associated with Building 3019B include the following types of activities:

- Walkdowns and inspections for structural integrity, safety, radioactive contamination, and hazardous material conditions;
- General housekeeping of the interior and exterior of the building as needed; and
- Maintenance activities required to maintain the security and safety envelope of the facility.

7. ABNORMAL ACTIVITIES/CONDITIONS

7.1 RESTRICTION ON HOT WORK AND OTHER POTENTIAL FIRE HAZARDS

Because Building 3019B is no longer protected by an automatic sprinkler system, ORNL Fire Protection Engineering must be consulted before the initiation of any decommissioning activities that could introduce additional fire hazards into the building. Examples of activities that could introduce additional fire hazards could include welding, the use of flammable solvents, etc. Such activities must also be evaluated through the Unreviewed Safety Question process outlined in DOE Order 5480.21 to ensure that the facility authorization basis is not violated.¹³⁸

7.2 PROHIBITION OF STORAGE

Because Building 3019B is no longer protected by an automatic sprinkler system, ORNL Fire Protection Engineering has prohibited Building 3019B from being used for storage to reduce the potential for a fire.¹³⁹

7.3 VENTILATION DUCT PERCHLORATE CONCENTRATION

The powdery residue in the ductwork of the laboratory off-gas system contains concentrations of perchlorates that exceed the levels set by the ORNL Perchloric Acid Committee by a factor of six.¹⁴⁰ Since dry perchlorates have the potential to explode if disturbed, the ORNL Perchloric Acid Committee should be consulted before undertaking any decommissioning activities that could disturb the perchlorates.

7.4 EMERGENCY EGRESS ROUTE FOR BUILDING 3019A

One of the emergency exit routes from Building 3019A goes through Room 15 of Building 3019B. A route between the east and south doors of Room 15 must be kept clear of obstacles that could impede evacuation. The fire department should be consulted before initiating any decommissioning activities that would temporarily block this route.

8. TURNOVER PACKAGE DOCUMENTATION

8.1 ADMINISTRATIVE TURNOVER PACKAGE

Administrative turnover consists of a collection of administrative documents. This collection includes procedures, agreements, permits, and other documents not directly related to the physical facility. The level of detail depends on the conditions, requirements, and agreements specific to the facility. The Administrative Turnover Package Checklist reflects the documents required for this facility with respect to administrative turnover. The following sections detail the contents of the applicable sections required for Building 3019B.

8.1.1 Final Deactivation Project Report

This report provides a management summary of the facility deactivation completion, general status and conditions, demonstrating conformance with DOE's specification of the overall end point. It identifies management actions needed that are not routine. Unresolved issues are also described.

8.1.2 Deactivation Locks Log and Keys

This includes a formal "Deactivation Lock System" for facility access, isolation of electrical components, chaining of valves, and other situations where physical access is to be controlled. The primary purpose of this system is to ensure control as the work force "backs out" of the facility as specified end points are achieved.

8.2 TECHNICAL TURNOVER PACKAGE

Technical turnover consists of a collection of technical documents that describe the facility, its equipment, and the conditions at the completion of all deactivation activities. The level of detail depends on the conditions requirements, and agreements specific to the facility. The Technical Turnover Package Checklist reflects the documents required for this facility with respect to technical turnover. The following sections detail the contents of the applicable sections required for Building 3019B.

8.2.1 End Point Completion Report

The End Points Completion Report documents the achievement of the end points identified in Attachment 4 of the *High Ranking Facilities Deactivation Project (HRFDP) End Point Determination - High Radiation Level Analytical Facility (3019B)*, (HRFDP/97/006-D). The End Points Completion Report will be an attachment to the MOA transferring the facility from EM-60 to EM-40. The signatures of the EM-60 and EM-40 representatives on the MOA shall indicate their concurrence with the end point completion report.

8.2.2 Updated Facility Drawings

These drawings include facility, room, and cell arrangements drawings to the extent they exist. However, except in unique circumstances, as-builts of the deactivated conditions are not provided. The

documentation addresses systems, such as water, sewer, air, electric, gas process (mechanical and chemical), and fire protection systems.

8.2.3 "As Left" Photos of Spaces and Major Equipment

Where available, these photos and descriptions document the status and condition of spaces for which access is not anticipated during S&M.

8.2.4 Radioactive Materials Inventory and Survey

This survey is an inventory of radioactive and fissile material remaining as contamination with characterization information, where available. It includes the final radiological/hazardous materials survey records, final configuration and surveillance and maintenance requirements, available drawings, specifications, procedures, manuals, and unplanned occurrences records applicable to the facility.

8.3 S&M TURNOVER PACKAGE

The S&M turnover package consists of a collection of documents required to support post-deactivation S&M activities. The level of detail depends on the S&M specific to the facility. The S&M Turnover Package Checklist reflects the documents required for this facility with respect to S&M turnover. The following sections detail the contents of the applicable sections required for Building 3019B.

8.3.1 Post-Deactivation S&M Plan

This document describes the S&M plan for the facility after deactivation is complete, up to the initiation of decommissioning. The S&M activities will be integrated into the decommissioning work and phased out as decommissioning is completed.

9. BUILDING 3019B PHOTOGRAPHS

The following photographs show the pre-deactivation and post-deactivation conditions of various areas of Building 3019B.

Fig. 1. Building 3019B Operating Area (Room 15) in Operation

Fig. 2. Pre-Deactivation Condition of Cell AC-1 Viewing Window

Fig. 3. Post-Deactivation Condition of Cell AC-1 Viewing Window

Fig. 4. Pre-Deactivation Condition of Building 3019B Roof

Fig. 5. Post-Deactivation Condition of Building 3019B Roof

Fig. 6. Pre-Deactivation Condition of Room 15, Facing South

Fig. 7. Post-Deactivation Condition of Room 15, Facing South

Fig. 8. Pre-Deactivation Condition of Room 15, Facing North

Fig. 9. Post-Deactivation Condition of Room 15, Facing North

Fig. 10. Pre-Deactivation Condition of Room 15 Ceiling

Fig. 11. Post-Deactivation Condition of Room 15 Ceiling

Fig. 12. Pre-Deactivation Condition of Building 3019B South Exterior Wall

Fig. 13. Post-Deactivation Condition of Building 3019B South Exterior Wall

Fig. 14. Pre-Deactivation Condition of Room 14

Fig. 15 Post-Deactivation Condition of Room 14

10. REFERENCES

Document Number	Document Title
ORNL/ER-322	<i>Work Plan for the High Ranking Facilities Deactivation Project at Oak Ridge National Laboratory, Oak Ridge, Tennessee</i>
ORNL/ER-141	<i>Annual Summary Report of the Decontamination and Decommissioning Surveillance and Maintenance Program at Oak Ridge National Laboratory for Period Ending September 30, 1992</i>
ORNL/CF-82/260	<i>Revised Safety Analyses for Building 3019-B</i>
ORNL/ER-60	<i>Annual Summary Report on Surveillance and Maintenance Activities of the Surplus Contaminated Facilities Program at Oak Ridge National Laboratory for Period Ending September 30, 1991</i>
HR-390-003-6	<i>Hot Cell Reference Guide - Building 3019B</i>
HRFDP/97/A/004	<i>High Ranking Facilities Deactivation Project FY 1996 Year End Summary Report</i>
N/A	<i>Fire Protection Engineering (FPE) Assessment - Building 3019</i>
ORNL-2989	<i>Plutonium Release Incident of November 20, 1959</i>
DOE/OR/01-1514&D1	<i>Removal Site Evaluation Report on Building 3019B at Oak Ridge National Laboratory, Oak Ridge, Tennessee</i>
HRFDP/97/006-D	<i>High Ranking Facilities Deactivation Project (HRFDP) End Point Determination - High Radiation Level Analytical Facility (3019B)</i>

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APPENDIX A

BUILDING 3019B FLOOR PLAN

BLDG. 3019B

APPENDIX B

BUILDING 3019B RADIOLOGICAL SURVEYS

ORNL Radiological Survey Data

Survey Number: 3019-97-0681

3019 Field Office

Date: 9/15/97

Time: 14:00

Surveyor Badge Number: 34006

☐ Routine Survey

RWP Number: 3019-1131

Building: 3019

Specific Location: ROOMS 13 & 14

COPY

Description:

PERFORMED COMPREHENSIVE MONTHLY SMEAR SURVEY OF ROOMS 13 AND 14.

Instruments Used and Calibration Due Date:

3019-06B	11/25/97	3019-15P	11/30/97	3019-12I	11/16/97	CTA-034	4/1/98
CTA-009	4/1/98	CTB-005	4/1/98	CTB-022	4/1/98		

General Description of Radiological Conditions:

CONTAMINATION AREA / RADIATION AREA

Division or Group Needing the Survey:

CTD

Person-hours spent on the survey:

12

of Pages: 3

Completed By: *N. S. C. R. f.*Reviewed by: *Sue at*

Date: 9/23/97

Smea Results (dpm/100 cm² unless noted)

Smear Number	α	β	Location	Smear Number	α	β	Location	Smear Number	α	β	Location
1			1000 WHEEL ASSEMBLIES	2			1000 WHEEL ASSEMBLIES	3	42		3000 WHEEL ASSEMBLIES
4			1000 WHEEL ASSEMBLIES	5			1000 WHEEL ASSEMBLIES	6			1000 WHEEL ASSEMBLIES
7			100,000 WHEEL ASSEMBLIES	8			220,000 WHEEL ASSEMBLIES	9			1000 WHEEL ASSEMBLIES
10			1000 WHEEL ASSEMBLIES	11			2000 WHEEL ASSEMBLIES	12			1500 WHEEL ASSEMBLIES
13			1000 WHEEL ASSEMBLIES	14			2000 WHEEL ASSEMBLIES	15			300 WHEEL BARS
16			273 WHEEL BARS	17			WHEEL BARS	18			798 WHEEL BARS
19			450 WHEEL BARS	20			WHEEL BARS	21			280 WHEEL BARS
22			TRACKS	23			210 TRACKS	24			238 TRACKS
25			TRACKS	26			TRACKS	27			TRACKS
28			4627 TRACKS	29			TRACKS	30			224 TRACKS
31			540 TRACKS	32			245 TRACKS	33			500 TRACKS
34			TRACKS	35			TRACKS	36			TRACKS
37			TRACKS	38			TRACKS	39			TRACKS
40			273 TRACKS	41			250 TRACKS	42			3199 TRACKS
43			1190 TRACKS	44			TRACKS	45			TRACKS
46			399 TRACKS	47			TRACKS	48			TRACKS
49			TRACKS	50			TRACKS	51			1000 IN GRATING
52			2000 IN GRATING	53			1000 IN GRATING	54			250 IN GRATING
55			1000 IN GRATING	56			30000 IN GRATING	57			15000 IN GRATING
58			25000 IN GRATING	59			25000 IN GRATING	60	518		3000 IN GRATING
61	420		1000 IN GRATING	62	42		500 IN GRATING	63			GEN. AREA FLOOR
64			GEN. AREA FLOOR	65			GEN. AREA FLOOR	66			GEN. AREA FLOOR
67			GEN. AREA FLOOR	68			GEN. AREA FLOOR	69			GEN. AREA FLOOR
70			GEN. AREA FLOOR	71			GEN. AREA FLOOR	72			GEN. AREA FLOOR
73			GEN. AREA FLOOR	74			GEN. AREA FLOOR	75			GEN. AREA FLOOR
76			GEN. AREA FLOOR	77			GEN. AREA FLOOR	78			GEN. AREA FLOOR
79			GEN. AREA FLOOR	80			GEN. AREA FLOOR	81			GEN. AREA FLOOR
82			GEN. AREA FLOOR	83			GEN. AREA FLOOR	84			GEN. AREA FLOOR
85			GEN. AREA FLOOR	86			GEN. AREA FLOOR	87			GEN. AREA FLOOR
88			203 GEN. AREA FLOOR	89			310 GEN. AREA FLOOR	90			371 GEN. AREA FLOOR
91			900 GEN. AREA FLOOR	92			GEN. AREA FLOOR	93			GEN. AREA FLOOR
94			GEN. AREA FLOOR	95			GEN. AREA FLOOR	96			GEN. AREA FLOOR
97			GEN. AREA FLOOR	98			GEN. AREA FLOOR	99			GEN. AREA FLOOR
100			GEN. AREA FLOOR	101			GEN. AREA FLOOR	102			GEN. AREA FLOOR

ORNL Radiological Survey Data

Survey Number: 3019-97-0681

3019 Field Office

Date: 9/15/97

Time: 14:00

103	-	GEN. AREA FLOOR	104	-	GEN. AREA FLOOR	105	-	GEN. AREA FLOOR
106	-	GEN. AREA FLOOR	107	-	GEN. AREA FLOOR	108	-	GEN. AREA FLOOR
109	-	GEN. AREA FLOOR	110	-	GEN. AREA FLOOR	111	-	ROOM 13 MAIN
112	-	ROOM 13 MAIN	113	-	ROOM 13 MAIN	114	-	ROOM 13 MAIN
115	-	ROOM 13 MAIN	116	-	ROOM 13 MAIN	117	-	821 ROOM 13 MAIN
118	-	ROOM 13 MAIN	119	-	ROOM 13 MAIN	120	-	ROOM 13 MAIN
121	-	ROOM 13 MAIN	122	-	ROOM 13 MAIN	123	-	ROOM 13 MAIN
124	-	ROOM 13 MAIN	125	-	ROOM 13 MAIN	126	-	416 ROOM 13 MAIN
127	-	220 ROOM 13 MAIN	128	-	899 ROOM 13 MAIN	129	-	ROOM 13 MAIN
130	-	ROOM 13 MAIN	131	-	RM. 13 BUFFER AREA	132	-	RM. 13 BUFFER AREA
133	-	RM. 13 BUFFER AREA	134	-	RM. 13 BUFFER AREA	135	-	292 RM. 13 BUFFER AREA
136	-	RM. 13 BUFFER AREA	137	-	RM. 13 BUFFER AREA	138	-	RM. 13 BUFFER AREA
139	-	RM. 13 BUFFER AREA	140	-	RM. 13 BUFFER AREA	141	-	RM. 13 BUFFER AREA
142	-	RM. 13 BUFFER AREA	143	-	RM. 13 BUFFER AREA	144	-	RM. 13 BUFFER AREA
145	-	RM. 13 BUFFER AREA	146	-	RM. 13 BUFFER AREA	147	-	RM. 13 BUFFER AREA
148	-	RM. 13 BUFFER AREA	149	-	RM. 13 BUFFER AREA	150	-	RM. 13 BUFFER AREA

COPY

ORNL Radiological Survey Data

Survey Number: 3019-97-0681

3019 Field Office

Date: 9/15/97

Time: 14:00

SMEARS#22-50

TRACKS: <20 D/M/100CM2 ALPHA

<200-4627 D/M/100CM2 BG

SMEARS#1-21

CELL DOOR WHEEL

ASSEMBLIES:

<20-42 D/M/100CM2

ALPHA

<200-220,000 D/M/100CM2 BG

(MAX. SMEAR READING

4.8 mrad/h contact)

SMEARS#51-62

IN GRATING:

<20-518 D/M/100 CM2

ALPHA

500-30000

D/M/100CM2 BG

SMEARS#111-130

ROOM 13 MAIN

<20 D/M/100CM2

ALPHA

<200-899

D/M/100CM2 BG

SMEARS#131-150

RM. 13 BUFFER

<20 D/M/100CM2

ALPHA <200-292

D/M/100CM2 BG

SMEARS#363-110

GEN. AREA FLOOR

ROOM 14

<20 D/M/100CM2 ALPHA

<200-900 D/M/100CM2 BG

COPY

NOTE:

SMEAR #S

MARKED WITH

UNUSED

NUMBERED

SMEARS

ON INDICATED

SURFACES.

#	- Smear Location	Boundary Designations	
#-#	- Large Area Smear	RA - Radiation Area	BA - Radiological Buffer Area
#	- Contact Dose Rate	HR - High Radiation Area	CA - Contamination Area
#	- 30 cm Dose Rate	VR - Very High Radiation Area	HC - High Contamination Area
#	- General Area Dose Rate	AR - Airborne Radioactivity Area	FC - Fixed Contamination Area
SOP	- Step-off Pad	PI - Potential Internal Contamination Area	IC - Internal Contamination Area
AS	- Air Sample Location	UM - Underground Radioactive Material Area	SC - Soil Contamination Area

The default units for dose rates are expressed in dose equivalent as mrem/h. If the dose rates are in units other than mrem/h (e.g., rem/h, umrem/h, etc.), then this shall be noted on the map. Dose rates designated on the survey indicate a summation of all the types of radiation detected, unless the indicated dose rate has a type-identifier with it (e.g., 2G). The type identifiers are as follows: B - Beta, G - Gamma, N - Neutron. Boundary designations are looking from the designations into the zoned area.

ORNL Radiological Survey Data

COPY

Survey Number: 3019-97-0629

3019 Field Office

Date: 9/3/97

Time: 15:02

Surveyor Badge Number: 29841

☒ Routine Survey

RWP Number: _____

Building: 3019

Specific Location: Room 12,15

Description:

Monthly smear survey.

Instruments Used and Calibration Due Date:

APC-002 10/31/97

CTA-034

4/1/98

CTB-022

4/1/98

General Description of Radiological Conditions:

Division or Group Needing the Survey: CTD

Person-hours spent on the survey: 1.5

of Pages: 2 Completed By: SM. J. Kelly Reviewed by: S. West Date: 9/9/97Smear Results (dpm/100 cm² unless noted)

Smear Number	α	β	Location	Smear Number	α	β	Location	Smear Number	α	β	Location
1	-	-	Floor	2	-	-	Floor	3	-	-	Floor
4	-	-	Floor	5	-	-	Floor	6	-	-	Floor
7	-	-	Floor	8	-	-	Floor	9	-	-	Floor
10	-	-	Floor	11	-	-	Floor	12	-	-	Floor
13	-	-	Floor	14	-	-	Floor	15	-	-	Floor
16	-	-	Floor	17	-	-	Floor	18	-	-	Floor
19	-	-	Floor	20	-	-	Floor	21	-	-	Floor
22	-	-	Floor	23	-	-	Floor	24	-	-	Floor
25	-	-	Floor	26	-	-	Floor	27	-	-	Floor
28	-	-	Floor	29	-	-	Floor	30	-	-	Floor
31	-	-	Floor	32	-	-	Floor	33	-	-	Floor
34	-	-	Floor	35	-	-	Floor	36	-	-	Floor
37	-	-	Floor	38	-	-	Floor	39	-	-	Floor
40	-	-	Floor	41	-	-	Floor	42	-	-	Floor
43	-	-	Floor	44	-	-	Floor	45	-	-	Floor
46	-	-	Floor	47	-	-	Floor	48	-	-	Floor
49	-	-	Floor	50	-	-	Floor	51	-	-	Floor

ORNL Radiological Survey Data

Survey Number: 3019-97-0629

3019 Field Office

Date: 9/3/97

Time: 15:02

# - Smear Location		Boundary Designations	
#—#	- Large Area Smear	RA - Radiation Area	BA - Radiological Buffer Area
#	- Contact Dose Rate	HR - High Radiation Area	CA - Contamination Area
#	- 30 cm Dose Rate	VR - Very High Radiation Area	HC - High Contamination Area
#	- General Area Dose Rate	AR - Airborne Radioactivity Area	FC - Fixed Contamination Area
SOP	- Step-off Pad	PI - Potential Internal Contamination Area	IC - Internal Contamination Area
AS	- Air Sample Location	UM - Underground Radioactive Material Area	SC - Soil Contamination Area

The default units for dose rates are expressed in dose equivalent as mrem/h. If the dose rates are in units other than mrem/h (e.g., rem/h, umrem/h, etc.), then this shall be noted on the map. Dose rates designated on the survey indicate a summation of all the types of radiation detected, unless the indicated dose rate has a type-identifier with it (e.g., 2G). The type identifiers are as follows: B - Beta, G - Gamma, N - Neutron. Boundary designations are looking from the designations into the zoned area.

ORNL Radiological Survey Data

COPY

Survey Number: 3019-97-0103

3019 Field Office

Date: 1/28/97

Time: 11:00

Surveyor Badge Number: 31995

☒ Routine Survey

RWP Number: 3019-97-0001

Building: 3019

Specific Location: rm. 13-14.

Description: Background re 4/16/97
quarterly smear survey

Instruments Used and Calibration Due Date:

3019-071 3/26/97

General Description of Radiological Conditions:

radiation/contamination area

Division or Group Needing the Survey:

CT

Person-hours spent on the survey: 1

of Pages: 2 Completed By: M.S. Poland

Reviewed by: J. Wray Date: 4/16/97

ORNL Radiological Survey Data

Survey Number: 3019-97-0103

3019 Field Office

Date: 1/28/97

Time: 11:00

all dose rates in mR/hr

COPY

COPY

MP
2-11-97

		Boundary Designations	
(#)	- Smear Location	RA - Radiation Area	BA - Radiological Buffer Area
(#) — (#)	- Large Area Smear	HR - High Radiation Area	CA - Contamination Area
#	- Contact Dose Rate	VR - Very High Radiation Area	HC - High Contamination Area
#	- 30 cm Dose Rate	AR - Airborne Radioactivity Area	FC - Fixed Contamination Area
#	- General Area Dose Rate	RM - Radioactive Materials Area	SC - Soil Contamination Area
SOP	- Step-off Pad	UM - Underground Radioactive Materials Area	
AS	- Air Sample Location		

Default units are in mR/hr and are for open window beta/gamma readings. Letter suffixes with the number indicate specific radiations: B - Beta (mRad/hr), G - Gamma (mR/hr), N - Neutron (mRem/hr). Boundary designations are looking from the designations into the zoned area.

APPENDIX C

USQD/3019-CTD/SSE-6/R0

USQD Number: USQD/3019-CTD/SSE-6/R0

Revision Number: 0

Date: 06/27/97

C-3

***UNREVIEWED SAFETY QUESTION DETERMINATION
FOR PHYSICAL CHANGES RELATED TO
THE ABANDONMENT OF BUILDING 3019B***

USQD Number: USQD/3019-CTD/SSE-6/R0

Revision Number: 0

Date: 06/27/97

C-4

REVISION LOG

REVISION NUMBER

R0

DESCRIPTION

Initial issue.

USQD Number: USOD/3019-CTD/SSE-6/R0

Revision Number: 0

Date: 06/27/97

Description of the item being evaluated: The planned abandonment of Building 3019B will involve physical configuration changes to services supplied to 3019B from Building 3019A. The nature of these changes is described below.

- 1) The HVAC supply and return ducts serving 3019B will be disconnected. These ducts supply air conditioning to the areas outside the 3019B hot cells. Ventilation confinement of the hot cells will continue to be provided by a separate system (i.e., laboratory off-gas). The HVAC ducts currently are routed through the 12.5-inch-thick wall which separates 3019A from 3019B. The duct sections passing through the wall will be removed and a ¼-inch-thick steel plate will be used to cover the wall openings. Fire caulking will be used to seal the space between the steel plate and the wall.
- 2) Process water, potable water, and steam lines serving 3019B will be blanked off and drained.
- 3) The sprinkler system serving Building 3019B will be deactivated (this deactivation is compensated by the installation of heat detectors, see item 4). The water supply to the sprinkler piping will be isolated by installing a 3-inch manual gate valve in the 3019B supply header. The supply header is routed through the 12.5-inch-thick wall which separates 3019A from 3019B. This same header also supplies Building 3135, sentry post 80. Therefore, isolation of the 3019B header will also deactivate the sprinkler system in Building 3135. The new valve will be installed on the 3019A side of the 12.5-inch-thick wall, a few inches from the point where the header penetrates the wall. The valve will be located in the drop ceiling in the 100 South corridor, just above the door leading to 3019B. Installation of the new valve will require relocation of an existing ¾-inch tee which supplies a branch line serving the 3019A, 100 South corridor and room 109.
- 4) A heat detector will be installed in the Radiological Buffer Area on the south side of the cells in 3019B. Additionally, two heat detectors will be installed in sentry post 80, Building 3135. These heat detectors, which are being installed to compensate for deactivation of automatic sprinklers, will be wired into the existing heat detector circuit protecting Building 3019B.
- 5) All fire extinguishers will be removed from 3019B in order to eliminate inspection, testing, and maintenance requirements. A fire extinguisher will remain located near the door between 3019A and 3019B.

- (1) Could the subject of this evaluation require a revision to the TSRs (Technical Specification or OSRs)? Yes___ No X

Justification: The current OSR contains Limiting Conditions for Operation (LCOs) for the Glove Box Off-Gas (GBOG) system and the Criticality Accident Alarm System (CAAS). Administrative controls are also included in the OSR which address the following:

- management responsibilities,
- control of the operational safety requirements,
- procedures,
- reviews and audits.

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- the unreviewed safety question program,
- the emergency preparedness program,
- the nuclear criticality safety program,
- the facility fire protection program,
- the radiation protection program,
- control of measuring and test equipment,
- the quality assurance program,
- conduct of operations program,
- conduct of maintenance program,
- occurrence reporting,
- qualifications and training,
- operability implementation principles, and
- facility inventory control.

The Design Features section of the OSR contains the following items: the 60-meter ventilation stack (3020), the process cells 1-7, and the shielding for the cell 4 and intercell storage wells.

The only OSR requirements potentially impacted by the proposed changes are the fire protection program requirements. The OSR facility fire protection program requirements are stated as follows:

“A program shall be established, implemented, and maintained for control of facility fire protection. This program should minimize the threats to the public health or welfare resulting from a fire, hazards to site personnel from a fire, and delays to DOE programs as a result of a fire.”

Although the sprinkler system in 3019B will be deactivated, several precautionary measures will be implemented which will reduce the probability of occurrence of a fire and improve the ability to detect and fight fires. All hazardous operations (cutting, welding, handling of combustibles, etc.) necessary to ready the facility for abandonment will be completed prior to sprinkler system deactivation. Combustible materials will be removed from the building to a level that is practical. The use of 3019B for storage of combustible items will be prohibited. Heat detectors will be installed in the building and monthly fire inspections and annual fire protection engineering assessments will be continued. In addition, 3019B is physically separated from 3019A by a 12.5-inch-thick wall with protected openings (i.e., fire doors) and penetrations. The newly installed, manual, 3-inch gate valve (located on the 3019A side of the 12.5-inch-thick wall) will permit reactivation of the sprinkler system should a fire occur. With these measures in place, the stated fire protection program requirements will still be met.

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USQD

- (2) Could the change or as-found condition increase the probability of occurrence of an accident previously evaluated in the authorization basis? Yes___ No X

Justification: The current authorization basis documentation for the facility consists of the following:

- 1) *Basis for Interim Operation, Building 3019 Complex - Radiochemical Development Facility*, BIO/3019-CTD/SSE/R0, June 11, 1996 with Safety Evaluation Report (06/10/96).
- 2) *Operational Safety Requirements for the Radiochemical Development Facility*, OSR/3019-CTD/R1, July 3, 1996 with Safety Evaluation Report (06/26/96).
- 3) *Unreviewed Safety Question Determination [Glovebox Off-Gas System Modification]*, USQD/3019/SSE01/R0, August 16, 1994.
- 4) *Unreviewed Safety Question Determination for the Receipt of U-233 from EG&G Mound Applied Technologies*, USQD/3019-CTD/SSE/R1, July 17, 1996.
- 5) *Safety Assessment, Radiochemical Development Facility (RDF), Building 3019 Complex UF₆ Trap Storage*, SA/3019-CTD/SSE-1/R0, October 21, 1996 with Unreviewed Safety Question Determination (USQD/3019-CTD/SSE-2/R0).
- 6) *Unreviewed Safety Question Determination for the Fabrication of Neptunium Test Targets*, USQD/3019-CTD/SSE-3/R0, October 22, 1996.
- 7) *Unreviewed Safety Question Determination for the Temporary Storage of two UF₆ Traps in the Building 3019 Penthouse*, USQD/3019-CTD/SSE-4/R0, November 27, 1996.

See Tables A-1 through A-3 at the end of this USQD for a listing of accidents identified in the BIO. Table A-4 lists events identified in the Mound USQD (item 4 above). Tables A-5 through A-7 list events identified in the MSRE Trap Storage Safety Assessment (item 5 above). Table A-8 lists events from the Neptunium Test Target USQD (item 6 above), and Table A-9 lists events from the Penthouse MSRE Trap Storage USQD (item 7 above).

The events potentially impacted by the proposed changes are events S3 (Table A-1), event PG10 (Table A-3), event SH5-3 (Table A-5), event 2 (Table A-8), and event TS-1 (Table A-9).

Events S3 (Table A-1) and SH5-3 (Table A-5) both evaluate the potential for a release of material from the 3019A process cell area (including the Cell 4 and intercell storage wells) during a major

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Revision Number: 0

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building fire. These events were determined to be incredible based on a previous analysis (BIO, Appendix A, reference A-10) which demonstrated that the massive 3019A cells were capable of surviving such a fire. None of the proposed changes impact the 3019A process cells and therefore, the probability of these events remains unchanged.

Event PG10 (Table A-3) and event 2 (Table A-8) both evaluate a major building fire and the effect of such a fire on a glovebox located in the 3019A laboratory area. The occurrence of a major building fire capable of causing a release of material from a laboratory glovebox was assigned a probability of extremely unlikely. This probability assignment was based on there being a lack of combustible material loading in the laboratory areas capable of supporting a major building fire. No credit for mitigation of the fire was assumed. A closely related event is TS-1 (Table A-9) which assumes that two MSRE traps temporarily stored in the 3019A Penthouse are involved in a major building fire. One of the traps is assumed to be stored in the Consolidated Edison Uranium Solidification Program (CEUSP) cask while the other is stored in the MSRE carrier. This event was also assigned a probability of extremely unlikely due to the short amount of time that the traps will be stored in the penthouse, and also due to the low likelihood that even a major building fire would be capable of heating the CEUSP cask or MSRE carrier enough to rupture the traps inside.

Several precautionary measures will be taken prior to deactivating the 3019B sprinkler system. All hazardous operations (cutting, welding, handling of combustibles, etc.) necessary to ready the facility for abandonment will be completed prior to deactivation. Combustible materials will be removed from the building to a level that is practically feasible. The use of 3019B for storage of combustible items will be prohibited. Heat detectors will be installed in the building and monthly fire inspections and annual fire protection engineering assessments will be continued. These precautionary measures, along with the physical separation of 3019B from 3019A by a 12.5-inch-thick wall with protected openings and penetrations, will greatly reduce the probability of occurrence of a major building fire. Therefore, the probability of events PG10, 2, and TS-1 will not be increased.

- (3) Could the change or as-found condition increase the consequences of an accident previously evaluated in the authorization basis? Yes___ No X

Justification: Events S3 (Table A-1) and SH5-3 (Table A-5) were determined to be incredible and therefore, have no consequences. The consequences determined for events PG10 (Table A-3), 2 (Table A-8), and TS-1 (Table A-9) are based on assumed amounts of material in process or storage in a 3019A laboratory glovebox or the Penthouse. The planned physical changes to 3019B will have no effect on the assumed 3019A inventories, and therefore, there will be no increase in the determined consequences.

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- (4) Could the change or as-found condition increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the authorization basis?

Yes___ No X

Justification: Equipment important to safety identified in the OSR for the facility includes the CAAS and GBOG systems, the 3020 stack, process cells 1-7 (structural integrity), and the shielding for the cell 4 and intercell storage wells. The only malfunction of equipment important to safety evaluated in the authorization basis involves failure of the GBOG system ductwork. The authorization basis documentation postulates failure of this equipment due to high winds, an earthquake, human error, or equipment failure. The GBOG system does not serve 3019B. Therefore, there are no aspects of the physical changes to 3019B which would increase the probability of occurrence of a malfunction of the GBOG system.

- (5) Could the change or as-found condition increase the consequences of a malfunction of equipment important to safety previously evaluated in the authorization basis?

Yes___ No X

Justification: The only malfunction of equipment important to safety evaluated in the authorization basis involves failure of the GBOG system ductwork. The GBOG system does not serve 3019B. The physical changes to 3019B will have no effect on the inventory of materials available for release from the areas which are served by the GBOG system. Therefore, the changes do not increase the consequences of a malfunction of the GBOG system.

- (6) Could the change or as-found condition create the possibility of a different type of accident than any previously evaluated in the authorization basis?

Yes___ No X

Justification: The primary accident of concern associated with the 3019B physical changes is the occurrence of a major building fire. This accident was evaluated previously in event S3 (Table A-1), event PG10 (Table A-3), event SH5-3 (Table A-5), event 2 (Table A-8), and event TS-1 (Table A-9). Therefore, no accidents of a different type are created.

- (7) Could the change or as-found condition create the possibility of a different type of malfunction of equipment important to safety than any previously evaluated in the authorization basis?

Yes___ No X

Justification: Equipment important to safety identified in the OSR for the facility includes the CAAS and GBOG systems, the 3020 stack, process cells 1-7 (structural integrity), and the shielding for the cell 4 and intercell storage wells. The only malfunction of equipment important to safety previously

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evaluated in the authorization basis documentation was a failure of the GBOG system ductwork. Building 3019B is not served by the GBOG system and therefore, no new malfunctions of the GBOG system are created by the physical changes. The 3019B changes are physically separated from the CAAS system, the 3020 stack, and the process cells and storage wells. The primary concern associated with these changes is the occurrence of a major building fire which is initiated in 3019B. The effect of a major building fire on the process cells and storage areas was previously evaluated in the BIO and the MSRE USQD. The proposed changes have no effect on the remaining items of equipment important to safety.

- (8) **Could the proposed activity or as-found condition reduce the margin of safety as defined in the basis for any Technical Safety Requirement (or Operational Safety Requirement)?**

Yes No X

Justification: The OSR for the Building 3019 complex does not include any Safety Limits (SLs) or Limiting Safety System Settings (LSSSs). The OSR does contain two Limiting Conditions for Operation (LCOs) which specify requirements for the CAAS and GBOG systems. There are no margins of safety defined in the basis for either of these requirements.

Special Conditions

The following special conditions were identified during the preparation of this USQD. These special conditions must be satisfied in order to ensure the conclusions which have been reached are not altered.

1. All hazardous operations (cutting, welding, handling of combustibles, etc.) necessary to ready Building 3019B for abandonment shall be completed prior to sprinkler system deactivation.
2. Combustible materials will be removed from Building 3019B to a level that is practical.
3. The use of 3019B for storage of combustible items will be prohibited.
4. Monthly fire inspections and annual fire protection engineering assessments of 3019B will be continued.

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Revision Number: 0

Date: 06/27/97

R. D. Nipper, Jr.
Preparer

6/27/97
Date

B. L. Atwell
Independent Reviewer

6/27/97
Date

Approvals:

PMK B. O. Patton
Facility Manager

6/27/97
Date

J. M. Keenan
Installation Facility
Safety Manager

6/27/97
Date

Table A-1 BIO STORAGE SCENARIO SUMMARY

ACCIDENT SCENARIO RELEASE DESCRIPTION	SCENARIO CASE S=Storage	ACCIDENT SCENARIO INITIATOR	FREQUENCY	MAR* Pu-EID gms [gms of isotope] (ARF/RF)	ASSUMPTIONS*	WORKER CONSEQUENCE RATING** / RISK RATING	PUBLIC CONSEQUENCE RATING / RISK RATING
S1. Powder release from storage area - ground release (external events)	S1a S1b S1c S1d	Earthquake (0.12g) External Explosion High Wind / Tornado Aircraft crash	unlikely incredible incredible incredible	17kg N/A N/A N/A		None / IV-Negligible N/A N/A N/A	None / IV-Neg. N/A N/A N/A
S2. Different types of criticality, due to loss of geometry in storage area (external events)	S2a S2b S2c S2d	Earthquake (0.12g) External Explosion Very High Wind Aircraft crash	unlikely incredible incredible incredible	N/A N/A N/A N/A		None / IV-Negligible N/A N/A N/A	None / IV-Neg. N/A N/A N/A
S3. Major building fire-consumes storage area	S3a S3b	Major building fire Earthquake/ Major fire	incredible incredible	N/A N/A		N/A N/A	N/A N/A
S4. Storage can fails due to extended storage period	S4a S4b	Corrosion / Radiolysis Pressurized can ruptures.	anticipated extr unlikely	462 (2E-3/0.3) 462 (9E-2/0.34)	bldg/3039 stack (DR=0.1) bldg/3039 stack (DR=0.1)	Neg / IV-Negligible Mod / III-Marginal	Low / III-Marginal Mod / III-Marginal
S5. Liquid spill from BT pit	S5a S5b S5c	Earthquake (0.12g) Human Err/Equip Fail Deflagration / Small Explosion	unlikely unlikely ext. unlikely	20.2 Pu-EID gm [2,313 Kg Th 185 gm U-233] (2E-4/0.5) N/A	lake dilution inhal pathway Lower deflagration limit is not reached	Neg / IV-Negligible Low / III-Marginal None / IV-Negligible	Low / III-Marginal Mod / II-Serious None / IV-Negligible
S6. Building 3100 Powder Release while inner containers are out of DOT Type B container	S6a S6b S6c	Earthquake (0.12 g) Small fire Human Error / Spill	extr unlikely extr unlikely anticipated	289 (1E-2/0.2) 289 (9E-2/0.34) 289 (2E-3/0.3)	-bldg intact stack release (DR=0.1) -bldg intact stack release -stack release	Neg / IV-Negligible Mod / III-Marginal Low / III-Marginal	Low / IV-Neg. Mod / III-Marginal Low / IV-Neg.
S7. DUOX powder release from penthouse	S7a S7b	High Wind/Earthquake Drum handling accident	unlikely anticipated	[700 Kg DUOX] (1E-2/0.2) [100 Kgs DUOX] (2E-3/0.3)	10 meter release DR = 10% material staged in penthouse, chemical hazard	Low/III-Marginal Low/III-Marginal	Low/III-Marginal Low/III-Marginal

* Weight is in dispersible form, the damage ratios (DR is given, if different from 1.0), release fractions, respirable fractions, are applied to this number for inhalation doses.

** Worker consequence above the consequences of any standard industrial accident. These consequences are related only to the nuclear source terms.

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Table A-2 BIO MULTI-KG PROCESSING IN HOT CELLS (AREA 2)
 (If Bldg intact, assumes NO filtration)
 (Assumes NO processing of gasses)

ACCIDENT SCENARIO RELEASE DESCRIPTION	SCENARIO CASE PC=Process in cell	ACCIDENT SCENARIO INITIATOR	FREQUENCY	MAR* Pu-EID gms [gms of isotopes] (ARF/RF)	ASSUMPTIONS*	WORKER CONSEQUENCE RATING** / RISK RATING	PUBLIC CONSEQUENCE RATING / RISK RATING
PC1. Powder release from CELL area, during unpack, repack/or crushing grinding operation (external events)	PC1	Earthquake (0.12 g)	unlikely	549 (1E-2/0.2)	Stack release (DR=0.1)	Neg /IV-Negligible	Low/III-Marginal
PC2. Powder spill in CELL area, during unpack, repack, crushing or grinding operation (internal event)	PC2a	Small nearby explosion in cell	ext. unlikely	549 (5E-3/0.3)	Stack release	Low/IV-Negligible	Mod/III-Marginal
	PC2b	Human Err/Equip Fail	anticipated	462 gms (2E-3/.3)	bldg/stack	Low/III-Marginal	Mod/I-Major
	PC2c	Pressurized can ruptures	extr unlikely	462 gms (9E2/0.34)	Stack release	Mod/III-Marginal	High/II-Serious
PC3. Small uranium metal chip fire in CELL area	PC3	Human Err	unlikely	462 gms (1E-3/1.0)	bldg/stack	Low/III-Marginal	Mod/II-Serious
PC4. Moderated criticality within CELL area	PC4	Human Err/Equip Fail	ext unlikely	10 ¹⁸ Fission Products (1.0 nobles, 0.25 iodines)	bldg/stack	Low/IV-Negligible	Low/IV-Negligible
PC5. Melter product release in CELL area	PC5	Human Err/Equip Fail	unlikely	29 gms (1.0/0.1)	bldg/stack (DR=0.1)	Mod/III-Marginal	Mod/II-Serious
PC6. Solution criticality in CELL area	PC6	Human Err/Equip Fail- 1 hour dose only	unlikely	2 X10 ¹⁸ Fission Products (1.0 nobles, 0.25 iodines)	bldg/stack	Low/III-Marginal	Low/III-Marginal
PC7. Explosive internal event in CELL due to ion exchange column resins	PC7	Human Err/Equip Fail	unlikely	87 gms (1E-2/0.6)	bldg/stack (DR=0.1)	Neg./IV-Negligible	Low/III-Marginal

* Weight is in dispersible form, the damage ratios (DR is defined if different from 1.0), release fractions, respirable fractions, and filter efficiencies are applied to this number

** Worker consequence above the consequences of any standard industrial accident. These consequences are caused by the event itself, and are related only to the nuclear source terms and consequences

Table A-2 BIO MULTI-KG PROCESSING IN HOT CELLS (AREA 2) cont.

(If Bldg intact, assumes NO filtration)

(Assumes NO processing of gasses)

ACCIDENT SCENARIO RELEASE DESCRIPTION	SCENARIO CASE PC=Process in cell	ACCIDENT SCENARIO INITIATOR	FREQUENCY	MAR* Pu-EID gm [gms of isotopes] (ARF/RF)	ASSUMPTIONS*	WORKER CONSEQUENCE RATING** / RISK RATING	PUBLIC CONSEQUENCE RATING / RISK RATING
PC8. Solution Spill (due to external event)	PC8	Earthquake (0.12 g)	unlikely	87 gms Pu-EID (2E-4/0.5)	-Slight inhalation dose -Bldg/stack release	Neg./IV-Negligible	Neg./IV-Negligible
PC9. Solution Spill or aerosolization from processing area during ANB, large scale operations with liquids (internal events in CELL area)	PC9a	Unattended Liquid vessel or piping leak	unlikely	87 gms Pu-EID (2E-4/0.5)		Neg./IV-Negligible	Neg./IV-Negligible
	PC9b	Human error/Equip fail (pressurized release)	unlikely	(1E-4/1.0)		Neg./IV-Negligible	Neg./IV-Negligible
	PC9c	Overheating/Equip fail/human error	unlikely	(1E-2/0.6)	Liquid boils	Low/III-Marginal	Mod/II-Serious
PC10. Building ventilation system severed	PC10a PC10b PC10c	Wind Earthquake Human Err/Equip Fail	unlikely unlikely anticipated	23.3 gms [500 grams U233, 10 PPM U232] (1E-3/1.0)	bldg/emergency ventilation secured in 24 hours (DR=0.1)	Neg./IV-Negligible Neg./IV-Negligible Neg./IV-Negligible	Neg./IV-Negligible Neg./IV-Negligible Neg./IV-Negligible
PC11. Release from filter pit due to earthquake	PC11	Earthquake (0.12 g)	unlikely	2.4E-4 [2.772E-3 gms ¹³⁷ Cs 4.8E-5 gms ²³⁵ U] (1E-2/1.0)	ground release	Neg./IV-Negligible	Neg./IV-Negligible
PC12. Hydrogen deflagration / small explosion during accessing of storage well.	PC12	Spark generated during removal of well shielding plates/plug.	ext. unlikely	6000 gms [13 bounding cans]	Only top can involved. (DR=1/13)	Mod/III-Marginal	High/II-Serious

* Weight is in dispersible form, the damage ratios (DR is defined if different from 1.0), release fractions, respirable fractions, and filter efficiencies are applied to this number

** Worker consequence above the consequences of any standard industrial accident. These consequences are caused by the event itself, and are related only to the nuclear source terms and consequences

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Table A-3 BIO MULTI-KG PROCESSING IN GLOVEBOX ROOMS (AREA 3)*

(If Bldg intact, assumes NO filtration)

(Assumes NO processing of gasses)

ACCIDENT SCENARIO RELEASE DESCRIPTION	SCENARIO CASE PG = Process in glovebox	ACCIDENT SCENARIO INITIATOR	FREQUENCY	MAR** Pu-EID gms [gms of isotopes] (ARF/RF)	ASSUMPTIONS**	WORKER CONSEQUENCE RATING*** / RISK RATING	PUBLIC CONSEQUENCE RATING / RISK RATING
PG1. Powder release from GBOX area, during unpack, repack/or crushing grinding operation (external events)	PG1a	Earthquake (0.12 g)	unlikely	549 (1E-2/0.2)	Gl. Release (DR=0.1)	Mod/ II-Serious	High/ I-Major
	PG1b	High wind destroys penthouse (Rm 201) glovebox	unlikely	549 (1E-2/0.2)	10 meter release	Mod/ II-Serious	High/ I-Major
PG2. Powder spill in GBOX area, during unpack, repack, crushing or grinding operation (internal event)	PG2a	Small nearby explosion in glovebox	ext. unlikely	549 (5E-3/0.3)	Stack release	Low/ IV-Negligible	Mod/ III-Marginal
	PG2b	Human err/Equip Fail	anticipated	462 gms (2E-3/.3)	bldg/stack	Low/ III-Marginal	Mod/ I-Major
	PG2c	Pressurized can ruptures	extr unlikely	462 gms (9E2/0.34)	Stack release	Mod/III-Marginal	High/II-Serious
PG3. Small uranium metal chip fire in GBOX area	PG3	Human Err	unlikely	462 gms (1E-3/1.0)	bldg/stack	Low/ III-Marginal	Mod/ II-Serious
PG4. Moderated criticality within GBOX area	PG4	Human Err	ext unlikely	10 ¹⁸ Fission Products (1.0 nobles, 0.25 iodines)	bldg/stack	High/ II-Serious	Low/ IV-Negligible
PG5. Melter product release in GBOX area	PG5	Human Err/Equip Fail	unlikely	29 gms (1.0/0.1)	bldg/stack (DR=0.1)	Low/ III-Marginal	Mod/ II-Serious
PG6. Solution criticality in GBOX area	PG6	Human Err/Equip Fail	unlikely	0.2 X10 ¹⁸ Fission Products (1.0 nobles, 0.25 iodines)	bldg/stack	High/ I-Major	Low/ III-Marginal
PG7. Explosive internal event in GBOX due to ion exchange column resins	PG7	Human Err/Equip Fail	unlikely	87 gms (1E-2/0.6)	bldg/stack (DR=0.1)	Mod/ II-Serious	Low/ III-Marginal

* Events involving the ventilation system and DUOX are covered in the cell processing table. They are not repeated here.

** Weight is in dispersible form, the damage ratios (DR is defined if different from 1.0), release fractions, respirable fractions, and filter efficiencies are applied to this number

*** Worker consequence above the consequences of any standard industrial accident. These consequences are caused by the event itself, and are related only to the nuclear source terms and consequences

Table A-3 BIO MULTI KG HANDLING AND PROCESSING IN GLOVEBOX ROOMS (AREA 3)* cont.

(If Bldg intact, assumes NO filtration)

(Assumes NO processing of gasses)

ACCIDENT SCENARIO RELEASE DESCRIPTION	SCENARIO CASE PG= Process in glovebox	ACCIDENT SCENARIO INITIATOR	FREQUENCY	MAR** Pu-EID gm [gms of isotopes] (ARF/RF)	ASSUMPTIONS**	WORKER CONSEQUENCE RATING*** / RISK RATING	PUBLIC CONSEQUENCE RATING / RISK RATING
PG8. Solution Spill (external events)	PG8	Earthquake (0.12 g)	unlikely	87 gms Pu-EID (2E-4/0.5)	-Slight inhalation dose -Bldg/stack release	Neg/ IV-Negligible	Neg/ IV-Negligible
PG9. Solution Spill or aerosolization from processing area during ANB large scale operations with liquids(internal events in GBOX area)	PG9a	Unattended Liquid vessel or piping leak	unlikely	87 (2E-4/0.5)		Neg/ IV-Negligible	Neg/ IV-Negligible
	PG9b	Human err/Equip fail (pressurized release)	unlikely	(1E-4/1.0)		Neg/ IV-Negligible	Neg/ IV-Negligible
	PG9c	Overheating/Equip fail/human error	unlikely	(1E-2/0.6)	Liquid boils	Low/ III-Marginal	Mod/ II-Serious
PG10. Major building fire impacts room with glovebox which contains powders	PG10	building fire spreads to laboratory area causing pressurized powder release	extr. unlikely	549 (9E-2/0.34)	building ventilation system is destroyed/fire plume rise of 200 meters	Mod/ III-Marginal	Mod/ III-Marginal

- Events involving the ventilation system and DUOX are covered in the cell processing table. They are not repeated here.
- ** Weight is in dispersible form, the damage ratios (DR is defined if different from 1.0), release fractions, respirable fractions, and filter efficiencies are applied to this number
- *** Worker consequence above the consequences of any standard industrial accident. These consequences are caused by the event itself, and are related only to the nuclear source terms and consequences

Table A-4 MOUND HANDLING RELATED SCENARIOS
(See legend below for abbreviations)

Accident Scenario Release Description	Initiator	Frequency	MAR Disp gms PuEID	Release Characteristics	D.R./ARF/RF	Worker Consequence (BV-in fac/risk rating) ^{1,2}	Public Consequence (BV/Risk Rating) ¹	Comments (references to BIO scenario)
1. Load drop (approximately 30 feet) of a single 6M container during lift to crane bay	equip fail	unlikely	21.6	ground level (gl) release	0.05/1E-2/0.2	Low-Neg/III-Marg	0.15R-mod/II-Serious	bounded by PG1a (eq.init gl release)
2. Drop (5 feet) of single can of powder in penthouse	human error or equip fail	anticip	10.8	cell off gas-to 60M stack	0.1/1E-2/0.2	Neg-Neg/IV-Minor	.0011R-Neg/IV-Minor	bounded by PG2 (see PC2b)
3. Drop (appro 35 feet) of can of powder down storage well impacting can(s) below it	equip fail	anticip	21.6	vessel off gas-3039 stack (76M)	0.1/1E-2/0.2	Neg-Neg/IV-Minor	.0016R-Neg/IV-Minor	bounded by PG2 (see PC2b)
4. High winds or tornado damages penthouse during operations	nat phen	unlikely	108 (5X21.6)	10 M release	0.2/1E-2/0.2	Low-Neg/III-Minor	0.46R-mod/II-Serious	bounded by PG1b, the max. amount of material out of type B is 21.6 gms, well below recommended 200 gms in BIO
5. Criticality		incredible						See NCSA ID No. 17, CAAS Evaluation.

¹For explanation of consequence and risk ratings see BIO/3019-CTD/SSE/R0, Appendix A, pg. A-15.

²The risk rating is based on the higher of the facility worker consequences or the on-site (BV) consequences.

ARF = Airborne Respirable Fraction

NCSA = Nuclear Criticality Safety Assessment

BIO = Basis for Interim Operation

Neg = negligible

BV = Bethel Valley Road

PuEID = ²³⁹Pu equivalent inhalation dose

CAAS = Criticality Accident Alarm System

RF = Respirable Fraction

Disp = Dispersible grams

D.R. = Damage Ratio

eq. = earthquake

fac = facility

gl = ground level

gms = grams

init. = initiated

MAR = Material at Risk

mod = moderate

Table A-5 Building 3019 MSRE Storage Related Scenarios
(For Interim Storage Only, Evolutions SH4 and SH5)

Accident Scenario Release Description	Initiator	Frequency	MAR R-Radioactive (Total Pu:Dispersible PuEID) C-Chemical (gms)	D.R.:ARF:RF	Worker Consequence ^{1,2} (BV-in fac/rating)	Dose at BV- Public Cons / Risk Rating ¹	Comments or references to BIO scenario
SH4-1. A trap fails in cell 1 due to overpressurization, faulty valve or corrosion.-signif radiolysis	Unantic phen/manuf defect	ext unlikely	R-2 ML traps-(66 gms: 6.6 gms) C-2 ML traps (54 gms F2)	0.5 : 9E-2 : 0.34 (only 1 trap fails) 0.5 :1.0:1.0	Neg-Neg/IV NA-Low/IV	.05rem-Low/IV .003PPM-Low/IV	Bounded by BIO event PC2c
SH4-2. Criticality in cell 1	trap contents released in unfav. geom. with several liters of water	incredible	R-Crit fission products 10 ¹⁸ fissions C-54 gms F2 C-738 gms HF	-See BIO PC 4 1.0:1.0:1.0 1.0:1.0:1.0			Similar to BIO event PC4, but storage only no process. See NCSAs-47 and 48
SH4-3 Small fire in cell	combust load in cell plus trap manuf defect	incredible (see comment)	R-2 ML traps (66 gms: 6.6 gms) C-54 gms F2 C-738 gms HF				Extremely low combustible cell loading.
SH4-4 Trap crushed by falling debris	earthquake (0.12g)	incredible (see comment)	R-2 ML traps (66 gms: 6.6 gms) C-54 gms F2				No potential energy sources.
SH5-1 Trap fails in storage well	Unantic phen/manuf defect	ext unlikely	R-9 ML traps (297 gms: 29.7 gms) C-243 gms F2	.11 : 9E-2 : 0.34 (1 trap out of 9 fails) .11:1.0:1.0	Neg-Neg/IV NA-Low/IV	.05rem-Low/IV .003PPM Low/IV	Bounded by BIO event S4
SH5-2 Criticality in storage well	trap contents released in unfav. geom. with several liters of water	incredible	R-9 ML traps -Crit FP at 10 ¹⁸ fissions C-243 gms F2 C-3321 gms HF	-See BIO event S2 1.0:1.0: 1.0 1.0:1.0: 1.0			No known initiator (see BIO PHA event S2, NCSA 47, and NSR-32)
SH5-3 Release from well (and storage cell) due to major building fire	earthquake then fire or major building fire	incredible (see comment)	R-9 ML traps (297 gms: 29.7 gms) C-243 gms of F2 C-3321 gms of HF				See BIO event S3

- chemical toxicity of UF6 is modelled assuming total reaction with atmospheric moisture, producing HF, radiological inhalation consequences of reacted UF6 modelled by looking at inhalation of UO2F2
- for criticalities, it is assumed that one trap overpressurizes and there is a radioactive powder release equivalent to SH4-1 plus criticality fission product consequences
- NA-Not applicable, worker chemical consequences for BV road are only applicable for high consequences (>ERPG-3 at 240 meters)
- See notes and abbreviation/acronym list at end of tables.

**Table A-6 Building 3019 MSRE Handling Related Scenarios
(For Handling Only, Evolutions SH1 and SH2)**

Accident Scenario Release Description	Initiator	Frequency	MAR R-Radioactive (Total Pu-EID:Disp PuEID gms) C-Chemical (gms)	D.R./ARF/RF	Worker Consequence ^{1,2} (BV-in fac/rating)	Dose at BV- Public Cons/ Risk Rating ¹	Comments or references to BIO scenario
SH1-1 Drop of shielded carrier with trap (approximately 20 ft) during lift up to penthouse, carrier/trap falls just outside bldg 3019	broken cable	unlikely	R-undecayed, 1 ML trap (2 gm: 0.2 gm) (no fluorine assumed due to fresh trap)	1.0 : 1.0E-2 : 0.2 (Ground Level)	Neg-Neg/IV	.029rem-Low/III	Bounded by USQD/3019-CTD/SSE/R0 scenario 1.
SH1-2 Fire while unloading truck at time of can transfer into the cask	leaking gas tank	incredible (see comment)	R- undecayed, 1 ML trap (2 gm: 2 gm) C-369 gms of HF only if UF6 escapes (no fluorine assumed due to fresh trap)				# x'fers, time for event, & configuration
SH2-1 Drop of empty shielded carrier on 2 traps in cell (approx 50 ft)	broken cable	unlikely	R-2 ML traps (66 gms: 6.6 gms) C-54 gms F2	1.0: 1.0E-2 : 0.2 1.0 : 1.0 : 1.0	Neg-Neg/IV NA-Low/III	.007rem-Neg/IV .006PPM-Low/III	Bounded by BIO event PC2b
SH2-2 Drop of shielded carrier (containing trap) on 1 trap in the cell (approx. 50 ft) (also bounds falling trap out of carrier impinging on a trap in cell)	broken cable	unlikely	R-2 ML traps (66 gms: 6.6 gms) C-54 gms F2	1.0 : 1.0E-2 : 0.2 1.0:1.0:1.0	Neg-Neg/IV NA-Low/III	.007rem-Neg/IV .006PPM-Low/III	Bounded by BIO event PC2b
SH2-3 Drop of trap out of shielded carrier into storage well onto stored trap (assume a 30 ft drop)	broken cable	unlikely	R-2 ML traps (66 gms: 6.6 gms) C-54 gms F2	1.0: 1.0E-2 : 0.2 1.0:1.0:1.0	Neg-Neg/IV NA-Low/III	.007rem-Neg/IV .006PPM-Low/III	Bounded by BIO event S4a
SH2-4 Drop of trap out of shielded carrier into storage well onto stored trap (assume a 30 ft drop)	human err	anticipated	R-2 ML traps (66 gms: 6.6 gms) C-54 gms F2	1.0: 1.0E-2 : 0.2 1.0:1.0:1.0	Neg-Neg/IV NA-Low/III	.007rem-Neg/IV .006PPM-Low/III	Bounded by BIO event S4a

- chemical toxicity of UF6 is modelled assuming total reaction with atmospheric moisture, producing HF, radiological inhalation consequences of reacted UF6 modelled by looking at inhalation of UO2F2
- NA-Not applicable, worker chemical consequences for BV road are only applicable for high consequences (> ERPG-3 at 240 meters)
- See notes and abbreviation/acronym list at end of tables.

Table A-7 Building 3019 MSRE Handling Related Scenarios (No Ventilation)-10 Meter Releases
(For Handling Only, Evolutions SH1 and SH2)

Accident Scenario Release Description	Initiator	Frequency	MAR R-Radioactive (Total Pu-EID:Disp PuEID gms) C-Chemical (gms)	LPF/D.R./ARF/ARR	Worker Consequence ^{1,2} (BV-in fac/rating)	Dose at BV- Public Cons/ Risk Rating ¹	Comments (references to BIO scenario)
SH2-1 Drop of empty shielded carrier on 2 traps in cell (approx 50 ft)	broken cable	unlikely	R-2 ML traps (66 gms: 6.6 gms) C-54 gms F2	0.6: 1.0: 1.0E-2: 0.2 1.0: 1.0: 1.0: 1.0	Neg-Neg/IV NA-Low/III	.08rem-Low/III .12PPM-Low/III	Bounded by BIO event PC2b
SH2-2 Drop of shielded carrier (containing trap) on 1 trap in the cell (approx. 50 ft) (also bounds falling trap out of carrier impinging on a trap in cell)	broken cable	unlikely	R-2 ML traps (66 gms: 6.6 gms) C-54 gms F2	0.6: 1.0: 1.0E-2: 0.2 1.0: 1.0: 1.0: 1.0	Neg-Neg/IV NA-Low/III	.08rem-Low/III .12PPM-Low/III	Bounded by BIO event PC2b
SH2-3 Drop of trap out of shielded carrier into storage well onto stored trap (assume a 30 ft drop)	broken cable	unlikely	R-2 ML traps (66 gms: 6.6 gms) C-54 gms F2	0.6: 1.0: 1.0E-2: 0.2 1.0: 1.0: 1.0: 1.0	Neg-Neg/IV NA-Low/III	.08 rem-Low/III .12PPM-Low/III	Bounded by BIO event S4a
SH2-4 Drop of trap out of shielded carrier into storage well onto stored trap (assume a 30 ft drop)	human err	anticipated	R-2 ML traps (66 gms: 6.6 gms) C-54 gms F2	0.6: 1.0: 1.0E-2: 0.2 1.0: 1.0: 1.0: 1.0	Neg-Neg/IV NA-Low/III	.08rem-Low/III .12PPM-Low/III	Bounded by BIO event S4a

¹For explanation of consequence and risk ratings see BIO/3019-CTD/SSE/R0 (ref. 2), Appendix A, pg. A-15.

²The risk rating is based on the higher of the facility worker consequences or the on-site (BV) consequences.

approx. = approximately

ARF = Airborne Respirable Fraction

BIO = Basis for Interim Operation

BV = Bethel Valley Road

cons = consequence

crit = criticality

Disp = Dispersible grams

D.R. = Damage Ratio

ERPG = Emergency Response Planning Guideline

err = error

ext = extremely

FP = fission products

ft = feet

F2 = fluorine

geom = geometry

gms = grams

HF = Hydrofluoric Acid

in fac = in facility (i.e., facility worker)

LPF = Leak Path Factor

MAR = Material at Risk

ML = Maximally Loaded Trap

munuf = manufacturer

Neg = negligible

PHA = Process Hazards Analysis

phen = phenomena

PPM = parts per million

Pu = ²³⁹Pu

PuEID = ²³⁹Pu equivalent inhalation dose

Rad = radiation consequences

RF = Respirable Fraction

signif = significant

unantic = unanticipated

undet = undetectible

unfav = unfavorable

UO2F2 = Uranium Oxyfluoride

x'fers = number of transfers

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Table A-8 Np-237-Test Target Fabrication Related Scenarios

Accident Scenario Release Description	Initiator ¹	Frequency	MAR Disp gms PuEID (gms Np237)	Release Characteristics	D.R./ARF/RF	Worker Consequence (BV-in fac/rating) ^{1,2}	Dose at BV-Pub Cons/ Risk Rating ¹	Comments (references to BIO scenario)
1. Use of alcohol in the glovebox results in a fire, putting at risk the 25 gm in-process inventory	human error	unlikely	0.3 gms (25 gms Np237)	60 M stack release	1.0/6E-3/1E-2 p 4-56, 4-57 in Mishima	Neg/Neg	8E-6 REM-Neg/Neg	consequences bounded by PG10 - Bldg. fire impacts glovebox.
2. Large fire in room 112 puts entire 200 gram inventory at risk	human error/equip failure	extremely unlikely	2.2 gms (200gms Np237)	60 M stack release	1.0/6E-3/1E-2 p 4-56, 4-57 in Mishima	Neg/Neg	6E-5 REM-Neg/Neg	consequences bounded by PG10 - Bldg. fire impacts glovebox.
3. During milling of plate inside hood (connected to lab off-gas system), mistake is made and Np237 compact is cut	human error	anticipated	0.07 gms (6.25 gms Np237)	60 M stack release	1E-2/1/1	Neg/Neg	.0004REM-Neg/Neg	bounded by all PG2 type accidents
4. Aluminum powder is airborne exterior to glove box during Al powder measuring step, and explosion results, falling debris aerosolizes all nearby Np powder; conservatively assume building confinement is breached	compound human error	extremely unlikely	2.2 (200 gms Np237, assume entire inventory)	ground level release	1.0/1E-2/0.2 (conserv-selected based on falling debris (see p4-87 Mishima)	Low-Low/IV-Minor (Radiological cons only)	0.31REM-Mod/III-Marg	Operator would have to trip, throwing Al powder into air with sufficient dispersal-conservative to assume building is breached
5. While in glovebox, all 4 jars are spilled, spilling 25 gms of Np and aerosolizing mix of NpO2 and Al powder, explosion occurs; glovebox is breached, bldg. stays intact.	human error/unlikely equipment interaction	extremely unlikely	0.3 gms (25 gms Np237)	60 M release	1.0/1.0/1.0 (conservative, however, its a powder explosion)	Low-Low/IV-Minor (Radiological cons only)	0.16 REM-Mod/III-Marg	Operator would have to disperse all 4 jars, estimated frequency may be incredible, however, recommend only one jar opened at any time.
6. Earthquake, high winds, or tornado damages room 112 during operations	nat phen	unlikely						bounded by PG1a due to low MAR
7. Criticality		incredible						FMCL for NP237 = 7100 grams

¹For explanation of consequence and risk ratings see BIO/3019-CTD/SSE/R0, Appendix A, pg. A-15.

²The risk rating is based on the higher of the facility worker consequences or the on-site (BV) consequences.

ARF = Airborne Respirable Fraction

BIO = Basis for Interim Operation

BV = Bethel Valley Road

Disp = Dispersible grams

D.R. = Damage Ratio

fac = facility

FMCL = Fissionable Material Control Limit

gms = grams

init. = initiated

MAR = Material at Risk

mod = moderate

Neg = negligible

PuEID = ²³⁹Pu equivalent inhalation dose

RF = Respirable Fraction

Table A-9 Scenarios for Temporary Storage (TS) of Two Traps on Penthouse floor.

Case	Accident Scenario Description	Initiator	Freq	TOTAL MAR R-Radioactive (gms Pu-EID) C-Chemical (gms HF)	Disp MAR R-gms Pu-EID C-gms HF	LPF	D.R	ARF	RF	Rel Ht (M)	BV/Pk Consq R-REM C-PPM	Public Consq ¹	Coloc Wrkr Consq ¹	In-fac Wrkr Consq ¹	Worker Risk Rating ^{1,2}	Public Risk Rating ¹	Comments
TS-1	Major Bldg fire-CEUSP cask and MSRE carrier impacted, 2 Max loaded traps fail due to heat, giving off UF6	Multiple failures-spread of small fire	EUL	R-6.0 gms (2ML traps; decay 4 wks) C-738 gms	R-6.0 gms C-738 gms	1.0	1.0	1.0	1.0	60.0	R-3.154 C-0.16	MOD LOW	MOD NA	NEG LOW	III-Marg IV-Neg	III-Marg IV-Neg	Similar to BIO case PG10-but lower plume rise assumed
TS-2	Seismic event occurs, penthouse collapses, traps in CEUSP cask and MSRE carrier crushed on penthouse floor	Seismic	UNL	R-6.0 gms (2ML traps; decay 4 wks)	R-0.6 gms	1.0	0.1	0.0 1	0.2	10.0	0.0013	NEG	NEG	LOW	III-Marg	IV-Neg	MAR below 200 gm PH limit; Bounded by BIO scenario PG1a
TS-3	High wind occurs, penthouse collapses, traps in CEUSP cask and MSRE carrier are crushed on penthouse floor by debris	High wind	UNL	R-6.0 gms (2ML traps; decay 4 wks)	R-0.6 gms	1.0	1.0	0.0 1	0.2	10.0	0.013	LOW	NEG	LOW	III-Marg	III-Marg	MAR below 200 gm PH limit; Bounded by BIO scenario PG1b

¹For explanation of consequence and risk ratings see BIO/3019-CTD/SSE/RO, Appendix A, pg. A-15.

²The risk rating is based on the higher of the facility worker consequences or the on-site (BV) consequences.

ARF = Airborne Release Fraction
 BIO = Basis for Interim Operation
 Bldg = Building
 BV = Bethel Valley Road
 CEUSP = Consolidated Edison Uranium Solidification Project
 Coloc = co-located
 consq = consequences
 Disp = Dispersible grams
 D.R. = Damage Ratio

EUL = Extremely Unlikely
 fac = facility
 Freq = Frequency
 gms = grams
 HF = hydrofluoric acid
 In-fac = in-facility
 LPF = Leak Path Factor
 MAR = Material at Risk
 Marg = Marginal
 M = meters

Max = Maximum
 ML = Maximally Loaded
 MOD = moderate
 MSRE = Molten Salt Reactor Experiment
 NA = Not Applicable
 NEG = negligible
 PH = Penthouse
 Pk = Peak
 PPM = Parts per Million
 Pu-EID = ²³⁸Pu equivalent inhalation dose

Rel Ht = Release Height
 RF = Respirable Fraction
 UNL = Unlikely
 wks = weeks
 Wrkr = workers

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