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Decommissioning Operations Plan

For The 779 Cluster Interim Measure/Interim Remedial Action

OCTOBER 1997

B779-A-00004

DECOMMISSIONING OPERATIONS PLAN

TABLE OF CONTENTS

ATTACHMENT

APPENDICES

FIGURES

TABLES

ACRONYMS

AB	Authorization Basis
ACBM	Asbestos Containing Building Material
ACM	Asbestos Containing Materials
AEA	Atomic Energy Act
AHA	Activity Hazard Analysis
ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
AP	Alkaline Permanganate
APEN	Air Pollution Emission Notification
ARAR	Applicable or Relevant and Appropriate Requirements
ATS	Automatic Transfer Switch
BE	Beryllium
BIO	Basis of Interim Operation
BOM	Bill of Material
BRCS	Building Radiation Cleanup Standard
CA	Contaminated Areas
CAA	Clean Air Act
CDPHE	Colorado Department of Public Health and the Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CID	Cumulative Impact Document
COEM	Conduct Of Engineering Manual
COOP	Conduct Of Operations Manual
CSOL	Criticality Safety Operating Limit
CWA	Clean Water Act
CWTF	Consolidated Water Treatment Facility
D&D	Decontamination and Decommissioning
dB	Decibels
DD&D	Decontamination, Decommissioning, and Demolition
DF	Decontamination Factors
DOE	Department Of Energy
DOP	Decommissioning Operations Plan
DOR	Direct Oxide Reduction
DOT	Department of Transportation
dpm	Disintegrations per minutes
DPMP	Decommissioning Program Management Plan
DPP	Decommissioning Program Plan
DQO	Data Quality Objective
E/C/D/F	Engineering/Construction/Decommissioning/Facilities
EB	Electron Beam
EDE	Effective Dose Equivalent
EMCC	Emergency Motor Control Centers
EO	Engineering Orders
EPA	Environmental Protection Agency
ER	Electro-refining
ESCA	Electron Spectroscopy for Chemical Analysis
ESH&Q	Environment, Safety, Health and Quality
FCR/FCN	Field Change Requests/Field Change Notices
FP	filter plenum
GB	Glovebox
HAP	Hazardous Air Pollutant
HASP	Health and Safety Plan
HCl	Hydrochloric Acid
HEPA	High Efficiency Particulate Air
HVAC	Heating, Ventilation and Air Conditioning
IH	Industrial Hygiene

IH&S	Industrial Hygiene & Safety
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action
IWCP	Integrated Work Control Program
JCO	Justification for Continued Operation
K-H	Kaiser-Hill
kW	Kilowatt
LDR	Land Disposal Restriction
LL	Low Level
LLM	Low Level Mixed
LLW	Low Level Waste
LRA	Lead Regulatory Agency
MAA	Material Access Area
MAAL	Maximum allowable asbestos level
µg	Micrograms
MARSSIM	Multi-Agency Radiological Survey and Site Investigation Manual
MCC	Motor Control Centers
MCL	Maximum Contaminant Level
MSE	Molten Salt Extraction
NAAQ	National Ambient Air Quality
NaCl	Sodium Chloride
NCP	National Contingency Plan
NCR	Non-Conformance Reporting
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
NMC	Nuclear Material Control
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NUREG	Nuclear Regulation
OSHA	Occupational Safety and Health Act
OSR	Operational Safety Requirements
PA	Protected Area
PAP	Process Air Programmer
PCB	Polychlorinated Biphenyl
PE	Project Engineer
PEL	Personnel Exposure Limit
PHA	Preliminary Hazard Analysis
PM	Project Manager
PMJ	Preble's Meadow Jumping
PNL	Pacific Northwest Laboratories
PPE	Personnel Protective Equipment
ppm	parts per million
psi	per square inch
PU&D	Property Utilization and Disposal
QA	Quality Assurance
QAP	Quality Assurance Program
QCR	Quality Condition Reporting
R&D	Research and Development
RBA	Radiological Buffer Area
RCM	Radiological Controls Manual
RCRA	Resource Conservation and Recovery Act
RCT	Radiation Control Technicians
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site

RFETS	Rocky Flats Environmental Technology Site
RLCR	Reconnaissance Level Characterization Report
RMRS	Rocky Mountain Remediation Services, L.L.C.
RPOSO	Radiation Protection and Occupational Safety Officer
RWP	Radiological Work Permits
SAAM	Selective Alpha Air Monitors
SAR	Safety Analysis Report
SARA	Superfund Amendments and Reauthorization Act
SEM	Scanning Electron Microscope
SHPO	State Historic Preservation Officer
SME	Subject Matter Expert
SNM	Special Nuclear Materials
SRA	Supporting Regulatory Agencies
SSOC	Safe Sites of Colorado
TBC	To-Be-Considered
TCLP	Toxicity Characteristic Leaching Procedure
TEM	Transmission Electron Microscope
TIRA	Temperature Indicating, Recording and Enunciating
TRU	Transuranic
TRM	Transuranic Mixed
TSCA	Toxic Substances Control Act
TSD	Treatment, Storage, Disposal
TSDF	Treatment Storage Disposal Facility
TWA	Time Weighed Average
TU	Temporary Units
UL	Underwriters Laboratories
UHC	Uniform Health Code
UPS	Uninterrupted Emergency Power Supply
VOC	Volatile Organic Compound
WAC	Waste Acceptance Criteria
WIPP	Waste Isolation Pilot Program
WMP	Waste Management Plan
WSRIC	Waste Stream Residue Identification and Characterization

DECOMMISSIONING OPERATIONS PLAN FOR THE 779 CLUSTER INTERIM MEASURE/INTERIM REMEDIAL ACTION

1.0 INTRODUCTION, PROPOSED ACTION, NATURE OF CONTAMINATION

1.1 INTRODUCTION

On July 19,1996, the Rocky Flats Clean-up Agreement (RFCA) was signed by Department Of Energy (DOE), the Colorado Department of Public Health and the Environment (CDPHE) and the Environmental Protection Agency (EPA). RFCA is the document which will govern the clean-up and decommissioning of the Rocky Flats Environmental Technology Site (RFETS) facilities. The clean-up actions will be completed as Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) removal actions. The 779 Cluster project will be conducted as an IM/IRA due to the estimated time (>6 months) from commencement of physical remedial work to completion. In compliance with RFCA, DOE has developed this Decommissioning Operations Plan (DOP) which outlines how the RFETS decommissioning activities for the 779 Cluster will be managed and controlled. RFCA also requires that a DOP be developed for the most hazardous facilities at RFETS. As the integrating contractor at RFETS, Kaiser-Hill Company, L. L. C. (K-H) has developed a Decommissioning Program Management Plan (DPMP), a Site wide management and project planning document, to identify how the RFETS decommissioning program will be implemented and monitored. The referenced procedures and project documents are identified to add clarity to the document. The DOP and the Reconnaissance Level Characterization Report (RLCR) will be transmitted to the Lead Regulatory Agency (LRA) for approval in accordance with RFCA. The other project documents (e.g., the Demolition Plan) will be supplied to the LRA for review and comment.

RFCA identifies six facilities which will require a DOP and states that other facilities may require a DOP. The necessity for a DOP is based on the hazards identified in the facilities' Reconnaissance Level Characterization Report (RLCR) and as negotiated with the LRA. The 779 Cluster (identified in Figure 1-1 and 1-2) is not one of the seven facilities identified in RFCA as requiring a DOP, but because the 779 Cluster is the first plutonium operations building to be decommissioned, it was identified by DOE as a pilot project. The 779 Cluster DOP will be used to define the detail required in future DOPs, how the DOP should be structured, and how the DOP will be used during the decommissioning implementation. This document is the DOP for the 779 Cluster. The hierarchy of decommissioning documents to be used in completing the 779 Cluster decommissioning is identified in Figure 1-3 of this document. The shaded boxes in Figure 1-3 identify the Site procedures that are incorporated into the Integrated Work Control Program (IWCP).

Prior to the start of decommissioning activities, the 779 Cluster goes through a deactivation process as described in the RFCA and the DPMP. The deactivation process was completed in Fiscal Year 1997. The condition of the 779 Cluster at the end of deactivation is identified in Section 2.1.2 of this document and is defined on a room-by-room basis. The information is derived from a walkdown of the facilities, information obtained for the RLCR, and actions completed during deactivation to achieve the identified Deactivation End Points.

1.1.1 PROPOSED ACTION

The proposed action in this document is to decommission the 779 Cluster Facilities by removing the interior equipment , decontaminating the remaining structures, and dismantling the facilities. This effort would leave the 779 Cluster facilities' foundations, basements and underground utilities in place. The remaining structures would go through a final closure when the area undergoes environmental restoration. Refer to Section 2.2, Decommissioning Overview, for further information on the basement.

1.1.2 NATURE OF CONTAMINATION

The major contaminant of concern in the 779 Cluster is plutonium 239. Plutonium was introduced into the 779 Cluster to complete experiments related to the earlier RFETS mission of weapons production. Presently, the plutonium is in an oxidized state and distributed throughout several rooms and systems. The estimated amount of Plutonium contained in the 779 Cluster is 4,377 grams but due to measurement uncertainties, there may be as much as 7,695 grams. The location of the material has been identified by completing non-destructive assay of the gloveboxes, B-boxes, the ventilation system, and related piping systems. A summary of plutonium concentration and location, by room, is contained in Appendix C, "779 Cluster Characterization and Work Summary Matrix." Plutonium emits alpha and neutron radiation as it decays. The radiation levels in the 779 Cluster associated with plutonium is a minor radiological hazard (<1millirem) in its current location and form.

Primary contaminants of concern have been identified for the 779 Cluster. They are plutonium, americium, uranium, lead, asbestos, beryllium and Polychlorinated biphenyls (PCBs). The basis for identification of these contaminants has been evaluation of process knowledge and the building specific Waste Stream Residue Identification and Characterization (WSRIC), review of analytical data and radiological surveys, and facility walkdowns. Available radiological survey information, as well as additional survey data generated during deactivation of the 779 Cluster has been reviewed and considered in the contaminant evaluation process.

The health hazards associated with the primary contaminants of concern are described below. In addition, controls and mitigation methods are briefly discussed.

<u>Plutonium</u>

Plutonium is a radioactive, silvery, metallic transuranic element, that was used in weapons production at RFETS. It is considered a human carcinogen and is toxic to the human system in relatively low doses. The carcinogenic properties of plutonium are attributed to the disruption of human tissue incurred by alpha particle bombardment. The amount of tissue damage is relative to the particle size and the energy released to the tissue. Tissue damage associated with exposure to plutonium is generally caused by inhalation, injection and absorption. Plutonium is specifically absorbed by bone marrow upon entering the body. The overall toxicity is chiefly attributed to the radioactive properties of plutonium.

<u>Americium</u>

Americium is a white transuranic metal element that was used in the production of weapons at RFETS. It is considered a human carcinogen and is toxic to the human system. Health effects associated with exposure to americium are increased cancer risk, specifically lung cancer. The toxicity is chiefly attributed to the radioactive properties of americium and inhalation of particulate. The amount of disruption of human tissue caused by alpha particle bombardment is relative to the particle size and energy released to the tissue. Americium also emits low energy gamma radiation. The external exposure and the resulting dose from this gamma radiation may be a health hazard to the worker if present in gram quantities.

<u>Uranium</u>

Uranium is a heavy silvery white metal which was used in weapons production at RFETS. It is considered a human carcinogen and is toxic to the human system. Health effects associated with exposure to uranium through inhalation are increased cancer risk, specifically lung cancer. The toxicity of uranium is chiefly attributed to its toxic effects on the kidneys. Natural uranium standards are based on these properties rather than radiological effects.

The Site Radiological Control Program is responsible for implementing the requirements of 10 CFR

835, Occupational Radiation Protection, which include regulatory dose limits and application of the As Low As Reasonably Achievable (ALARA) principal by workers. Because the toxicity associated with these transuranic elements is directly related to personnel exposure, the DOE maintains Site personnel exposure levels well below regulatory dose limits by integrating ALARA into work practices.

An ALARA review will be prepared for the 779 Cluster and dose limits will be identified prior to commencing the decommissioning process. Work activities are planned so that ALARA is integral to the task at hand, thereby limiting exposure to the worker. Administrative, engineering and physical controls will be implemented and are the primary means whereby exposure will be limited.

Lead

Lead is a toxic metal that has been detected in virtually all biological systems. Lead is toxic to most living things and generally acts as a neurotoxin. Neuropathy and hypertension may occur in adults exposed to toxic levels of lead. The level of toxicity is related to the age and circumstances of the effected individual. The primary exposure routes for lead are ingestion and inhalation, while injection is a lesser exposure route.

Occupational Safety and Health Act (OSHA) guidelines will be implemented to minimize worker exposure to lead. Activities will be performed using requirements identified in the 779 Cluster Health and Safety Plan (HASP) and integrated through the Activity Hazard Analysis (AHA) and work control practices.

Asbestos

Asbestos is considered a human carcinogen. Large amounts of inhaled asbestos leads to mesothelioma. Ingestion of asbestos fibers has been linked to cancer of the gastrointestinal tract. When inhaled, fibers remain permanently in the body.

Asbestos exposure limits are regulated by OSHA and are controlled on-Site through procedures and work practices. Characterization, sampling/survey, and abatement will be performed by qualified personnel in accordance with the requirements of OSHA, EPA, and the National Institute of Occupational Safety and Health (NIOSH). The clearance standard or maximum allowable asbestos level (MAAL) for areas after abatement is performed, for which the 779 Cluster project will adhere to, is as follows:

- 0.01 fibers/cc utilizing the phase contrast microscope means of analytical technique
- 70 structures/mm utilizing the transmission electron microscopy technique

Beryllium

Beryllium is a lightweight, corrosion-resistant, rigid, steel-gray metallic element that was used in weapons production at RFETS. Beryllium is considered a human carcinogen. Inhalation of beryllium particulate has been attributed to lung cancer and berylliosis, an acute pulmonary disease.

Beryllium particulate is controlled at RFETS through housekeeping and air monitoring. Work areas and equipment where beryllium has been identified or suspected of being present will be surveyed prior to disruption or removal of such items or surfaces. Housekeeping will be performed by trained personnel, wearing the appropriate personnel protective equipment (PPE), in the event that beryllium contamination levels are exceeded. The RFETS surface contamination housekeeping limit for beryllium of 25 $\mu g/ft^2$ will be maintained while the project is completed. An airborne limits of 0.5 $\mu g/m^3$ will also be maintained while completing the project. These limits are identified in RFETS procedure 1-15310-HSP-13.04, "Beryllium Protection."

Current RFETS practice for protecting personnel from beryllium is to utilize the ALARA principle. This includes using engineering controls to minimize exposure, medical screening of personnel, and the reduction of limits and the proposed establishment of lower action levels. The limit for beryllium is currently being reviewed and a lower action level is being considered to ensure worker safety.

Polychlorinated Biphenyls

Polychlorinated biphenyl, also referred to as PCB, is a term given to a series of chemical compounds produced industrially by the chlorination of biphenyl with anhydrous chlorine and iron filings or ferric chloride as a catalyst. PCBs have been linked to liver damage and to a lesser degree, kidney damage.

Human exposure levels to PCBs are regulated by OSHA. OSHA guidelines will be implemented, as appropriate, to minimize worker exposure to PCBs. Other than the potential for PCBs in oil (contained in equipment), adhesives and paints (in high temperature areas) and lighting ballasts, no additional contamination is suspected. In any event, OSHA guidelines will be implemented, where PCBs are identified, and the appropriate personal protective equipment (PPE) will be donned by workers. The 779 Cluster project will manage all materials <50ppm PCBs as non-Toxic Substances Control Act (TSCA) regulated.

In addition to identification of the primary contaminants of concern, the general location of these contaminants is summarized below.

Contaminant		Location
Plutonium	-	Interior of gloveboxes and ventilation systems, isolated locations on building surfaces
Americium	-	Interior of gloveboxes and ventilation systems, isolated locations on building surfaces
Uranium	-	Interior of gloveboxes and ventilation systems, isolated locations on building surfaces
Lead	-	Painted surfaces, lead bricks and shielding
Asbestos	-	Thermal system piping insulation, transite, tile, adhesive
Beryllium	-	Building and equipment surfaces
PCBs	-	Electrical lighting ballasts, paints, oils, tar, adhesives (high temperature areas)

As surface areas in the facility become accessible or hazards are removed as a result of the decommissioning process, additional in-process characterization will be performed. In the event that other contaminants are identified during the in-process characterization process, the contaminants will be evaluated with respect to worker health and safety, and facility decommissioning criteria. The resulting evaluation may result in any of the following: additional or fewer health and safety related precautions taken by workers, engineering changes, or implementation of a different decommissioning process.

The 779 Cluster Decommissioning Project Specific Health and Safety Plan focus on the specific safety concerns (chemical, radiological, industrial and hazardous) in the 779 Cluster which exist or are created during the decommissioning process. It describes the controls and monitoring programs to be utilized during the decommissioning of the 779 Cluster which will ensure protection of the decommissioning employees, surrounding workers, the public and environment from hazards during the decommissioning process. The program will be implemented in accordance with all appropriate Applicable or Relevant and Appropriate Requirements (ARARS), OSHA standards and in accordance with the appropriate Site specific plans and procedures.

1.2 SCOPE

The following provides a brief discussion of the DOP structure, content, and scope.

Section 1.0 provides an introduction to the governing documents for decommissioning at RFETS and a summary of Building 779 history, facility layout, and processes. Detailed information on the various room/areas associated with the 779 Cluster are presented in Appendix A.

Section 2.0 presents a description of the areas to be decommissioned and of the planned decontamination/decommissioning activities. Section 3.0 provides a description of the Research and Development (R&D) processes and associated equipment that are in Building 779 and identifies hazards, by work area, which will be considered during the work planning process. A more detailed description of the work areas is provided to establish the base scope and magnitude of the decommissioning effort.

Finally, a description on how decommissioning work packages will be developed, the types of decontamination techniques to be used (Appendix B), and the control mechanisms built into the process which will ensure protection of the workers, public and environment. Section 2.0 describes the initial engineering assessment for the 779 Cluster.

Section 3.0 describes the facility characterization phases which will be completed during decommissioning. This section describes the relationship between characterization and the hazards identified within the 779 Cluster. The characterization information is required to properly plan the decommissioning activities. A summary of the Reconnaissance Level Characterization phase information is provided in Appendix C. Appendix C, in a summary fashion, demonstrates how characterization information will be used to assess a specific room/work area hazard during work package preparation.

Section 4.0 states how the facility release criteria are determined. The 779 Cluster must be decontaminated and surveyed to demonstrate the building surfaces are below the release criteria prior to being dismantled.

Section 5.0 is a discussion of how the authorization basis documents for the 779 Cluster will be downgraded during the project implementation.

Section 6.0 describes controls and programs which will be used throughout the decommissioning process, (in conjunction with the work packages) to ensure worker health and safety during decommissioning operations. It also defines how workers will be properly trained to accomplish their assigned tasks. Section 6.0 contains the Preliminary Hazard Analysis (PHA) for the 779 Cluster.

Section 7.0 introduces the types and volumes of wastes which the project expects to generate, and how the waste will be managed when it is generated.

Section 8.0 describes the regulatory considerations for this CERCLA Action. This section discusses Resource Conservation Recovery Act (RCRA) closure, identifies ARARS, describes performance monitoring obligations, and addresses National Environmental Policy Act (NEPA) concerns.

Section 9.0 establishes the quality controls and management attributes which will be implemented during the decommissioning process.

Section 10.0 provides an overview of the security requirements for the 779 Cluster.

Appendix A contains current baseline knowledge for the 779 Cluster and systems.

Appendix B is an overview of decontamination techniques which may be used during the 779 Cluster decommissioning.

Appendix C cross references the characterization information to the type of work which will be completed in each area.

1.2.1 Building 779

Building 779 was originally constructed in 1965. The building was expanded in 1968 and again in 1973. The additions are referred to as Building 779-A, and Building 779-B. Since all three additions are physically connected, and share resources and mission, any reference to Building 779 should be understood to include all three additions.

The first addition to Building 779 was completed in 1968. The addition added office space, laboratory area dedicated to pyrochemical technology, hydride operations, physical metallography, joining technology, and the necessary heating, ventilation, and air conditioning (HVAC) equipment to supplement the existing HVAC system. The 1968 addition is a single story facility attached to the north end of Building 779.

The second addition to Building 779 was made in 1973. The addition is a two-story facility added to the south side of the original Building 779. Although both additions are architecturally and structurally different from the original Building 779, they are functionally tied to the original building.

Building 779 was used as a R&D center. Building 779 contained process equipment which could mimic some of the production facilities' mission, and laboratory equipment to conduct material and environmental testing.

A more detailed description of Building 779's capabilities and structural layout is contained in Appendix A.

1.2.2 Building 779 Support Facilities

The Building 779 Support facilities are identified on Figure 1-2 and described below.

Along with the two building additions, two filter plenum buildings were constructed after Building 779 was completed. Building 729 was constructed in 1971, and contains a filter plenum and an emergency electrical power generator. Building 729 is connected to Building 779 via a second story bridge. Building 729 has dimensions of 72 ft. x 38 ft. and is located immediately south of Building 779. Building 782 was constructed in 1973, and serves as the second filter plenum for Building 779. Building 782 covers 60 feet x 99 feet and is located east of Building 779. The emergency generator for Building 782 was located in the separate Building 727, located north of Building 782.

The following buildings are located adjacent to each other, north-east of Building 779, and north of Building 727 (see Figure 1.2):

Building 783 (A,B,C,D) - Cooling Tower Pump House
Building 784 - Cooling Tower
Building 785 - Cooling Tower
Building 786 - Cooling Tower West Chiller
Building 787 - Cooling Tower East Chiller
Building 780 - Paint/Storage Facility
Building 780-A - Metal Storage Facility
Building 780-B - Gas Bottle Storage Facility

1.2.3 Facilities Descriptions

A thorough description of the 779 Cluster work areas is provided in Section 2.1 and Appendix A.

1.2.4 Changes to Work

Changes to work identified in the 779 Cluster DOP will be addressed in accordance with Part 10, "Changes to Work," of RFCA and will use the consultative process described therein.

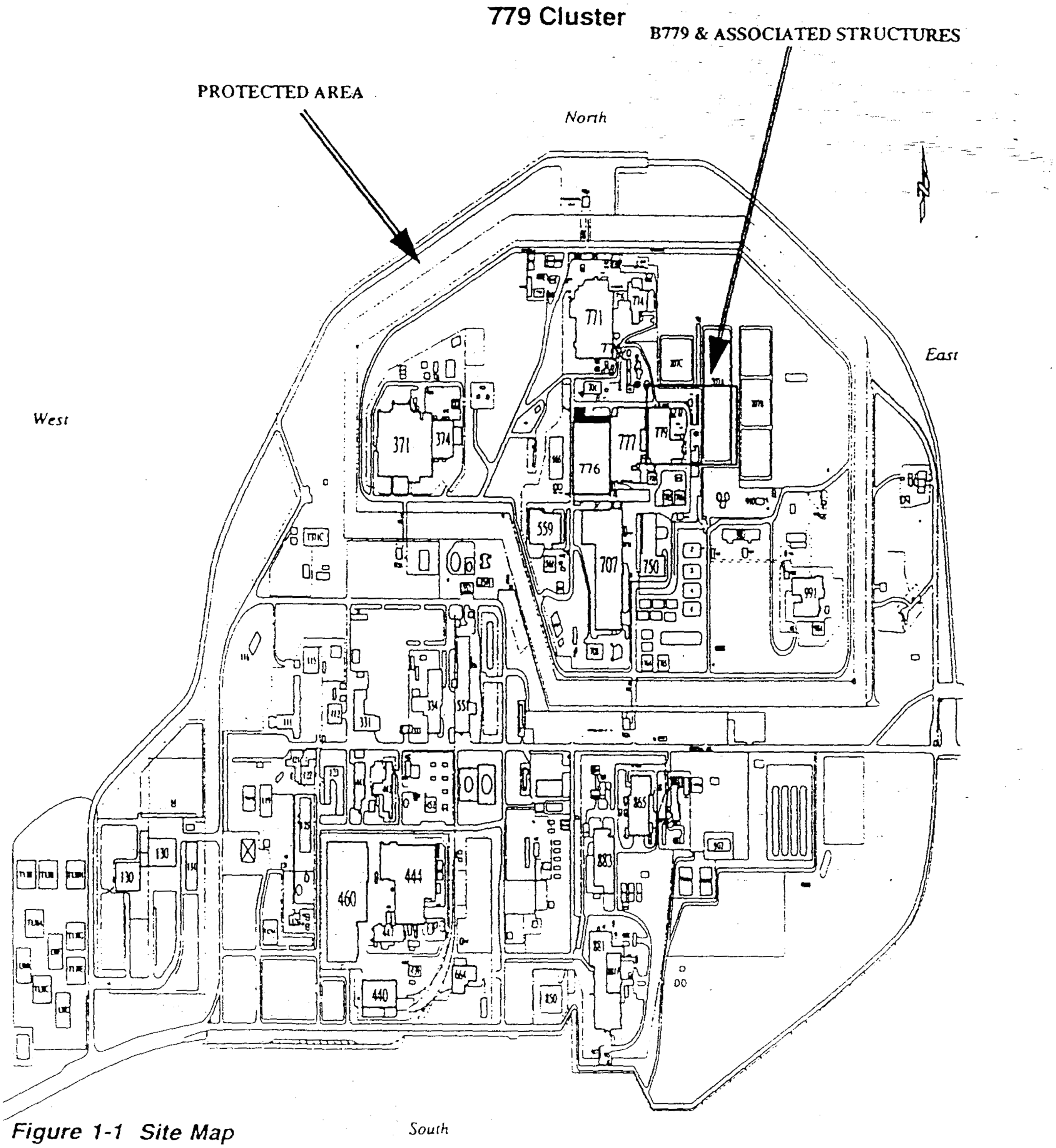
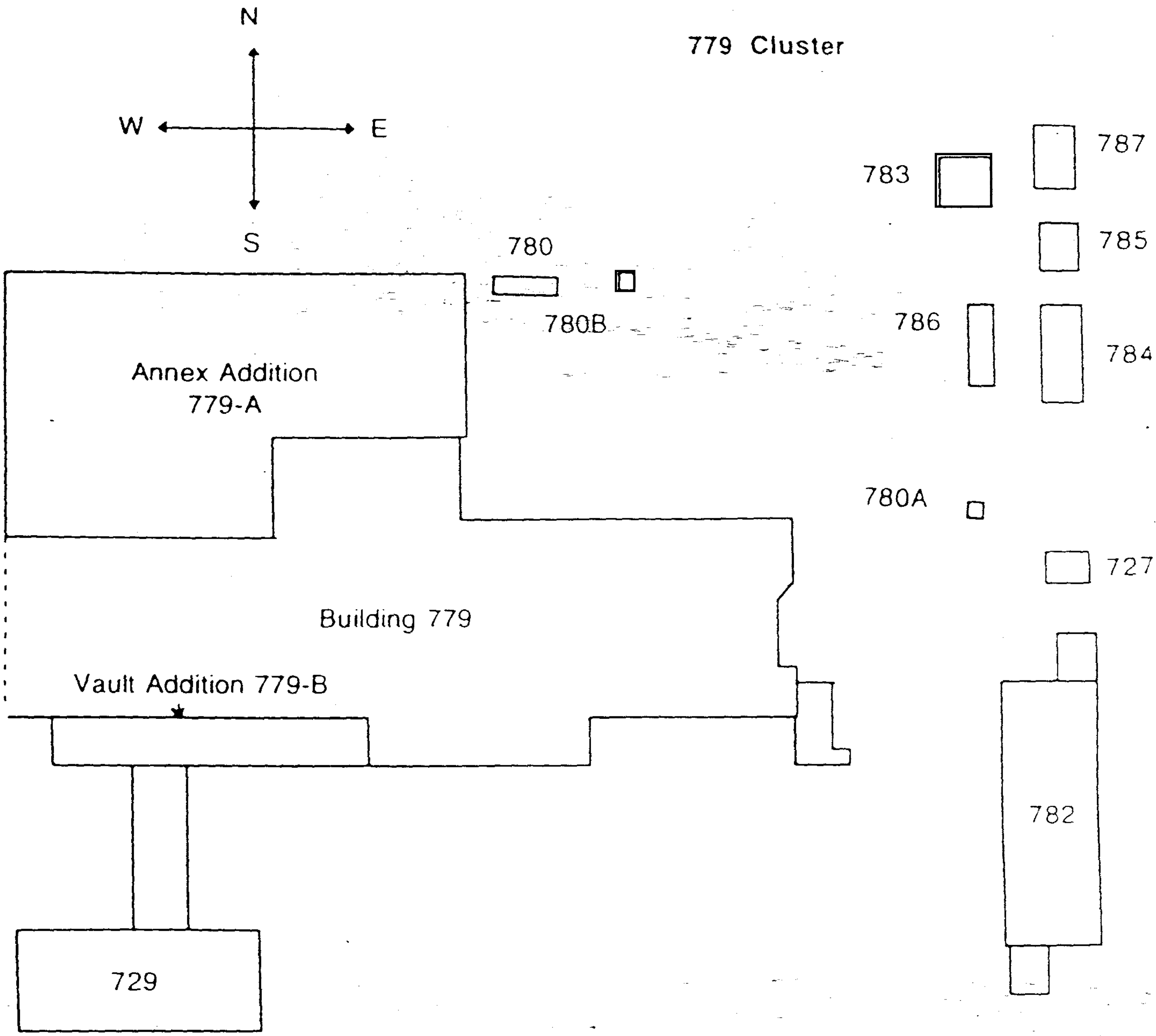


Figure 1-1 Site Map



727	Emergency diesel generator facility serving Building 779.
729	Facility containing filter plenums and emergency diesel generator.
779	Research and Development Center.
780	Paint/Storage Facility.
780A	Metal Storage Facility.
780B	Gas Bottle Storage Facility.
782	Filter Plenum Exhaust Enclosure For Building 779 Exhaust
783	Building 779 Cooling Tower Pump House.
784	Building 779 Cooling Tower Support Facility (A, B, C, D).
785	Building 779 Cooling Tower Support Facility
786	Building 779 Cooling Tower West Chiller.
787	Building 779 Cooling Tower East Chiller (A, B, C, D).

Figure 1-2 779 Cluster Layout

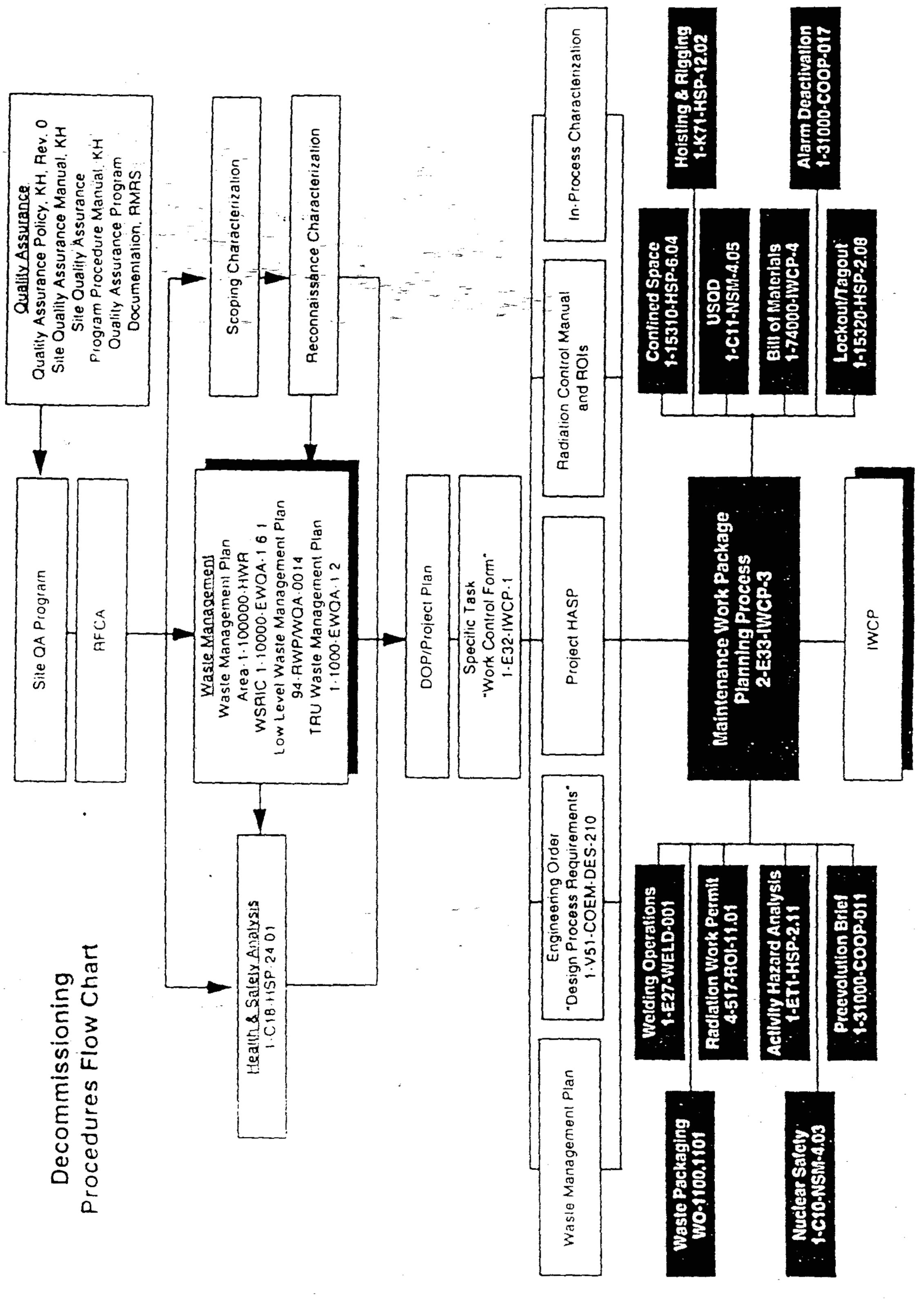


Figure 1-3 Decommissioning Document Hierarchy

2.0 AREA DESCRIPTIONS AND PLANNED ACTIVITIES

2.1 AREA DESCRIPTIONS

The information provided in this section gives a brief description of the processes which were performed in Building 779 and summarizes the current condition within each of the work areas. The room descriptions and characterization information (Section 2.1.2 and Appendix C) will be used during the work package development discussed in Section 2.2. In addition, Appendix C identifies whether rooms, or equipment in rooms are radioactively contaminated and presents gram estimates of plutonium for the respective room/equipment. Significant additional characterization information is contained in the *779 Cluster Decommissioning RCLR*.

2.1.1 History of Processes Conducted in Building 779

This section describes the research, development, and support operations which were conducted in Building 779. This information is provided as an overview of the processes, equipment used, and hazards that may be encountered during building decommissioning. The information provided in this section is historical. None of these processes are currently active in Building 779. The description of previous Building 779 operations are separated into five basic categories:

1. Process Chemistry Technology
2. Physical Metallurgy
3. Machining and Gauging
4. Joining Technology
5. Hydriding Operations

Process Chemistry Technology

The chemistry laboratories in Building 779 were engaged in production process development, stockpile reliability testing, and methods development for recovering, separating, and purifying actinides from waste streams and residues. Some research activities and operations were performed on a continuous basis in production-scale facilities. Other activities were short-term and were performed on a laboratory scale using more highly specialized equipment.

Ion Exchange Technology

Ion exchange resins were tested for the purification and separation of plutonium from other actinides.

Plutonium Precipitation Technology

The plutonium peroxide precipitation and calcination process was simulated on a laboratory scale. The process converted plutonium solutions to a plutonium peroxide precipitate. The precipitate was then calcined to a plutonium oxide powder.

Thermodynamics Studies

Thermodynamics studies of nuclear materials were conducted on a laboratory scale. Experiments involved measurement of chemical energy changes associated with certain chemical reactions, as well as the determination of heat capacities and enthalpies of materials, some of which were radioactive.

Solvent Extraction

Solvent extractants were tested for the separation and removal of actinides from acid and salt wastes. Aqueous and organic wastes were transferred to Waste Operations for disposal. Solvent extraction involved contacting aqueous and organic phases in small vials.

Thermogravimetric Analysis

Equipment is in place which was used for characterizing solids and their interactions and reactions with solids and vapors at sub-atmospheric pressure and at subzero, ambient, and high temperature. These capabilities used vacuum microbalances, differential thermal analysis, and Thermogravimetric equipment. Radioactive, nonradioactive, and air sensitive materials were studied. Sample sizes were generally less than 5 grams.

Surface Studies

Methods used to study the surface of solid samples included auger electron spectroscopy, low energy electron diffraction, electron spectroscopy for chemical analysis, and ellipsometry. Both radioactive and nonradioactive materials were examined.

Radiation Effects on Materials

Effects of radiation on various solids, liquids, and gases were evaluated using gamma, beta, and alpha irradiation sources. These studies determined the radiation stability of materials.

Compatibility Studies

Compatibility and chemical studies were performed with plutonium and uranium samples. Equipment used in these tests included pressure volume-temperature systems, dynamic gas analyses systems, and high vacuum-, gas, and acid-handling systems. The laboratory performed kinetic tests and, using gravimetric methods, tests for corrosion. These sometimes involved chemical reagents not normally used in other operations in the building.

Product Testing and Surveillance

Product testing included process development research, production support experimentation, and stockpile reliability evaluations. These processes, typically, involved coupon-size samples used for determining reactivity and reaction mechanisms.

Production support experimentation was typified by testing of materials proposed for production use. Each material was tested for compatibility with other production materials before it was approved for use.

Plutonium products were tested under a variety of field-simulated conditions of temperature, pressure, and chemical environment. This area of work included short-term operational cycle experiments, as well as accelerated aging studies and subzero temperature shelf-life testing.

Evaporative Separation

A high-temperature furnace was used to develop methods for distillation of salts and volatile metals from plutonium and americium alloys and residues. Volatile metals were mostly zinc and magnesium.

Pyrochemical Processes

Pyrochemical process development was associated with production equipment and production process applications of the pyrochemical techniques. This group experimented with molten salt extraction, salt sparging, direct oxide reduction, and electro-refining.

Molten salt extraction was performed to remove impurities (e.g., undesirable radionuclides) from plutonium. The molten salt extraction operation was performed at an elevated temperature to melt the plutonium metal. Molten metal was combined with a salt mixture that contained magnesium chloride, which served to oxidize the impurities in the plutonium metal. Once molten, the mixture was separated into a salt phase (which contains the impurities) and a metal phase. Upon cooling, the salt was removed and processed for reuse. The purified plutonium button was returned to production.

Spent salts from several pyrochemical processes were melted and combined with various metals to reduce the plutonium and americium contained in the salt to a metal form. A metal/plutonium/americium alloy resulted, along with the spent salt. The salt was disposed of if plutonium levels were low enough. The metal alloy button was either placed into storage or sent to the Savannah River Site as feed material.

Direct oxide reduction was a one-step process for converting plutonium oxide into plutonium metal, plutonium oxide, calcium chloride, and calcium metal were placed into a crucible and melted. The molten mixture was stirred to allow the reduction reaction to take place. The molten products were allowed to cool and solidify. Breakout of the cooled contents yielded a plutonium metal button and a discardable salt.

Electro-refining was another method of plutonium purification based on the mobility of plutonium ions in the presence of an electric current. Plutonium was heated to a molten state in the presence of molten salt. A direct current source was applied to the molten mixture through a tantalum anode placed in the mixture. The molten metal mixture acted as the anode. Plutonium ions collected at the cathode and were reduced to pure plutonium metal. Impurities remained in the molten salt phase. The resultant plutonium metal was returned to production, and the spent salt was sent to salt sparging for reprocessing.

Physical Metallurgy

Physical Metallurgy conducted research on various metals, alloys, and materials required by plant missions. The group also supported different research groups, design agencies, plant production, and others in metallurgical studies of materials and manufacturing techniques for components and processes. Support operations included optical and electron metallography, microprobe analysis, X-ray diffraction, tensile testing, hardness testing, and dilatometry.

Physical Metallurgy personnel experimented with small samples of metals, such as plutonium, uranium, beryllium, steel alloys, copper, and various ceramics and glasses. Laboratories with gloveboxes were used for handling radioactive materials. Tensile testing and electron metallography facilities were housed in special laboratory rooms.

Machining And Gauging

Machining operations within the buildings were conducted in three shops, two general machine shops and a general machining laboratory.

The general machine shop supported Joining Technology. The work consisted of making tooling, fixtures, and special order parts of steel, cast iron, and other common materials. Shop equipment included lathes, mills, tool grinders, a belt sander, and a power hack saw. Standard shop practices, monthly safety inspections, and trained operating personnel provided a safe working environment. Only non-nuclear material was handled in the general machine shop.

The second general machine shop was a maintenance shop used in support operations. It is equipped with a lathe, mill, drill press, and tool grinders. General machining tasks employed common materials such as aluminum, brass, copper, and steel. Again, only non-nuclear materials are handled.

The general machining laboratory was used for high-precision machining, machining tests, and general machining jobs. It was equipped with a direct numerically controlled lathe, tracer lathe, straight lathe, mill, jig borer, drill press, electrodischarge machine, band saw, surface grinder, monoset grinder, and tool grinders.

Joining Technology

Joining activities included electron-beam welding, gas-tungsten-arc welding, pressure gas-metal-arc welding, gas welding, brazing, metallography, machining, dimensional inspection, and electronics development.

The Coatings facility in Building 779, had three hot-hollow cathode systems and associated hardware. The function of this facility was to define the required parameters associated with the deposition of various materials onto specified substrate geometries. The material most often Deposited was silver. However, other materials, such as gold, silicon dioxide, and silicon monoxide, were also deposited.

Substrate materials were usually Vascomax, steel, stainless steel, beryllium, and uranium-238, in a variety of forms. At no time were the substrate materials mechanically worked on, as in sectioning or grinding, in this facility. Coatings were Deposited onto the substrates in a closed chamber and under partial vacuum.

Hazardous materials used in the Coatings facility were methanol, nitric acid, and sodium hydroxide. These materials were present in small quantities.

Hydriding Operations

Hydride Operations received parts with recoverable plutonium, and through the process of hydriding, removed plutonium from the part in the form of plutonium hydride. This hydride was then dehydrated and converted to plutonium metal or oxidized to plutonium oxide.

In the hydriding process, the procedure varied depending upon the material being processed; however, the general procedure is outlined below. The part was placed in the hydriding vessel; which was evacuated and backfilled with pure hydrogen. In the hydriding reaction, the hydrogen gas in the vessel was consumed in the reaction; therefore, hydrogen was continuously added by an automatic controller to maintain proper operation pressures.

Upon completion of the reaction, the hydride was placed in the oxidation reactor. Oxidation occurred by passing air through the oxidation reactor. When oxidation was complete, the material was burned in the presence of pure oxygen, to ensure that all the hydride was converted to oxide.

2.1.2 Decommissioning Work Area Description

This section identifies the current conditions within the 779 Cluster work areas. The discussion is broken down by buildings and then further divided into a room-by-room description (for a summary of characterization information by room see Appendix C). The walkdowns discussed in Section 2.2.2 will be performed to reverify room status prior to starting decommissioning work. The descriptions which follow are not all inclusive but, do cover the areas with the greatest potential health-based for risk. Rooms not identified in this section are listed in Appendix C. See Section 3 for a more thorough discussion of facility characterization.

Building 779

Room 123

Room 123 is a decontamination room. The drains from this room will be treated as potentially containing radioactive material.

Room 124

This room was a RCT office. Radiation sources were stored in lockers in the center of the room. The radiation sources have been removed from the building.

Room 125

This room was an RCT office. This room was used to calibrate and repair radiation instruments and contained radiation sources. The radiation sources have been removed from Room 125.

Room 126

Room 126 is a utility area. Initial surveys indicate there is no loose surface contamination in this area. The room has gloveboxes connected to the house vacuum and contains an uninterrupted emergency power supply (UPS). The UPS lead acid batteries have been removed during the building deactivation activity. The gloveboxes are clean or have low levels of contamination (Reference Appendix C for plutonium gram estimates). The UPS is not operational. The Room 126 helium tank system and scrubber on the west wall was for a helium inert glovebox in Room 133. The helium system was never put into service and was abandoned in place. The room has an abandoned water still which was used for producing distilled water from the potable water system. The cooling water from the system drained into Tank 5 (T-5). The still is not expected to be radioactively contaminated.

The sub-basement below Room 126 contains process piping for T-5 (i.e., holding tank for all Building 779 process drains including all lab sinks). Formerly regulated under the RCRA, this tank has been flushed, triple rinsed and fully RCRA closed. Now T-5 receives sanitary, eyewash liquids, low level radioactive solutions, water from chillers, condensate water, and water from safety showers. The room above T-5 houses pumps and two cooling water system tanks. There are two other sumps in addition to the one containing T-5 that are accessed from the pump room. These sumps are labeled as contaminated. There are asbestos insulated pipes, (condensate, steam lines) in the pump room overhead. Two old concrete pump bases exist (pumps have been removed) which have been painted over. It is possible that there is radioactive contamination underneath the paint.

Room 127

Room 127 is a utility room containing chillers and part of the filter plenum. The filter plenum is contaminated. There is asbestos insulated pipe in the room. The chillers are not expected to be radioactively contaminated.

Room 125

Room 125 was used for repair of radiation instruments. Radiation sources were stored in this room, but the radiation sources have been removed from the building.

Room 128

Room 128 was an office used by Nuclear Material Control (NMC).

Room 131

Room 131 was an aqueous lab supporting plutonium pyrochemical technology.

Within Room 131 Glovebox 961 (GB-961) was brought on-line in the mid-80s. GB-961 was used to high fire (calcine) plutonium oxide. The box is lined with lead which has been epoxied onto the exterior of the glovebox. The windows are etched from the chemical exposures. There are two furnaces in this line. GB-961 has an airlock with a vacuum line, filter and an uncertified hoist inside.

Gloveboxes 131A through E (GB-131C is a B-Box) form an aqueous line. Various aqueous processing was performed ranging from cleaning tantalum stir rods with hydrochloric acid (HCl) to use of ion exchange resin. The boxes are lined with lead which has been epoxied onto the exterior of the boxes. The A-Boxes are connected to a vacuum pump which is suspected to have internal contamination. Windows on these boxes are scratched, dirty, and difficult to see through. The general cleanliness of the aqueous line components is poor.

The fume hood in the northeast corner of Room 131 was a general hood for storing volatile chemicals. There is a fume scrubber system in the northeast corner next to the hood and a caustic scrubber on the northwest side of the hood. The scrubber system is potentially contaminated.

There are three wall storage cabinets on the south wall. The storage cabinet contained oxidizers, low reactivity chemicals, non-flammable organics, inorganic bases, and other chemicals. The lower cabinets contained additional chemicals and supplies. Excess chemical removal is an on-going deactivation activity.

Room 132

Room 132 housed an auger spectrometer which has been removed. Room 132 is now being used as a calibration room/office. Sources were stored in a cabinet on the south wall. The sources have been removed from the room.

Room 133

Room 133 was a laboratory for R&D of plutonium pyrochemical processes. A number of small and medium scale furnaces were used for these operations, including Direct Oxide Reduction (DOR), Electro-refining (ER), Vacuum Melting, Molten Salt Extraction (MSE), and salt scrub.

The following gloveboxes are in Room 133:

Glovebox 953 was designed for a can-counter, but the glovebox was never used. It is lined with lead which has been epoxied onto the exterior of the glovebox. The glovebox is believed to contain very low levels of contamination but Room 133 has experienced high levels of airborne contamination in the past; consequently, the exterior of this GB may be contaminated. There is a covered well in the bottom of the box.
Glovebox 954 is lead-lined with the lead bolted onto the glovebox exterior. The box has an airlock on the south side which is empty. There are two filters in the box to filter recirculating nitrogen. The six position storage rack in the glovebox is empty. The box shows some signs of corrosion and equipment within the glovebox is corroded. The glovebox floor is dented and corroded.

Glovebox 955 is lead-lined with the lead bolted onto the glovebox exterior. There is a vacuum melt furnace on the north end with a well below this section which is surrounded by its own box. The bottom is filled with sand, corrosion, and signs of former spills. The furnace itself has a domed cap. There is a criticality drain in the bottom of the vacuum melt furnace. The glovebox contains a can of MgO sand. There is a can sealer in the south end of the box. The glovebox has an emergency booster exhaust whose filter holder is corroded. There is a hoist in the glovebox at the south end. The hoist is on a rail in the glovebox which runs along the length of the box. This glovebox was used in the late 1970s and 1980s to remove americium.

Glovebox 956 has two stationary furnaces with wells on the south and north end of the glovebox. The box is lead-lined with the lead shielding screwed onto the glovebox exterior. In the middle of the box is an old furnace well underneath the box with a flat plate welded into the floor. The glovebox is contaminated inside with plutonium. There is a vacuum system at the north end under the box whose line has been welded shut at the bottom of the box.

Glovebox 957 has a six position empty storage rack. The glovebox has two exhaust lines, one with a filter, one without a filter. The line without the filter is partially open. The airlock on the northwest corner is empty. There is a muffle furnace on the northeast end which is closed to inspection. The bag-in/bag-out port has corrosion particles on top of the bag and there are corrosion materials on the floor of the box. There is a filter housing outside and under the glovebox on the northeast corner. Glovebox 958 has a vacuum cleaner inside the glovebox and an airlock on the north end. Glovebox 958 went into service in 1985.

Glovebox 959 is lined with lead which has been epoxied onto the glovebox exterior and it has two furnace wells. There is an empty storage rack at the south end which can hold ten containers. The rack has five lower storage positions and five upper storage positions. The racks are water filled. This water-walled storage rack was commissioned in 1985. The exhaust line in the center of the box has no filter (not designed for one). The exhaust line on the northeast end is filtered. The box contains miscellaneous crucibles, tantalum, and ceramics. The glovebox is dirty and radioactively contaminated.

There are four control panels on the east wall, two of which may be internally radioactively contaminated.

On the south wall are three wall cabinets which did contain reactive metals including calcium, magnesium, zinc, tin, and aluminum. The metals were stored in plastic bottles. Ceramic crucibles were also stored in these cabinets. The lower cabinet contains miscellaneous equipment and crucibles.

Room 134

Room 134 was originally office space which was later converted to store chemicals. It contained three flammable chemical storage cabinets.

Room 135

Room 135 has been used for storage by the RCTs.

Room 137

Room 137 was an aqueous R&D laboratory. Gloveboxes 106-1 through 106-6 formed an aqueous processing line along the east wall. The aqueous processing included use of nitric acid and chloride processing. Consequently, some boxes are coated for corrosion resistance. Glovebox 106-6 on the north wall was used for microwave degradation. Glovebox 106-1 has lead shielding that has been bolted in place. The glovebox contains balances and an intake filter. The glovebox has an airlock that is clean and empty.

Hood 106-1 is located in the Southwest corner of Room 137. The hood is radioactively contaminated. HCl acid was stored in three one gallon glass bottles in the hood. The sump pump for the process drain is contaminated (under the sink in the southwest corner of the room).

Glovebox 106-2 has lead shielding that has been bolted in place. There is a recessed ledge in the back of the box for the exhaust line which has some sort of buildup on the ledge.

Hood 106-2 is located in the west-center of the room. Several chemicals were used in this hood including phosphoric acid and non-flammable organics.

Cabinets 4 and 5 contain chemicals, including reactive metals of aluminum, zinc, calcium, potassium, and cadmium as well as flammables.

Cabinet 1 in the northeast corner of the room is thought to have contained organic acids.

Glovebox 106-6 contains a furnace but unlike other gloveboxes it is not lead-lined. The glovebox is connected to the line through an airlock. Gloveboxes contain miscellaneous equipment, glassware, and the glovebox floor is dirty and exhibits corrosion. There is calcium chloride in the box. Cabinet Number 3 is under this glovebox. The cabinet contained bases (ammonium hydroxide) and sodium silicate. Glovebox 106-5 has lead shielding that has been bolted in place. The coating on the glovebox floor is coming off.

Glovebox 106-4 has lead shielding that has been bolted in place. The box contained various chemicals and SNM including enriched uranium in nitric acid and etching solution. The inside lining is completely corroded away. There is a recessed ledge in the back of the box going to the exhaust filter which is external to the box.

The B-Box between 106-4 and 106-3 had no lead lining. Radioactive contamination is present within the B-Box. Glovebox 106-3 has lead shielding bolted in place. The lining inside the glovebox has corroded away. The exhaust line has a recess built into the box which has buildup on the floor of the recess.

Room 138

Room 138 was used to store excess chemicals. Routine surface contamination surveys indicate no loose radioactive contamination is present in the room. Excess chemicals have been removed from the building.

Room 139

Room 139 was a soil analysis laboratory. It has extremely low levels of contamination (Reference Appendix C).

Cabinet 1 contains equipment. Cabinet 2 through 8 contained chemicals. The cabinet on the south wall next to the sink has radioactively contaminated soil samples on top of the cabinet. The sump pump under the sink has been triple rinsed.

Hood 139-S (SW) has a large magnet in the hood. The hood is radioactively contaminated at low levels.

There is a control panel in front of Hood 139-S which contains radioactively contaminated equipment. The west cabinet contained eight sources in small bottles. The sources have been removed.

The center table contained chemicals, tools, resins, and soil samples.

No SNM was allowed into B-Box 139-4. The exhaust line connects to a large filter housing overhead in the room. B-Box 139-4 contains absorbent columns and glassware. The box is contaminated.

Box 139-3 contains two round exhaust filters. There is an airlock on the outside of the north exhaust filter for inserting new filters. The box is connected to the house vacuum system. There is a small amount of residue in the corners.

No SNM was allowed in B-Box 139-2. B-Box 139-2 contains a furnace, tumbler, bottles, and pans. B-Box 139-1 was used with plutonium, americium, and depleted uranium.

Room 140

Room 140 was a sample preparation laboratory for metal analysis, weld failure analysis, etc. There was some beryllium work performed in Room 140, however, most was stainless steel work. In the southwest corner of the room are two hoods (140SD and 140SE), which have radioactive contamination. These hoods were used to prepare depleted uranium and beryllium samples. Surplus equipment is currently stored in the hoods which were used to prepare the depleted uranium samples.

The 140SE hood has beryllium and uranium contamination.

The 140 SW hood was used for polishing. Hood 140SW is also beryllium and uranium contaminated. The hood is full of equipment and tools. The exhaust plenum is connected at the back of the hood.

Room 140A

Room 140A was a support room for a scanning electron microscope (SEM). Room 140A houses a metallograph and miscellaneous supplies area.

Room 140B

Room 140B houses a SEM. The SEM was used to analyze coated samples, such as saltcrete and cement and has been moved to Building 707.

Room 141

This room contains an Electron Spectroscopy for Chemical Analysis (ESCA) instrument which is used for non-radioactive analysis.

Room 141A

Room 141A houses a microprobe instrument. The inside of the microprobe chamber is contaminated with plutonium. The microprobe is non-functional. The filtered vacuum system for this unit is connected to the Health Physics vacuum system.

Room 141B

Room 141B contains a SEM. The SEM is not believed to be radioactively contaminated.

Room 141C

Room 141C contains a metallograph and optical reduction equipment. This equipment was used to photograph samples and is not believed to be radioactively contaminated.

Room 142

Room 142 is a building utilities room. Room 142 is used as a satellite accumulation area for florescent light bulbs.

Rooms 171 and 172

These two rooms were SNM storage vaults. A chainveyor vault is located in Room 172 and Room 171 has Benelex-shielded cubicles. The rooms are not known to have been radioactively contaminated.

Room 217

Room 217 contains a radioactively contaminated auger and ESCA. The ESCA was attached to a relatively new (late 1980s) stainless steel, non-lead-lined glovebox (GBs 330-371).

Glovebox 963 (GB-963) contains miscellaneous furnaces and balances. GB-963 is not lead-lined. A vacuum pump is located under the glovebox which is likely to have internal radioactive contamination. The glovebox contains miscellaneous equipment.

Glovebox 964 (GB-964) is a supporting non-lead-lined glovebox which was used to store SNM. GB-964 is expected to be highly contaminated with radioactive material. This glovebox was used for molten plutonium studies. Two vacuum pumps are located under GB-964 and are likely to have internal plutonium contamination. There is possible asbestos-containing materials in the glovebox. A hydraulic pressure pump under the glovebox may also be internally contaminated with plutonium. The glovebox also contains miscellaneous equipment.

Gloveboxes 330-371 is not lead-lined. The glovebox contains miscellaneous tools and an auger which is internally contaminated with plutonium. This glovebox has glove-ports in its plexiglas windows. The glovebox has an airlock which is empty.

The E hood has fixed contamination on a grill outside of the hood. The hood contains two small furnaces. Miscellaneous equipment is stored underneath the hood.

A vault is located in the northwest corner of Room 217. The vault was used to store uranium.

Room 218

Hood 218SE is located on the southeast side of Room 218. Hood 218SE is radioactively contaminated and houses a microbalance. There is a vacuum pump under the hood which is likely to have internal radioactive contamination. The hood is coated inside to minimize/prevent corrosion. The hood appears to have an old criticality drain, which is capped on the bottom and taped over on the top inside of the box. The hood work surface is full of equipment. Hood 218S and 218SW were used for preparing polymer and cementation samples which were slightly contaminated with plutonium. The 218SW hood is not lead-lined. It contains balances, mixers, beakers, tools, and Portland cement.

Glovebox 970 (GB-970) was used for plutonium storage and studies and is highly contaminated with plutonium. GB-970 has lead tape on the exterior front. GB-970 has a bagout port on the bottom of the box. There is a vacuum pump underneath the glovebox which is disconnected, but has internal plutonium contamination. There is an empty three position storage rack, miscellaneous tools, and a balance inside the glovebox. The filter (inside the GB) has crystals growing on its surface. GB-970 has an airlock.

Glovebox 971 (GB-971) is not lead-lined. Low level contamination is anticipated in GB-971. This glovebox was used for plutonium studies. There are miscellaneous tools on the south side of the glovebox. The glovebox contains a reaction vessel. In the northwest corner of Room 218 sits a Gamma Cell which has a Cobalt 60 source (21,632 curies). The Cobalt 60 source was used for materials radiation studies.

Room 220

Hood 220SE is located on the southeast side of Room 220. Hood 220SE is contaminated. Hood 220SE was used for material storage and entry to Glovebox 463 (GB-463). Hood 220 SE is non-lead-lined. GB-463 exhaust is to an external filter overhead in the southwest corner of Room 220.

Glovebox 463 is non-lead-lined. It was used for plutonium oxidation and waste disposal (all samples were burned here). The box contains a muffle furnace, tools, cans, check weights and a four position heat detector.

Glovebox 462 (GB-462) has lead lining which is bolted in place. GB-462 has a vacuum system. The glovebox was used for uranium/plutonium studies. GB-462 is tagged "Out of Service." GB-462 contains a small muffle furnace and hot plate. The glovebox has an airlock.

Hood 220C is non-lead-lined. It is posted with contamination levels. The hood has a vacuum system and contains miscellaneous items.

Glovebox 974 (GB-974) is lead-lined with the lead epoxied onto the glovebox exterior. GB-974 was used for plutonium studies. GB-974 contains a three position heat detector and contains miscellaneous equipment and tools. There is a vacuum system connected to the glovebox which is radioactively contaminated. The glovebox has an airlock. Several cabinets on the south end of the room contain glassware and supplies.

Rooms 221A, 221B, 273, 274, 275, 277

Rooms 221A, 221B, 273, 274, 275 and 277 were used as offices and study areas. The rooms contain miscellaneous furniture and equipment.

Room 222

Room 222 contains several gloveboxes and analytical hoods as identified below:

Glovebox 975 (GB-975) was used for plutonium studies. This glovebox is divided in the middle and contains gloveports in the plexiglas windows. GB-975 contains balances, checkweights, cans, and tools. The south end of the floor beneath the glovebox is contaminated around the vacuum pump and there is fixed contamination on the outside of the glovebox window. A vacuum system (disconnected) is located under the glovebox airlock. The vacuum chamber is radioactively contaminated internally.

Glovebox 976 (GB-976) was used to complete some R&D studies on reactive species. GB-976 contains a three-position heat detector, a vacuum furnace, balance, and miscellaneous tools. A vacuum line connected to the airlock does not have a filter. There are in-line sealed filters to and from the adjacent argon supply cabinet. A vacuum pump and chiller are servicing this glovebox.

Glovebox 977 (GB-977) is lead-lined with the lead epoxied onto glovebox exterior. The box is not radioactively contaminated and is identified as being out of service. There are no gloves on the box. The glovebox is coated inside and contains an empty three position heat detector storage unit.

Glovebox 330-371 is a two part glovebox. One part was used for sample preparation and contains an analytical balance. The other side has a solution calorimeter. This glovebox was used for research. Both box parts are radioactively contaminated. The glovebox well on the west end is almost full with the calorimeter. The glovebox has an airlock. Room 222 contains an X-ray refractometer which is not radioactively contaminated.

B-Box 981 was not used extensively, but the glovebox is radioactively contaminated. The box is not lead-lined.

Glovebox 980 is a nitrogen inert glovebox with an automatic dump valve and flow through system. There may have been some Research and Development (R&D) studies on reactive species completed in the glovebox. The glovebox contains an analytical microbalance, tools, glassware and check weights. The box has an airlock which is empty.

Glovebox 982 (GB-982) contains a muffle furnace, miscellaneous tools, and items in the airlock. Beneath the box is an air sample bottle connected to piping entering the box.

B-Box 105 is radioactively contaminated and was used as an entry for Gloveboxes 105 and 106.

Glovebox 105 was used for plutonium studies. This glovebox is lead-lined with the lead bolted in place and the lining seams were lead taped. It also contains a one-position heat detector. There is a muffle furnace in the glovebox and what appears to be a sheet of transite (asbestos) on the southeast glovebox floor. Glovebox 106 (GB-106) is radioactively contaminated. GB-106 was used for storage of SNM and equipment.

Hood 222NC was used for miscellaneous uranium and non-plutonium studies, primarily uranium studies. Some of these R&D studies may have involved reactive species. It was utilized as a non-contaminated box. Experiments were conducted with encapsulated materials. There is some radioactive contamination inside the hood. There are also some glass, and supplies underneath the hood.

Glovebox 460 (GB-460) was designed for gas and solid reactions. Radioactive contamination levels inside GB-460 should be very low. The box is lead-lined with the lead bolted in place. The glovebox contains miscellaneous tools. An airlock is attached. There is a vacuum pump under the box which is likely to have radioactive internal contamination.

Glovebox 983 was used for compatibility studies and is not expected to be radioactively contaminated. This glovebox is non-lead-lined. It has gloveports in its plexiglas window. Glovebox 03339 is not contaminated and was never put into service. The glovebox was to be used for a calorimeter but was never used. It is lead-lined with the lead epoxied onto glovebox exterior.

Glovebox 017 is radioactively contaminated and is not connected to the building ventilation system.

Glovebox 985 (GB-985) was used in support of plutonium compatibility studies and is similar to Glovebox 975. The glovebox is not lead-lined. GB-985 contains a three position storage unit, a sample vial rack, a balance, laboratory press, and miscellaneous tools. At the east end of the glovebox there appears to be a capped off exhaust line and filter housing. Both inlet and exhaust filters are external to the glovebox in separate housings.

Glovebox 986 has moderate to very low uranium contamination. The glovebox internal surface is coated with a protective material.

Hood 555 is attached to a "Cary" Ultra Violet Mass Spectrometer. It has low level radioactive contamination and has not been used since 1969.

Glovebox 230 is blanked off, but radioactively contaminated. The bolts are silicone sealed. The box is lead-lined and the lead is bolted in place. There appears to be no exhaust to the line (closed off). The line contains a pig tailed bag of trash in the south end. The floor appears to have been swept. There is a pile of tools in the center of the glovebox.

Gloveboxes 989 and 990 are the same glovebox. The glovebox contains two tube furnaces. There is a capped vacuum line on the south end of the glovebox. The glovebox airlock is empty. The glovebox vacuum pump is under the glovebox and is likely to have internal radioactive contamination. Glovebox 992 contains a large lab press, polishing equipment and balance in the glovebox. An enerpac hydraulic pump is underneath the glovebox which services the press. The hydraulic system is likely to be radioactively contaminated internally. There is a metal plate under the press (not welded to the glovebox floor) which has been silicone sealed along the edge. The glovebox has an empty airlock.

Glovebox 991 contains miscellaneous tools, check weights, and a balance. The glovebox floor is clean. However, the floor under the glovebox is contaminated on the north end.

Room 223

Hood 223-1 was used for beryllium work. The floor in front of the hood is radioactively contaminated and there is probable radioactive contamination in the exhaust line from the hood. The hood is dirty inside and contains cans and beakers.

There is fixed contamination on the sink top next to the hood.

In the northwest corner there is a heater attached to a vent. Lead tape covers the holes in the south side of the heater cabinet. There is fixed radioactive contamination on the front of the filters leading into the cabinet.

A vacuum coating surface is in the south center of Room 223. The inside of the furnace is open to the room through an open side port. The furnace exhausts directly to the room.

Radioactive contamination has been identified in the lab on the north wall. There are large vacuum systems on the east wall that may be internally contaminated.

Room 225

Although there are no gloveboxes or hoods in Room 225, there is radioactive contamination on the northeast cabinet and a hot spot on the floor next to the vacuum system.

Room 228

This room was used for sample preparation for X-ray analyses, plutonium metallurgy and tensile testing.

Glovebox 45 contains an Instron testing machine. It contains a six position and a two position heat detector and miscellaneous tools. There is a glovebox well under the south end of the box.

B-Box A-1 has low level radioactive internal contamination. The B-Box contains two diamond cutoff saws and a vacuum bell jar. A metal plate with lead tape covers a hole in the box floor. The lead tape is around the plate edges and attaches to the glovebox floor. GB-192 contains six tube furnaces and miscellaneous tools. Four of the furnaces appear dated and could contain asbestos. The glovebox has an airlock.

Glovebox 202 (GB-202) contains a constant temperature bath on the east end with other miscellaneous items. GB-202 has an airlock which is empty. There is lead tape around the windows.

Hood 202 contains polishing and cutting machines. The hood's exhaust line runs to a large overhead room filter plenum.

Hood 468 S contains a sputtering coater in the west end which was used for coating plutonium samples. There are miscellaneous cans and tools in the box.

Hood 468 NE contains a canner, balance, miscellaneous cans and tools. There is a disconnected vacuum pump under the hood which may be radioactively contaminated internally. The intake filter is under the hooded floor in the northeast corner.

Hood 468 NW contains miscellaneous tools.

Hood 198 does not have an exhaust filter.

Glovebox 199 (GB-199) is lead-lined which is epoxied onto glovebox exterior. GB-199 was used for plutonium sample polishing. The glovebox contains a vacuum furnace, a diamond cut-off saw, a muffle furnace, balance, a five-position heat detector and an airlock. The vacuum pump located under the glovebox is likely to have internal plutonium contamination. There are two pass-throughs, one to Room 234, Glovebox 205, and one to Glovebox 203 (GB-203).

GB-203 contains two polishing machines, an ultrasonic cleaner and miscellaneous tools. There is a vacuum system under the box which could be internally contaminated with plutonium. The glovebox has a pass-through to Room 234, Glovebox 205C.

Glovebox 200 (GB-200) contains a tube furnace on the west end and a constant temperature bath. In the east end of GB-200, there are miscellaneous tools throughout. The airlock is on the east end. The vacuum system for the tube furnace is under the glovebox and likely to be radioactively contaminated internally.

Glovebox 201 contains a microbalance which is attached to a rubber gasket in the floor to dampen vibration.

There are five X-ray refractometers in Room 228 which are not believed to be radioactively contaminated.

<u>Room 233</u>

Room 233 is an office containing a workbench, desk and bookshelves. This room is connected to Room 235.

Room 234

The Room 234, Gloveboxes 205, A, B, C and D were used for plutonium sample preparation as described below:

Glovebox 205 (GB-205) was used for sample preparation. The glovebox contains a balance, assorted tools and check weights. There is a cover over the exhaust filter. Above the glovebox is a freon tank. The vent for this tank is located in the glovebox.

A vacuum pump is located below the glovebox. It is suspected that this pump was used to fill the freon tank above the box. GB-205 has a pass-through that goes to the gloveboxes in Room 228.

Glovebox 205A contains a piece of Lexan, a heat detector and an ultra-sonic cleaner that may have used carbon tetrachloride. No carbon tetrachloride is present.

Polishing of samples was performed in Gloveboxes 205B and 205C. Both of these gloveboxes have floor mounted polishers. The gloveboxes also contain tools, sample holders, ultra-sonic cleaners, heat detectors and empty bottles that at one time contained freon.

Hood 205D was used for polishing and etching. The glovebox contains tools, ultra-sonic cleaners, controls and empty bottles. GB-205 has a blanked off exhaust port with expanded metal welded over the opening.

Hood 205E is small in size and contained sample vial containers which are to be removed during deactivation.

Room 234 also contains two metallographs. Both are contaminated and have signs that indicate removable and fixed radioactive contamination is present. The floor below the metallographs also has radioactive contamination.

The room's refrigerator was used to store chemicals for photograph developing and sample molding. Room 234 has a fire cabinet which stored solvents and an acid cabinet which was used to store acids such as nitric and hydrofluoric acid.

Paint covers fixed contamination on the floor. Room 234 contained several chemicals which may have left a residue.

Room 234A

Room 234A contained an X-ray unit which has been removed from the room. Room 234A is now used for storage. The floor has several areas with yellow paint indicating the possibility of fixed contamination on the floor.

Room 234B

This room was used as a dark room. No radioactive contamination is suspected to be in this room.

Room 235

Room 235 has a transmission electron microscope (TEM). The unit is not believed to be radioactively contaminated.

Room 270

In the southeast corner of Room 270 is an ESCA used for surface analysis. B-Box 270 N was not used and should not be radioactively contaminated. Gloveboxes 972 and 973 were used for plutonium and hydrogen studies. Two X-ray units were removed, from the northwest corner, placed in crates, and are being stored in Room 157 (these were radioactively contaminated). Glovebox 2115 is contaminated with uranium. Glovebox 3072 (GB-3072) is contaminated with uranium. GB-3072 has some tools remaining inside the glovebox.

Room 271

Room 271 was used as a low level mixed (LLM) waste storage area.

Room 272

Room 272 was a testing laboratory. The center glovebox (Glovebox 6621) is not contaminated. GB-6620 was used to support testing and is plutonium contaminated.

Room 273

Room 273 has fixed radioactive contamination on an electrical connector on box.

Room 147

Room 147 was used for storage of non-RCRA drums and treatability study samples.

Room 150

Room 150 contains equipment used for welding. The room equipment includes Electron Beam (EB) welders, tanks, work benches, storage cabinets, vices, tool boxes, fixtures, a fire cabinet, grinders, sanders and bookcases. The room has one welder, marked "caution beryllium" and three hoods (150N, 150-S, and 150-W) connected to the building ventilation system. It is thought that minimal radiation operations were performed in this room. The possibility exits for contamination.

Room 152

Glovebox 208 (GB-208) was deactivated in 1995. GB-208 is constructed of aluminum that has been lead-lined and lead taped. The glovebox contains a large vacuum furnace on the south end, which is open and empty. The critically drain on the south end of the box has been welded shut.

Glovebox 211 (GB-211) has been deactivated. GB-211's lead-lining is epoxied onto the glovebox exterior. The lead-lining seams are lead taped. The glovebox has an airlock which is empty.

There is an empty vault located in the north end of the room.

There is a radioactive contamination posting in the northwest corner of the room.

Room 153

Room 153 was used for drum storage and had one RCRA drum storage location to collect leaded gloves.

Room 153A

Room 153A appears to have been used for drum storage at one time. This room contains signs on the wall labeled "hot tooling" and "tritium." The room contains a trash compactor, a lead drum shield, and three abandoned pumps.

Room 153B

Room 153B is a down draft room. Room 153B was used to open contaminated and potentially contaminated containers as well as for repackaging drums. This room also contains a trash compactor.

Room 154

Room 154 was used for hydriding and dehydriding plutonium.

Hydriding and dehydriding was accomplished in Gloveboxes 1363 (GB-1363) and 1364 (GB-1364). Glovebox 7248's (GB-7248) lead-lining is bolted in place. Lead tape is used to seal the lining seams. This glovebox contains three furnaces.

The vacuum pump underneath GB-1364 has internal radioactive contamination. The glovebox has an airlock on the south end. GB-1364 has a criticality drain on the south end which is taped over and plugged.

Glovebox 1363's (GB-1363) lead-lining is bolted in place. Lead tape is used to seal the lining seams. GB-1363 contains two furnaces and has an airlock at the south end. GB-1363 has two vacuum pumps which were used to support the glovebox operations. The vacuum pumps are internally contaminated with plutonium. The tray on the outside of this box is contaminated.

Glovebox 2025 (GB-2025) is non-lead-lined. GB-2025 was used to burn off hydrogen from the hydriding process. The glovebox contains a torch and some miscellaneous tools. GB-2025 has an airlock.

Glovebox 1365's (GB-1365) lead-lining is bolted in place. Lead tape is used at the lining seams. The glovebox contains miscellaneous jugs and containers. The vacuum pump's line is connected to the airlock located on the north end of the glovebox. The criticality drain from GB-365 is painted with magenta paint indicating fixed contamination.

Glovebox 4933's (GB-4933) leading lining is bolted in place. Lead tape is used to seal the lining seams. The glovebox has a three space heat detector and hot plate. The glovebox internal surface is coated with a protective barrier, which is flaking off.

Room 155

Room 155 was a plutonium sample-mounting laboratory supporting auger spectroscopy. Room 155 has etching equipment, polishing equipment, a furnace and B-Boxes to pull samples out of the production line.

Hood 155 NE was a 90 day accumulation area (779-2269). Hood 155 NE contains trash and corroded laboratory equipment. There is possible transite (asbestos) lining the hood.

Glovebox 206-218 contains a muffle furnace, miscellaneous tools and a heat detector.

Glovebox 206-219 contains a polishing wheel, burnables, and cutting disks.

Glovebox 206-220 contains two polishing wheels.

Glovebox 206-221 contains two electroetching units. This glovebox has internal radioactive contamination.

Glovebox 206-222 (GB 206-222)contains a cutoff saw, tools, balance, heat detector, and vacuum furnace.

Glovebox 206-223 (GB-206-223) contains a polishing lap, miscellaneous tools and bushings. There are two vacuum pumps underneath GB-206-223, which access GB-222. The vacuum system has internal radioactive contamination. The criticality drain has a cover over the bottom outlet.

Glovebox 206-224 contains a polishing lap and miscellaneous tools.

B-Box 206-225 contains electropolishing equipment. There is direct radioactive contamination on the shelf in front of the B-Box.

Room 156

Room 156 is a calorimeter room. The calorimeter and two portable air handlers, which are radioactively contaminated, are in this room. The air handlers have been wrapped in plastic and tape.

Room 157

Room 157 was used for various materials testing.

Glovebox 223 (GB-233) houses a radioactively contaminated tensile testing machine. GB-223 contains miscellaneous tools, an old style heat detector and miscellaneous equipment.

Glovebox 224 was used to prepare samples and is radioactively contaminated.

Glovebox 222 was never connected. It contains a tensile machine and is considered uncontaminated.

Glovebox 225 is uncontaminated.

Glovebox 226 contains a few tools. There are two filter housings located external to and above the glovebox.

There are miscellaneous cabinets and electronic equipment in Room 157.

Room 159

Room 159 was a permitted storage area for RCRA waste (Unit 779-90.42). This RCRA unit is closed.

Room 160

Room 160 was retrofitted in the early 1980s as a pyrochemical development facility. Operations that took place in this room included direct oxide reduction, molten salt extraction, electro-refining salt scrub, and other high temperature studies with plutonium and americium.

In 1985, there was a major stationary furnace breach in Glovebox 865 which contaminated the entire room with plutonium and americium. Walls, floors, ceiling, and pipes were painted after decontamination of the room to fix any residual contamination.

Glovebox 865's lead-lining is bolted in place. There are two stationary furnaces in this glovebox. Radioactive contamination exists on all internal surfaces of the glovebox. The vacuum pump located underneath the glovebox has internal radioactive contamination.

Glovebox 867 is radioactively not contaminated (never used). The door to the main line is blanked off. This box is labeled "out of service". Its lead-lining is epoxied onto the glovebox exterior. This glovebox has leaded glass windows over plexiglas.

Glovebox 863's (GB-863) lead-lining is epoxied onto the glovebox exterior. A chainveyor for moving materials between boxes is attached to GB-863. There are two stationary furnaces in this glovebox. This glovebox contains miscellaneous tools and a furnace lid in the south end.

Glovebox 866's (GB-866) lead-lining is epoxied onto the glovebox exterior. This glovebox has two wells intended for calorimeters. This glovebox is connected to GB-863 by an intact rubber blank. The glovebox is not contaminated.

Glovebox 857's (GB-857) lead-lining is epoxied onto the glovebox exterior. GB-857 has an airlock. The glovebox contains furnaces, tools, and hot plates. GB-857 is serviced by a vacuum pump which is likely to have internal radioactive contamination.

Glovebox 862 (GB-862) is a continuation of GB-863. GB-862's lead lining is epoxied onto the glovebox exterior. The connection between this box and Glovebox 860 has radioactive contamination on the external surface of the gasket separating the gloveboxes.

Glovebox 860 (GB-860) was used for storage of special nuclear material. It is water walled with lead epoxied onto the front of the box. GB-860 contains a 32-position storage rack.

Glovebox 859 (GB-859) was used for removing buttons and salts from crucibles. GB-859 has a lead lining which is epoxied onto the glovebox exterior. There is miscellaneous equipment in this glovebox which includes a drill press. This glovebox also has an airlock on the west end which is out of service.

Glovebox 864's (GB-864) lead-lining is epoxied onto the glovebox exterior. GB-864 houses a large tilt-pour furnace which never went hot. There is still a rubber blank (with metal backing) sealing GB-864 from Glovebox 862. There are no gloves on the gloveports of GB-864.

Glovebox 858 (GB-858) is not lead-lined. GB-858 was to be a controlled atmosphere glovebox used for drying salts which were used in the pyrochemical operations. Adjacent to GB-858 are two drying ovens for pre-drying the salts.

There are cabinets on the south wall which did contain cans of salts (NaCl and KCl), as well as unused ceramic crucibles.

Glovebox 868 (GB-868) may be radioactively contaminated. GB-868 is a conveyor line for transporting materials between Glovebox 872 and 862.

Room 160 also contains several control panels and other miscellaneous items. Everything in Room 160 is potentially contaminated with plutonium and americium.

Room 160A

Room 160A was a vault that was full of SNM. Room 160A is empty of all SNM.

Room 163

Room 163 is currently being used for storage of empty drums.

Other Rooms

The other rooms within Building 779 are mainly office areas and shower facilities. These rooms have a low potential for significant hazards/risk.

Building 729

As described in Appendix A (Section 1.2.4), Building 729 services the ventilation requirements of a portion of Building 779. Building 729 contains a control room, emergency diesel generator room and filter plenum room. There is also a filter plenum duct bridge between Building 779 and Building 729.

Contamination within Building 729 is anticipated in the four-stage glovebox exhaust plenum system and the two stage building exhaust system.

Building 782

As described in Appendix A, (Section 1.2.8), Building 782 services the ventilation requirements of a portion of Building 779.

The main features of Building 782 are it's three exhaust plenums, (hood exhaust plenum, glovebox exhaust plenum and general building exhaust plenum), exhaust fans and a fire water collection tank (deluge tank) filled with raschig rings. As with Building 729, the plenum filters in Building 782 are expected to be radioactively contaminated.

Building 727, Emergency Generator Facility

The Building 727 emergency diesel generator supplies backup electrical power to the Building 782 ventilation system to ensure continued operation of the exhaust fans. Building 727 systems exhibit no unique hazards or risk.

Other Cluster Buildings

Building 780	Paint/Storage Facility
Building 780A	Metal Storage Facility
Building 780B	Gas Bottle Storage Facility
Building 783	Cooling Tower Pump House
Building 784	Cooling Tower
Building 785	Cooling Tower
Building 786	Cooling Tower West Chiller
Building 787	Cooling Tower East Chiller

These facilities do not exhibit unusual hazards or risk. No radioactive contamination is expected to be found in any of these buildings.

2.2 DECOMMISSIONING OVERVIEW

This section provides a general description of the sequential steps which will be followed to decommission rooms/areas within the 779 Cluster. The detailed technical approach to decommission an area/room of the 779 Cluster will be developed and approved in accordance with the IWCP process. The IWCP contains detailed instructions for performing work on-Site and contains specific controls and requirements to ensure protection of the workers, public and environment. The Engineering Package/IWCP Development section contains additional information on how an IWCP is developed. Figure 1-3, Decommissioning Document Hierarchy identifies the procedures and documents associated with the IWCP process. Appendix C and Table 6-1 are used to relate the major hazards within a room to the work approach which will be used in developing the IWCP. Table 2-2, Technical Approach to the 779 Cluster D&D Project, summarizes the proposed technical approach for major elements, such as equipment and systems, for the project.

Table 2-2 Technical Approach to the 779 Cluster D&D Project

MAJOR D&D ELEMENTS	TECHNICAL APPROACH
Glove Boxes	• Hydraulic shear/ cold cutting techniques (nibblers) • Loose material removed/ strip coating • Utility isolation (ventilation last) • Holdup characterization • PERMACON/ in place soft-side containment • Limited size reduction • LLW (macroencapsulation
Ventilation	• Annex B, A modifications • Use of portable HEPAs • Maintain negative ventilation until end of project • The last major element to remove will be the ventilation system
Piping System	• Characterized/ flushed/ drained during removal • Segregate/packaged based on characteristics or process knowledge. Drains will be sampled and the material handled based on sample results.
Beryllium Contaminated Equipment (Excess Equipment)	• Follow "zero" added beryllium standard for free release to the public • Decontamination (wipe method) OSHA • Disposition and size reduce
Beryllium Contaminated Waste (Proposed Approach)	• Job Safety Analysis/Hazard Analysis • Identify worker safety requirements • Contain beryllium contamination (shrink wrap, containerization) • Notify disposal site of the possible receipt of beryllium contaminated wastes
Demolition / Building Structure	• Fix or decontaminated structure to facilitate demolition without containment • Decontaminate structures to meet release criteria. These operations may remove surface material up to 1/8 inch. Free release in accordance with Rocky Flats release criteria. • If unable to meet free release criteria, ship waste to Nevada Test Site as LLW • Develop Demolition Plan • Interior Walls: Selective demolition of areas containing deep residual contamination using wet saw cutting, and/or controlled breakup and removal. • Exterior Walls: If unable to meet release criteria, fix contamination in place and use controlled selected demolition practices. Rad Engineering will prescribe additional controls (tents, covers, etc.) as required. • Use of back hoe and caterpillar with La Bounty sear or crusher for demolition. • Use dust suppression as identified by air quality. • Outbuildings D&D'd in parallel with Building 779 D&D

2.2.1 Objectives

The Engineering approach is based on achieving the following objectives:

1. Ensure worker safety while completing the decommissioning activities. In order to accomplish this objective, the use of engineering controls is maximized as appropriate. Another important consideration is minimization of radiological occupational exposure. The application of ALARA principals to each activity will be accomplished by having a dedicated Radiological Engineer as a part of the project team. One of the primary responsibilities of the Radiological Engineer will be ALARA job reviews.

2. Prevent the release of hazardous and/or radiological material to the environment. The facility is expected to be fully decontaminated or have remaining contamination fixed in place prior to disrupting the primary building containment. If the End State Criteria (4.0) has not fully been satisfied additional engineering controls will be put in place prior to breaching the containment.

3. Maintain project costs and schedule within projections. Costs are usually a function of planning and risk projection. As discussed later (Reference "Engineering Walkdowns" paragraph), a project team will be used to plan the decommissioning efforts, thus minimizing unplanned activities. By using a team concept in the planning effort the potential risks will be better characterized. Schedule flexibility will be maintained by providing several options in planning the decommissioning tasks.

4. Waste Minimization is an integral part of the decontamination progress.The decontamination process selection plays an important part in minimizing secondary waste streams. Scarification/scabbling is the primary decontamination method to be used on concrete surfaces. Metal surfaces will be decontaminated using a variety of techniques. Surfaces will be wiped down with cleaning solution, sprayed with strippable paint and potentially cleaned using abrasive blasting as appropriate. Other processes (such as microwave ablation) may be used if required and funded.

5. Maximize the use of existing procedures and develop others as needed. This will allow focusing project team members on the task at hand instead of creating new documents.

2.2.2 Decommissioning Engineering Package/Integrated Work Control Package Preparation

The following paragraphs describe the steps and the integrated "project team" approach which will be used to develop IWCPs which adequately address the scope of work to be performed and specific administrative and engineering controls which are required to be applied to specific decommissioning operations. This approach is in compliance with the Enhanced Work Planning philosophy.

Review of Characterization Data and Historical Information

Review of characterization information will be completed to identify/verify the potential hazards within the work area so that the IWCP can be developed to ensure that the individuals assigned to work within an area are properly trained and protected. Additional characterization will be conducted as described in Section 3.0 (Facility Characterization) and Appendix C (Characterization Survey and Work Summary Matrix).

Perform Engineering Walkdowns

Engineering walkdowns will be performed to evaluate and define the specific decommissioning techniques to be used and engineering controls required to minimize personnel exposure. These walkdowns and tabletop work planning efforts will include participation from an integrated "project team" composed of:

- Radiological Engineering
- Radiological Operations
- Construction Management/Craft Foreman
- Mechanical, Civil, Electrical and Instrument Engineering
- Waste Management
- Building Operations
- Industrial Hygiene and Safety
- Craft
- Environmental Compliance
- Area Subject Matter Expert (as available)

Engineering Package/IWCP Development

The engineering package development and IWCP process have been combined to develop work instructions for the 779 Cluster Decommissioning Project.

Based on input from the project team, walkdowns, characterization data and applicable building documents, an engineering package will be developed for each work area. The engineering packages will contain detailed work instructions for all the decommissioning activities. The packages include engineered radiation controls, health & safety practices, and waste management requirements, in addition to the decontamination, disassembly, and size reduction instructions. Work instructions will be written such that they can be used directly as the IWCP. Isometric drawings, piping and instrument drawings, and photographs will be used as tools to supplement the work instructions. The IWCP will be reviewed and approved by core members of the project team and applicable support groups.

2.2.3 Standard Work Steps

Provided below is a summary description and typical sequence of operations which will be employed during the decommissioning of work areas/rooms within the 779 Cluster. These activities will be controlled and authorized by a specific IWCP and may be modified, as appropriate, to address a specific condition or hazard in a particular area or room. **Note**: All equipment and materials are evaluated for reuse potential and life-cycle waste costs prior to final dispositioning.

- Additional radiological, industrial hygiene and safety characterization will be performed to prepare appropriate work authorization documents such as RWPs, ALARA reviews and AHA. This characterization process will be an ongoing process throughout the decommissioning process to ensure the work area hazards are adequately addressed and proper personnel and environmental protection is provided.

- Prior to starting any activities, all involved personnel will participate in a pre-evolution briefing to discuss the proposed work and to review the applicable safety requirements.

- If asbestos containing materials is disturbed as part of the scope of decommissioning activity, the area will be abated by a qualified contractor prior to start of decommissioning work which could disturb the asbestos containing material. The abatement activity will be carefully coordinated to minimize interference with other activities.

- PCB contaminated paints will be removed and handled as TSCA regulated waste; PCB contaminated structures will be disposed of as TSCA-regulated waste.

- Prior to working in a potentially Be-contaminated area, characterization will occur to determine the level of contamination. Industrial Health and Safety (IH&S) will determine the level of PPE and safety precautions.

- Equipment and horizontal surfaces within a work area/room will be vacuumed and/or wiped down if surface contamination is expected. Damp cloths and decontamination fluid and/or tack rags may be used. This house cleaning will be performed to minimize personnel exposure to potentially contaminated dust during subsequent decommissioning activities.

- Electrical power to components/systems to be removed will be de-energized and locked out, tagged out, and disconnected. Electrical system conduit which cannot be de-energized or is required for continued decommissioning operations will be clearly identified. Temporary power may be utilized and will be clearly identified and controlled.

- Temporary ventilation will be used as necessary.

- Piping systems and equipment will be drained, isolated and locked out/tagged out prior to any work on the system/equipment. All collected liquids will be appropriately sampled and managed/dispositioned in accordance with Site waste management procedures. **(Note:** Liquids will usually require sampling prior to draining to determine compliance with Criticality Safety Operating Limits (CSOLs.)

- Interconnecting system piping, conduit, bracing and supports will be removed as necessary to remove equipment and components from the room.

- Equipment within the work area/room will be removed. As a general rule, equipment located at floor level will be removed first to allow better access to overhead areas. Equipment removal may include the disassembly and decontamination of the equipment, if it is determined to be cost effective. The decontamination efforts may be completed in place or the equipment/glovebox may be moved to another area for decontamination and size reduction. A variety of decontamination techniques may be used including, a simple wipe down, use of abrasive material such as Scotch Brite™, steel wool or sandpaper. More aggressive methods discussed in Appendix B may be used if necessary. All equipment and components to be unconditionally released will be surveyed in accordance with the RFETS RCM and associated implementing procedures prior to release.

Gloveboxes, B-Boxes and Hoods will be decommissioned using the following approach:

- Inspect and change gloves as necessary. The building ventilation system is to remain in service until the gloveboxes are breached or taken off the main line.

- Equipment and components will be removed from the internal portions of the contamination containment device (e.g., glovebox). This is accomplished by bagging out the material to preserve the glovebox containment which will facilitate decontamination of the surfaces likely to be contaminated.

- The cleaning materials are bagged into and out of the glovebox to preserve the glovebox containment.

- Internal surfaces will be wiped down using materials such as tack rags and non-ionic cleaning solution. Loose materials will be swept up and as required, a light abrasive material will be used such as Scotch Brite. More aggressive techniques may be used such as abrasive grit blast or other methods discussed in Appendix B. The glovebox ventilation is isolated for a short time while the spray coat is being applied. The ventilation is restored after applying the spray coat around the glovebox exhaust.

- Based on radiological survey measurements, a strippable coating may be applied to fix surface contamination during size reduction operations. When appropriate, the strippable coating may be applied and removed several times to reduce surface contamination levels. This action will minimize the volume of TRU waste generated. The gloveboxes ventilation is isolated for a short time while the spray coat is being applied. The ventilation is restored after applying the spray coat around the glovebox exhaust.

- Lead shielding affixed to external surfaces of the gloveboxes may be removed to minimize the generation of mixed waste.

- Prior to the size reduction of a glovebox, B-Box or hood it will be enclosed in a contamination control containment. Depending on the layout of the room, the size of the component to be size reduced and contamination levels, a containment may be erected around the equipment in place or the equipment may be moved to a semi-permanent size reduction facility located within Building 779. Entry and egress from the temporary containment is through an airlock attached to the containment. The contamination control containment will be equipped with high efficiency particulate air (HEPA) ventilation to control the spread of contamination and minimize worker exposure during size reduction and waste packaging operations. The building ventilation system exhaust to the glovebox is left in service until the glovebox openings make the system ineffective. The building exhaust is isolated at that time and containment is preserved by the temporary enclosure. Note that the temporary enclosure is maintained under a slight negative pressure by the temporary air mover and HEPA filtration system that exhausts to the room ventilation system. The room ventilation also exhaust also exhaust through HEPA filters before leaving the facilities.

- Working inside a containment, workers will size reduce the component using a variety of methods including nibblers, saws and other metal cutting techniques. Size reduction will be performed as required to minimize waste volume and allow packaging in approved containers. All waste material will be characterized and packaged in accordance with Site Waste Management procedures as described in Section 7.0. The waste material is bagged out of the containment to preserve contamination control and a negative, between the room and the temporary enclosure.

- After all equipment and systems have been removed from the room/area, the exposed room surface will be radiologically decontaminated and abated for lead and/or PCBs in painted surfaces, as necessary. The surfaces will be sampled/surveyed to determine the need for further decontamination and to verify the effectiveness of the decontamination process. Room surfaces will typically be decontaminated by wipe down and/or surface scarification methods such as scabbling or other similar technique discussed in Appendix B. The temporary containment is collapsed in on itself (while maintaining a negative pressure) if the containment is no longer required. The temporary ventilation system is turned off and then disconnected. The containment is then disposed of or taken to another area for reuse.

Ventilation System Removal

- The ventilation system is removed after all of its services have been disconnected.

- The contaminated ventilation internal surfaces are coated with a fixative. This is done by shutting down the ventilation system for a short time and bagging in a probe to spray the fixant. After applying the fixant, the probe is removed and the system is restarted. The ventilation system is shut down to ensure the HEPA filters are not plugged with fixant.

- The ventilation system is removed starting at the most remote point from the HEPA filtration unit and fans. The portion to be removed is sleeved in plastic so that this contained area of the ventilation system can be cut or unbolted while the area is contained to ensure contamination control. The section is cut/unbolted and moved away from the header. The plastic sleeve is oversized and expands as the section is moved away from the header; contamination control is maintained throughout this process. The sleeve is crimped, taped, and cut. The removed section is then put in a waste container. This process is repeated until all of the duct has been removed.

- The building fans are kept in service and throttled down to the maximum extent possible. Temporary air movers and HEPA filters may be used where necessary.

2.2.4 Sequence Of 779 Cluster Decommissioning

The overall approach is to divide the 779 Cluster into workable sub-areas. Planning and work documents will then be developed around the sub-areas.

The Building 779 Annex is the first sub-area to be decommissioned. The annex was chosen as the first sub-area because:

1. The annex was built as a stand-alone structure.

2. The annex has ventilation and utilities which can be decommissioned without affecting the remaining building systems or structures.

3. Deactivation is scheduled for completion by the end of the 1997 fiscal year.

The second sub-unit consists of the Building 779 rooms, hoods and gloveboxes which exhaust through the ventilation plenums in Building 729. These areas were chosen because they contain a substantial amount of the remaining radioactive contamination hazard. In addition, the rooms and support systems for this area can be isolated from the remaining building.

The third sub-area consists of the Building 779 rooms, hoods and gloveboxes which exhaust through the ventilation plenums in Building 782. These rooms and the exhaust plenum contain the remaining known contamination. After the third sub-area is decontaminated, the risk to human health and the environment is minimal.

As the equipment and systems are cleared from each sub-area of the building, an additional engineering package will be developed to complete the removal of all remaining utilities to the area. This will include the ventilation systems and all electrical power within the area. The sub-area will then be sealed off until demolition of the building containing the sub-area commences. Once Building 779 is sealed off, workers will use engineering packages for utility isolation, decontamination, and removal of the satellite buildings associated with the 779 Cluster. The satellite buildings will then be ready for demolition.

The final engineering packages will be demolition plans for the individual 779 Cluster. These plans will detail the work steps and precautions required to accomplish the final dismantlement of the buildings in the Cluster.

The demolition plan for Building 779 will contain the engineering plan for the building's basement. In general, all accessible equipment, piping, and conduit will be removed from the basement. The remaining basement floors, walls, and ceiling will be sampled, surveyed, and cleaned (scabbled if necessary) to leave a clean surface. The basement will then be left in place and capped. The clean basement surfaces will eliminate the need to prevent migration of ground water into or out of the entombed area. If the basement surfaces can not be cleaned to the release criteria, the material will be removed (cut out) under selective demolition or the contamination will be fixed in place. A water monitoring and removal system will be put in place if the basement area can not be put in a releasable condition.

3.0 FACILITY CHARACTERIZATION

3.1 INTRODUCTION

Characterization of a facility is the process of identifying physical, chemical, biological and radiological hazards are associated with a facility. The hazard may be contained, (i.e., acid in a tank) or loose (i.e., radioactive material on a floor). The hazard may be potential, (i.e., broken ladder) or immediate, (i.e., a leaking pipe which contains radioactive material).

This section discusses the types and phases of characterization which have been and will be completed for the 779 Cluster. There are five phases of facility characterization which are being completed in the 779 Cluster as defined below:

3.1.1 Scoping Characterization

The Scoping Characterization phase is the process of gathering existing information about facility hazards from existing sources. The primary sources of this information are historical records, routine survey records, facility walkdowns, and interviews with facility personnel and former facility personnel. No additional sampling or surveys are performed during this characterization phase. This information is used as the basis for preliminary evaluations of proposed decommissioning activities. The Scoping Characterization phase provides information for completion of the Reconnaissance Characterization phase. Specifically, this phase assists project personnel in determining the amount of additional characterization necessary to support the project.

The 779 Cluster's Scoping Characterization phase has been completed. The documents which were reviewed in gathering this information are contained in the project files. The following four subsections provide general information on the types of characterizations used for decommissioning at RFETS. Section 3.2 provides a summary of the results of characterization completed thus for.

3.1.2 Reconnaissance Level Characterization

The Reconnaissance Level Characterization phase establishes a baseline of information about the facility's hazards. During this phase, the Scoping Characterization is used in conjunction with a review of the proposed decommissioning activities to determine if the proposed activities are feasible and to identify the need for additional sampling and/or surveys. If additional characterization is needed to adequately define the quantity and distribution of contaminants, additional sampling would be completed during the Reconnaissance Characterization phase. A RLCR is then produced. The RLCR is a summary of all the known characterization information which was obtained for the facilities being investigated.

The 779 Cluster RLCR has been completed and the results are summarized within this document in Appendix C. The RCLR is submitted under separate transmittal to the LRA. The Characterization Survey and Hazard Summary Matrix, Appendix C, has been produced through the evaluation of the scoping and reconnaissance characterization information and the activities that will be performed during decommissioning. The Characterization Survey and Hazard Summary Matrix summarizes the hazards that are known to be present or expected to be present in each work area. The 779 Cluster RLCR and Appendix C information are used to: (1) complete the preliminary hazard analysis, (2) to support the preparation of detailed decommissioning work packages, (3) to estimate the type and amount of waste which is expected to be generated during the decommissioning, and (4) to support project plan considerations of dose assessments for ALARA analyses.

3.1.3 In-Process Characterization

In addition to the Reconnaissance Characterization, additional radiological, chemical, and safety surveys will be completed, as necessary, to prepare appropriate work authorization documents such as, RWPs and AHAs. These surveys are typically completed shortly before a work activity is initiated to ensure conditions have not changed since the work planning stage. As work processes and hazards are removed, further characterization is completed to verify the effectiveness of the decommissioning work efforts. These sampling and survey activities are called In-Process Characterization.

There are three aspects of the data life cycle that apply to the characterization process: Planning, Implementation, and Assessment. To produce a usable document (i.e., RLCR) each of the three aspects must be applied in sequence.

The planning process uses the Data Quality Objectives (DQOs) to determine data needs, quality and survey design. The DOP contains information regarding the initial planning phase for characterization activities (Reference Section 2.2.1) . The DQO process applied to the characterization of the 779 Cluster is defined in the draft Decommissioning Characterization Protocols. This draft document is being evaluated for inclusion in the RFCA Implementation Guidance Document (IGD).

Implementation of in-process characterization includes the assessment of historical documentation concerning the operations of the facilities and any associated chemical or radiological inventory, followed by additional sampling as necessary. Additionally, a physical survey is accomplished using the design as outlined during the planning phase.

3.1.4 Final Decommissioning Survey

The Final Decommissioning Survey will be conducted prior to demolition in order to demonstrate that the radiological and industrial contaminants within the facility have been reduced to levels that comply with the established release criteria. The Final Decommissioning Survey Report will be included as part of the project's administrative record and turned over for final Site remediation.

3.1.5 Confirmatory/Verification Survey

This survey will be performed by DOE or an independent party, approved by DOE, and will be conducted to verify that the facility, and/or material removed meets established release criteria. The independent party performs a review of the Final Decommissioning Survey methodology and survey data. Typically a confirmation survey of one to 10 percent of the area is performed. The independent and project confirmation/verification surveys are then compared to project data for consistency. If discrepancies are identified, they will be evaluated and resolved by the project team.

3.2 779 CLUSTER CHARACTERIZATION

The quantity and quality of the data presently reviewed has been used to plan the decommissioning activities and provide for protection of the decommissioning work force. The following decisions/observations were made from the Reconnaissance Characterization data:

1. There are no areas within the 779 Cluster which have significant amounts of unidentified, uncontrolled, unmarked radioactive contamination. There are some areas which are clearly identified as contamination areas that are not in B-Boxes or gloveboxes. There are no accessible areas which have radiation levels above 1 mrem. Room 160 in Building 779 is

the only room known to have significant amounts of fixed radioactive contamination on painted surfaces. (**Note:** Due to the nature of activities performed in the facilities, painted surfaces throughout the facilities will be evaluated for contamination such as PCBs and radionuclides.) As equipment is removed from the 779 Cluster exposing painted surfaces, sampling and analysis for loose and fixed radiation contamination will be completed. Current planning is to remove paint from rooms where significant quantities of radioactive material were used.

2. Waste chemicals have been identified and removed from the 779 Cluster during the deactivation process. Because the chemicals have been identified for removal during deactivation and there are no known areas which have a buildup of chemical residue, no special chemical characterization is anticipated. Should residual waste chemicals be identified during the decommissioning process, the chemical will be handled in accordance with the Compliance Order on Consent 97-08-21-02, regarding waste chemicals. The Chemical Control Administrator will be responsible for handling and removing the chemicals.

3. The quantity and distribution of asbestos containing material is known. The 779 Cluster facilities have been evaluated and sampling has been performed. The inspections have been performed by an accredited asbestos inspector and documented in an Asbestos Investigation Report. There is asbestos in some insulation material, ceiling tiles, floor tiles, mastic and wall board taping compound. Much of the insulation material has been wrapped in place to prevent disturbance. Other areas which have a potential for containing asbestos are in good condition. Further sampling and asbestos abatement will precede any activity which would disturb the potential asbestos containing material.

4. Data from industrial hygiene sampling of similar facilities indicates that the majority of painted surfaces contain lead. For this reason, the 779 Cluster decommissioning planning process includes evaluation of painted surfaces for lead. The 779 Cluster decommissioning project planning considers all painted surfaces to contain lead; appropriate controls will be put into place to protect personnel from this hazard. In process characterization sampling will be performed to characterize and ensure compliant disposal of lead paint contaminated debris.

5. The first decommissioning effort is to evaluate the need for housekeeping in each area. This effort will remove dust which may contain asbestos, lead, or beryllium.

6. Beryllium metal was removed from the 779 Cluster during the deactivation process. But, because beryllium was machined in some areas of the facility, housekeeping will be performed in these areas. This effort is to remove any dust which may contain beryllium. A more thorough sampling and analysis will be completed prior to work in areas previously identified as a beryllium work area.

7. The 779 Cluster fluorescent lights and fluorescent light ballasts will be removed and disposed in accordance with appropriate RFETS procedures.

8. The following contaminants of concern have initially been identified based on an analysis of the proposed work, facility history, walkdowns, and process knowledge. If other contaminants are identified during the course of decommissioning, or additional information becomes available, these contaminants will be included, as appropriate, in future characterization efforts:

Contaminant		Location
Plutonium	-	Interior of gloveboxes and ventilation systems, isolated locations on building surfaces
Americium	-	Interior of gloveboxes and ventilation systems, isolated locations on building surfaces
Uranium	-	Interior of gloveboxes and ventilation systems, isolated locations on building surfaces
Lead	-	Painted surfaces and shielding
Asbestos	-	Thermal system piping insulation, tile, adhesive
Beryllium	-	Building and equipment surfaces
PCBs	-	Electrical light ballasts, oils, paint, tar, adhesives (high temperature areas)

The 779 Cluster Decommissioning Project Specific Health and Safety Plan is the document that describes how the above information will be implemented/integrated as the decommissioning effort is completed.

3.3 RADIOLOGICAL CHARACTERIZATION

The radiological characterization of the facility and equipment will make use of existing operational radiation protection surveys, supplemented by additional surveys and sample, to determine the presence and/or level of radioactive contamination. The radiological monitoring of radiation exposure levels, contamination, and airborne radioactivity will comply with the requirements of 10 CFR 835, the RFETS RCM and implementing procedures. The characterization surveys will be performed by trained and qualified personnel using instruments that are properly calibrated and routinely tested for operability. Samples of potentially contaminated liquids, painted surfaces, and sediment will be collected and analyzed by qualified individuals using appropriate equipment and approved procedures. The results of radiological surveys will typically be documented on a map. The documentation will contain sufficient detail to permit identification of original survey and sampling locations.

Using the facility operational and radiological history, biased sampling locations will be selected to quantify radioactivity based on suspected, or known, contamination at a given location. Examples include horizontal surfaces such as the tops of gloveboxes and piping in overhead areas. Unbiased locations of unaffected areas will be selected at random. Examples of these areas include office areas and areas where radioactivity is not expected (Reference Appendix C for room specific information).

3.4 ASBESTOS CHARACTERIZATION

The objective of the asbestos material characterization is to determine the type, quantity and location of asbestos containing building material (ACBM). The characterization of the 779 Cluster was conducted in several phases. These phases correspond to the work areas identified in this DOP. Any additional asbestos characterization that may need to be addressed in the work areas will be performed prior to the disruption or removal of suspect materials (see Appendix C for room specific information).

Asbestos material characterization includes a review of documents detailing facility history, facility construction drawings, facility walkdowns, sample collection and analysis, and evaluation and documentation of results, and conclusions. The asbestos characterization survey was designed and managed by a qualified individual in accordance with the requirements of 29 CFR 1926.1101. Samples were collected at locations identified during the review of facility drawings and walkdowns. Surveys were performed by trained individuals who follow written procedures. All samples were tracked from sample collection, transport, and analysis. All samples are analyzed at a certified laboratory. Data was recorded in an orderly and verifiable manner and are reviewed by a qualified Building Inspector for accuracy and consistency. A summary of the report has been included in the RLCR.

3.5 BERYLLIUM CHARACTERIZATION

Work areas and equipment where beryllium is known or suspected of being present will be surveyed prior to disruption or removal of such items or surfaces. Beryllium smears will be collected and analyzed from various equipment and surfaces within the facility. Sampling and analysis will be conducted by trained individuals in accordance with the RFETS Beryllium Control Program (Reference Appendix C for room specific information).

3.6 LEAD CHARACTERIZATION

Lead shielding and lead-based paint are present in the 779 Cluster. The applicable IWCP provides detail as to how sampling will be performed on painted materials (walls, concrete, door jams) within the facilities. The results of this sampling will determine the regulatory requirements for management and disposal of these materials.

3.7 POLYCHLORINATED BIPHENYLS

Based on the review of the 779 Cluster records there is no reason to believe that PCBs have been spilled in any of the facilities. PCBs are suspect in electrical lighting ballasts, oils, and to a lesser degree in paints, adhesives and roofing tars. Representative sampling will be performed to determine if PCBs are present in these materials and to ensure appropriate waste management and safety of the workers. Sampling will be conducted by trained personnel following standard industry practices.

3.8 SAMPLE COLLECTION AND DOCUMENTATION

During characterization activities, direct, indirect, and media samples will be obtained, measured, and analyzed for radiological and hazardous material contaminants. The results will be used to determine the extent and magnitude of the contaminants and serves as the basis for estimating waste quantities for decontamination options. Sample collection, analysis, and the associated documentation will follow standard procedures and meet the recommendations and requirements of applicable regulatory agencies. A chain of custody sample tracking form will be used for each sample collected to account for the sample from collection to the point of analysis. Radiation protection for the sampling event and the sampling team will be addressed under an RWP. Personal protective equipment for the sampling activity will be specified by Industrial Hygiene in the AHA.

Records will be maintained as part of the project files in accordance with the criteria established through RFETS records management, quality assurance and the conduct of engineering manual in accordance with CERCLA. Appropriate project documents are sent to the Administrative Record.

4.0 BUILDING CLEANUP CRITERIA

The purpose of this section is to identify the cleanup criteria (acceptable level) which will be used to release the 779 Cluster for demolition. Based on the 779 Cluster characterization information, the predominate hazards to be removed from the facilities are:

Radioactive Contamination

The release levels for radioactive contamination are discussed below. Note that of all the radioactive contaminants known to have been introduced into the 779 Cluster, the radioactive contaminant with the lowest release level is plutonium.

Asbestos

Asbestos containing material will be removed from the facilities prior to demolition.

Beryllium

Beryllium metal has been removed from the 779 Cluster during the deactivation efforts. There are no environmental laws which have an identified beryllium surface contamination limit. The release criteria and survey methods will conform to the approved RFETS policies and procedures. Building surfaces and equipment suspected as being contaminated with beryllium will be surveyed to assess the level of any beryllium contamination. The RFETS beryllium housecleaning surface contamination limit is 25 micrograms (μg) per square foot (ft^2). In any case, no beryllium contaminated material will be released from RFETS without being properly packaged, labeled and having DOE approval.

Lead

In accordance with the 779 Cluster Waste Management Plan, any remediation waste that is characterized as D008 (e.g., lead bricks or sheeting, lead-based painted debris, and lead paint chips) will be managed in accordance with all hazardous remediation waste related ARARs.

Lead will be segregated from other materials and dispositioned appropriately. Lead contained in material which could be sent to a landfill (i.e., painted building materials) will be analyzed for leachability using EPA approved procedures, as agreed to by the lead regulatory agency.

PCBs

The 779 Cluster's building surfaces will be below the release limit for PCB contamination. The limit for release of PCB containing material is less than 50 parts per million (ppm).

4.1 RADIOLOGICAL

The purpose of this section is to provide the radiological contamination cleanup criteria for the 779 Cluster. Section 3.0 Facility Characterization, Appendix C, Characterization Survey and Work Summary Matrix, and Reconnaissance Level Characterization Report for this project, identify the contaminants which are expected to be present at the start decommissioning. The characterization information is used to ensure that workers are protected from the hazards in the work area, contamination is contained to protect the environs, and the waste generated is properly and safely handled, packaged, labeled and moved.

In accordance with RFCA, the residual radiological contamination levels present on building structures, equipment and building debris remaining after decommissioning will meet the EPA's preliminary regulation (40 CFR 196) that calls for an effective dose equivalent (EDE) of 15/85 mrem from the Site in any single year above background. Until this regulation is finalized, accepted industry standards for specific residual surface contamination levels which have been agreed to by the LRA will be used. These accepted industry standards for the release of materials are identified in "Radiation Protection of the Public and Environment", DOE Order 5400.5 as referenced in RFCA. and *Termination of Operating Licenses for Nuclear Reactors*, NRC Regulatory Guide 1.86. *The Health and Safety Practice Transfer and Unrestricted Release of Property and Waste*, P73-HSP-1810 Appendix 1 (See Table 4-1) is based on Figure IV-1 from DOE Order 5400.5 and Table I from NRC Regulatory Guide 1.86.

TABLE 4-1
SUMMARY OF CONTAMINATED VALUES FOR UNRESTRICTED RELEASE

Limits in this table are from the Nuclear Regulatory Commission Regulatory Guide 1.86

RADIONUCLIDE (1)	Average Total (Fixed & Removable) Contamination (3,4) dpm/100cm2 (2)	Maximum Total (Fixed & Removable) Contamination (4,5) dpm/100cm2 (2)	Removable Contamination (2,4,6) dpm/100cm2 (2)
Transuranics, I^{125}, I^{129}, Ra^{226}, Ac^{227} Ra^{228}, Th^{228}, Th^{230}, Pa^{-231}	100	300	20
Th (natural), Sr^{90}, I^{126}, I^{131}, Ra^{224}, U^{232}, Th^{232}	1,000	3,000	200
U (natural), U^{235}, U^{238}, and associated decay products, alpha emitters	5,000	15,000	1,000
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr^{90} and others noted below (7)	5,000	15,000	1,000

Notes:

(1) Where surface contamination by both alpha and beta-gamma emitting radionuclides exists, the limits established for alpha and beta-gamma emitting radionuclides should apply independently.

(2) As used in this table, disintegrations per minute (dpm) are defined as the rate of emission by radioactive material as determined by correcting the counts per minute measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

(3) Measurements of average contamination should not be average over an area of more than one $meter^2$. For objects with a total surface area of less than one $meter^2$, the average should be derived for each object.

(4) The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mRad/hour and 1.0 mRad/hour, respectively at 1cm.

(5) The maximum contamination level applies to an area of not more than $100cm^2$.

(6) The amount of removable material per $100cm^2$ of surface area should be determined by wiping an area of that size with a dry filter of soft, absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of surface area of less than $100cm^2$ is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. Except for transuranics and Ra^{228}, Ac^{227}, Th^{228}, Pa^{231}, and alpha emitters, it is not necessary to use swiping techniques to measure removal contamination levels if direct scan surveys indicate the total residual surface contamination levels are within the limits for removal contamination.

(7) This category of radionuclides includes mixed fission products, including the Sr^{90} which is present in them. It does not apply to Sr^{90} which has been separated from the other fission products or mixtures where the Sr^{90} has been enriched.

The 779 Cluster and associated property, equipment, and material will be surveyed and released as follows:

Property, Equipment or Recycle Material for Unrestricted Release	Sanitary Waste for Off-Site Disposal	Building Structures, Equipment, & Building Debris Remaining At Original Location
Surveyed in accordance with 4-K62-RO1-03.03 Performance of Surface Contamination Surveys and released in accordance with 1-P73HSP-18.10 and S23-RO1-03.02 Radiological Requirements for radioactive Material Transfer and Unrestricted Waste	Surveyed in accordance with 4-K62-R01-03.01 Performance of Surface Contamination Surveys and released in accordance with 1-P73HSP-18.10 and S23-RO1-03.02 Radiological Requirements for radioactive Material Transfer and Unrestricted Waste	Surveyed in accordance with 4-K62-R01-03.01 Performance of Surface Contamination Surveys and released in accordance with an established final survey plan utilizing 1-P73-HSP-18.10 unrestricted release criteria.

All property, equipment and material not meeting the applicable unrestricted release criteria will be decontaminated to the applicable standard or disposed of as radioactive waste. The determination to dispose of real property includes an economic evaluation as identified in the Property Management Manual (1-MAN-009-PMM), Chapter 5, "Economic Disposal Plan."

In addition to adherence to the applicable release criteria, and following RFETS radiation protection implementing procedures, and ALARA principles will be adhered to in order to minimize radiation exposure to the workers, public, and environment.

If it becomes necessary to remove a portion of a structure such as a wall in order to remove a piece of equipment, before the final survey is performed, appropriate engineering and radiological controls will be put into place to minimize the potential for a radioactive release to the environment. These actions may include the use of a fixative or the use of a containment around the material to be removed.

4.2 EQUIPMENT UNCONDITIONAL RADIOLOGICAL RELEASE CRITERIA

The unrestricted release of equipment to be removed from the Site will comply with the HASP (1-P73-HSP-1810, Appendix 1), and DOE Order 5400.5, Radiation Protection of the Public and the Environment (Figure IV-1) and applicable radiation protection implementing procedures. If 10 CFR Part 834 is approved, all applicable practices and procedures will be reviewed and modified accordingly to ensure compliance. Table 4-1, taken from the HASP (1-P73-HSP-1810, Appendix 1) includes all applicable RFETS radiological limits for the release of materials and equipment.

4.3 BERYLLIUM RELEASE CRITERIA

The beryllium release criteria and survey methods will conform with current RFETS policies and procedures. Building surfaces and equipment suspected of being contaminated with beryllium will be surveyed to assess the level of contamination. The surface contamination housekeeping limit for beryllium is 25 µg/ft2. Current RFETS practice for protecting personnel from beryllium is to utilize the as low as practical principle. This includes the use of engineering controls to minimize exposure, medical screening of personnel, and the reduction of limits and the proposed establishment of lower action levels. The airborne 8-hour time-weighted average (TWA) personnel exposure limit (PEL) for beryllium is 2 $\mu g/m^3$ with a plant action level of 0.5 $\mu g/m^3$. Personnel protection for beryllium is identified on a task-by-task basis and is identified in the AHA. (Reference Section 6.1.5 for further information.)

4.4 ASBESTOS CONTAINING MATERIALS CLEANUP STANDARDS

Prior to and during the course of the decommissioning project a comprehensive assessment and abatement program will be implemented in accordance with the OSHA Standard 1926.1101, Colorado Reg. 8 and the Site specific HSP Manual. Characterization, sampling/survey, abatement will be performed by qualified personnel per the requirements of OSHA and EPA. The MAAL for areas after abatement has been performed will be as follows:

- 0.01 fibers/cc utilizing the phase contrast microscope means of analytical technique
- In order to release an area after asbestos removal has been performed, or visual inspection will be conducted for the presence of dust. The dust will be analyzed for asbestos.

4.5 POLYCHLORINATED BIPHENYLS

The limit for release of material containing PCBs is less than 50 ppm.

4.6 LEAD CONTAINING MATERIAL RELEASE CRITERIA

Transuranic, and Transuranic Mixed remediation wastes containing lead, will be packaged for ultimate disposal at the Waste Isolation Pilot Project (WIPP). Remediation hazardous waste or mixed hazardous remediation waste will be disposed of at an approved Treatment, Storage, and Disposal (TSD) facility. Hazardous remediation waste characterized as EPA hazardous waste number D008 or mixed hazardous remediation waste will be disposed of at an approved TSD facility. Lead paint contaminated debris that is characterized as industrial waste will be released to either an approved low-level waste (LLW) TSD facility or a sanitary landfill based on radiological evaluation. In addition, all applicable OSHA requirements regarding worker protection during lead abatement (i.e., removal of lead contaminated paint debris) will be adhered to.

5.0 AUTHORIZATION BASIS TRANSITIONS

An Authorization Basis (AB) is the document or collection of documents recognized by the DOE as the contractual vehicle used to manage the risk associated with operating a nuclear facility and its associated support facilities. The AB also provides a framework for compliance with the Price Anderson Amendment Act.

For the 779 Cluster, the AB for day-to-day operations is an approved Safety Analysis Report (SAR) which was developed in 1987 under the DOE Albuquerque Field Office guidance and implementation of DOE Order 5480.5. The SAR consists of documentation which describes the facility and operations which will be conducted within the facility. The SAR also analyzes the risks associated with conducting these operations and sets bounds in which the facility operations must be performed. If the conditions within the facility fall outside the operational bounds identified in the SAR, corrective actions must be taken to maintain risk within an acceptable level or a facility shutdown process is implemented.

Because the decommissioning activities were not identified in the SAR, accidents associated with completing decommissioning activities were not analyzed for impact on the capability of the facility to manage the risk during and after the postulated accident scenarios. The authorization basis will be upgraded and maintained through the use of SAR page changes and development of Justification for Continued Operation (JCO) documents. The other RFETS engineering and administrative infrastructure documents which are used to control and manage work at RFETS will continue to be used.

6.0 HEALTH AND SAFETY

6.1 INTRODUCTION

6.1.1 Scope

The purpose of this section is to describe the controls and monitoring programs to be utilized during the decommissioning of the 779 Cluster to ensure protection of the decommissioning employees, co-located workers, the public and environment from hazards during the decommissioning process (Reference 8.4.3). This program will be implemented utilizing federal OSHA standards and Site specific plans and procedures.

6.1.2 Policy

It is the RFETS policy to ensure all employees are afforded a safe work environment while performing decommissioning activities on the 779 Cluster. Decommissioning operations will adhere to the ARARs identified in Section 8.

6.1.3 Objectives

The major objectives of the health and safety controls and monitoring for the 779 Cluster Decommissioning Project are to:

- Protect the decommissioning employees, surrounding workers, the public and environment from hazards during the decommissioning process.
- Ensure compliance with the integrated safety management principles.
- Ensure appropriate safety management and quality is administered throughout the decommissioning process.
- Develop and maintain a high level of health and safety awareness that is practiced by all levels of management, supervision and employees.
- Meet the goal of zero lost time accidents for the entire decommissioning process of Building 779 and support facilities.
- Foster excellent safety communications between all Site work groups that are affected by the decommissioning of Building 779 and its support facilities to ensure the intent and goals of RFCA are met.
- Train project personnel so they are capable of completing assigned tasks safely and in compliance with the applicable environmental and safety regulations.

6.1.4 Technical Resources and Approach

Decommissioning will utilize the Site specific HSP Manual as the working level document to govern health and safety of the workers during the decommissioning process. A project-specific safety plan will supplement the RFETS HSP Manual to focus on the specific safety concerns (chemical, radiological, industrial and hazardous) in the 779 Cluster which exist or are created during the decommissioning process.

Other safety documents may be developed as necessary to support new or changing environments, during the decommissioning process. They will be incorporated into the appropriate plans and/or work instructions as conditions require their use. Additionally, the appropriate OSHA standards (29 CFR 1910 and 1926) will be utilized and referenced as necessary to safely conduct decommissioning work activities in Building 779 and support facilities.

6.1.5 Activity Hazard Analysis

As discussed in Section 3.0 (Facility Characterization), several types of hazards have been identified in the 779 Cluster that will be evaluated to ensure the appropriate controls will be included in the IWCP. These hazards are identified in the Appendix C matrix.

Based on these hazards, the work supervision craft and industrial hygiene personnel will perform an AHA for the work tasks which have the potential to injure or damage personnel, property or the environment. This AHA will identify things such as: potential hazards, training requirements, protective control measures and special equipment needed for specific job steps. The AHA will be implemented utilizing the RFETS Health and Safety Practices Manual, Section 2.11, Job Safety Analysis. An overview of the project's potential hazards are presented on Table 6-1 per HSP 24.01, Construction Health and Safety Requirements. A more task specific analyses is covered in the AHA. In addition to the AHA other enhanced work planning elements will be used throughout the project (see Section 2.2.2).

6.2 INDUSTRIAL SAFETY

6.2.1 Applications

Day-to-day industrial activities will be governed by OSHA Standard 1926 (Occupational Safety and Health Standards for the Construction Industry), RFETS Health and Safety Practices Manual and other contractor and project-specific safety documents, as applicable. The OSHA standard 1910 (Occupational Safety and Health Standards for General Industry) will be utilized when OSHA 1926 does not cover or address a specific health and safety topic. Areas to be addressed, and implemented by utilizing the RFETS Health and Safety Practices Manual include, but are not limited to:

- First Aid and Medical Attention
- Fire Protection and prevention
- Housekeeping/Egress
- Personnel Protective Equipment
- Employee Emergency Action Plans
- Noise Exposure
- Foot Protection
- Hearing Protection
- Head Protection
- Eye and Face Protection
- Safety Belts, Lanyards, Safety Nets and Lifelines
- Proper Tool and Machine Guarding
- Fall Protection
- Basic Electrical Safety
- Lockout and Tagout
- Scaffolding Usage
- Demolition
- Welding/Cutting Operations
- Ladder Safety
- Basic Respiratory Protection
- Confined Space Entry
- Excavation/Trenching
- Ergonomic Concerns
- Bloodborne Pathogens

Individuals will be trained to perform specific job task(s). A project specific training matrix will be used to identify training requirements for project personnel.

6.3 TOXIC/HAZARDOUS MATERIALS AND CHEMICAL SAFETY

6.3.1 Applications

Worker Safety and Hazardous materials and chemical hazards management are governed by the state and federal regulations and the Site specific Health and Safety Practices Manual. An AHA will be completed before handling, storing, transferring or disposing of these items. The AHA will identify job specific training requirements. The contractor's training matrix must be structured to ensure workers are trained according to their specific work task. If workers are working with a specific hazard, job specific training will be provided (e.g., asbestos awareness). The Project Manager (PM) is responsible to ensure individuals involved with the project are properly trained. The PM generally delegates this task to the job supervisor. The training requirements are reviewed at the pre-evolution briefings.

Examples of work tasks which would require training verification or additional training are:

- Asbestos abatement
- Lead movement and handling
- Beryllium protection and clean-up
- Toxic chemical control
- Plutonium movement and handling
- Toxic chemical handling and transfers PCB management
- Hazardous materials storage and transfer
- RCRA closure

Additionally, before handling any of these materials personnel will be trained in the use of the appropriate personnel protective equipment.

6.4 RADIOLOGICAL SAFETY

6.4.1 Applications

Radiological work activities are required to comply with 10 CFR 835 - Occupational Radiation Protection, the DOE Radiological Controls Manual, the RFETS RCM (Site RCM) and the RFETS Health and Safety Practices Manual. Areas of focus in radiological safety include:

- Applications of ALARA practices and principles
- Radiological engineering work controls
- Construction and Restoration Projects
- Controlling the spread of contamination
- Decontamination techniques
- Ventilation usage and controls
- Radioactive material handling, storage and control
- External and internal exposure controls
- Respiratory protection usage
- Radiological worker training
- Radiological worker training for special applications
- Radiological performance indicator goals and standards
- Personnel contamination control

All personnel working in radiologically controlled work areas will be trained in the appropriate procedures for proper monitoring, correct work techniques and the proper usage of PPE while working in these areas. In some cases a hazardous material or chemical environment might be located in a radiologically controlled area. If this occurs, the most protective PPE will be utilized for personnel protection.

6.5 HEALTH AND SAFETY PROGRAM ELEMENTS

6.5.1 Applications

In preparation for the decommissioning of Building 779 and support facilities, key elements of the Health and Safety Program will be in place prior to starting the decommissioning efforts. Some of the key elements (of the safety program) are:

- General safety training for all workers involved in physical decommissioning work activities
- Specific safety training for workers and supervisors depending on the job task and hazards involved
- Supervisory safety task assignments criteria
- The development of safety communication vehicles (e.g., safety toolbox meetings, bulletin board information, safety newsletter), etc.
- Designations of competent persons
- Establish employee stop work authority process
- Establish process for all employees to correct safety and health hazards

6.6 EMERGENCY/INJURY MANAGEMENT

6.6.1 Applications

The decommissioning process for Building 779 and support facilities will utilize the Site Health and Safety Practices Manual for illness and injury reporting. The Procedure HSP - 3.03 covers specific elements such as:

- Reporting requirements for injuries or illnesses of personnel
- OSHA 200 form requirements
- Classification of accidents
- Reporting requirements for vehicle injuries/damage
- Reporting requirements for property damage
- Investigation requirements
- Follow-up actions for injuries/illnesses

If a radiological incident report is required in the event of an occupational injury in a radiologically controlled area, it will be processed in conjunction with the safety reporting forms utilizing HSP - 3.02, Radiological Deficiency Report.

6.7 PRELIMINARY HAZARD ANALYSIS

Table 6-1, PHA overview for 779 Cluster's Decommissioning and Dismantlement, was developed to aid in the planning of the 779 Cluster decommissioning. The PHA identifies the major tasks, the associated hazards, the hazard's probable cause and the preventive measures which should be taken to minimize the risks in completing the activity identified. Additional hazard identification and preventive/mitigative features have been evaluated in the 779 Cluster HASP.

Table 6-1 Preliminary Hazard Analysis (PHA) Overview for 779 Cluster's Decommissioning and Dismantlement

PLANNING PHASE

MAJOR WORK TASK	HAZARD	CAUSE	PREVENTATIVE MEASURES
Perform building walkdowns to identify Integrated Work Control Package (IWCP) work steps.	Tripping, falling, exposure to chemicals, hazardous substances and / or radioactive materials. Also exposure to noise hazards.	No planning, lack of communicating between work groups, improper use of Radiological Work Permits (RWPs), not following room or building instructions.	• Develop Activity Hazard Analysis (AHA). • Conduct effective pre-evolution briefings. • Follow all building instructions and postings. • Ensure all personnel have been properly trained before entry.
Move office equipment and furniture to prepare for D&D activities.	Back strains, pinch points, extremity injuries due to falling objects or moving vehicles.	Improper lifting of equipment, careless handling of equipment, improper planning and walkdowns, no continuing observations or use of the buddy system.	• Proper training conducted and documented. • Use of the buddy system. • Proper use of forklifts and trucks including operating alarm systems and brakes. • Planning meetings and briefings completed. • Proper use of AHA and PPE .
Perform hazard analysis characterization activities. This includes asbestos, beryllium (Be), chemical, lead and radiological sampling.	Overexposure to substances, accidental inhalation of substances, absorption into skin of substances, eye and skin irritation.	Improper use of PPE; PPE not being used; Improper sampling; not following prescribed sampling procedures; Improper transport or handling of samples.	• Prepare and implement AHA for job task. • Use PPE correctly. • Conduct planning meetings and briefings. • Follow all building instructions for sampling. • Utilize all procedures and sampling protocols properly. • Ensure all sampling personnel are in the proper medical surveillance programs. • Ensure all required training has been completed.

ABATEMENT PHASE - ASBESTOS/LEAD

MAJOR WORK TASK	HAZARD	CAUSE	PREVENTIVE MEASURES
Perform asbestos and lead abatement and clean up activities.	Exposure to asbestos airborne and surface contamination fibers which are lung hazards. Exposure to lead materials is hazardous to internal organs of the body.	Improper clean up techniques including: Improper tent, decontamination or PPE usage. Improper ventilation usage. Improper waste handling and disposal. Lack of adequate engineering controls. Improper characterization.	• Obtain the services of a certified state abatement inspector to plan and supervise the abatement project • Ensure all workers are trained as asbestos workers. • Ensure all RFETS asbestos/lead prerequisites are met prior to job commencing. • Develop and implement an AHA(s) for the job. • Ensure all medical, training and PPE prerequisites are met. • Ensure the proper air monitoring sampling is performed during the course of the job by IH&S personnel. • Ensure all posting and clearance sampling is performed. • Ensure that all areas are evaluated and properly characterized by SME or competent person.

ABATEMENT PHASE - BE/RADIOLOGICAL

MAJOR WORK TASK	HAZARD	CAUSE	PREVENTATIVE MEASURES
Perform beryllium decontamination and clean up activities.	Exposure to beryllium contamination in the air or on surfaces is a lung hazard. Improper use of decontamination equipment can cause extremity or limb damage to workers.	Improper clean up techniques including: Improper tent, decontamination or PPE usage. Improper ventilation usage. Improper waste disposal and handling. Improper training in the use of decontamination equipment can injure the user and co-workers. Lack of adequate engineered controls.	• Ensure all workers are trained as Be workers. • Ensure all RFETS Be prerequisites are met prior to job commencing. • Develop and implement an AHA(s) for the job. • Ensure all medical, equipment training and PPE prerequisite are met. • Ensure the proper air monitoring sampling is performed during the course of the job by IH&S personnel. • Ensure all posting and clearance sampling is performed.
Perform radiological decontamination operations.	Exposure to radioactive materials internally and externally. Cell damage and damage to internal body organs may occur with over exposures to radioactive materials. Improper use of scrabbling or other decontamination equipment can injure extremities or limbs of workers by causing gash or cutting wounds.	Improper clean up techniques including: Improper tent, decontamination or PPE usage. Improper ventilation usage. Improper waste disposal and handling. No or improper training in the proper use of decontamination equipment.	• Ensure all workers are trained as rad workers. • Ensure all RFETS rad prerequisites are met prior to job commencing. • Develop and implement an AHA(s) for the job. • Ensure all medical, equipment training and PPE prerequisites are met. • Ensure the proper air and smear monitoring sampling is performed. • Follow the RWP instructions.

DISMANTLEMENT AND DECOMMISSIONING PHASE

MAJOR WORK TASK	HAZARD	CAUSE	PREVENTATIVE MEASURES
De-energize work areas and remove cables and wiring.	Electrical shock to body, cutting of extremities or body parts using wire strippers or other hand tools, fall off ladder or scaffolding if used.	Lockout/tagout (LO/TO) not used properly, all workers not informed of LO/TO status. Improper use of hand tools, ladders or scaffolding. Improper lighting in room may result in improper use of equipment also. Lack of As-Built drawings.	• Utilize LO/TO procedures properly (including verification that energy source has been isolated). • Inspect all hand tools before use. • Ensure all workers are trained in ladder, scaffolding and fall protection measures before using this equipment. • Develop and utilize task specific AHAs. • Perform work area walkdown and conduct proper planning meetings and briefings. • Follow all IWCP instructions. • Ensure all worker training is current.
Move equipment out of rooms or areas and transport utilizing forklifts, pallet jacks, or pick up trucks.	Back injuries, pinching, extremity damage by dropping or falling objects. Internal and external body injuries by vehicle impact. Eye injuries by poking or dust particles in eye. Noise hazards. Be exposure from contaminated surfaces under equipment.	Improper lifting techniques, job flow not planned properly, pre-job walkdowns not performed, vehicle alarm systems not working, buddy system not used, lack of attention to detail, worker fatigue, or no use or improper use of PPE.	• Perform pre-job walkdowns. • Develop AHAs for job. • Use buddy system. • Ensure vehicle alarm and braking systems are working properly. • Utilize PPE properly • Perform proper lifting techniques. • Ensure proper job flow is used and job is not rushed. • Perform pre-job warm up exercises before lifting. • Do not attempt to move items that are stacked too high. • Cover all sharp edges. • Perform beryllium pre-job swipe sampling.

DISMANTLEMENT AND DECOMMISSIONING PHASE (con't.)

MAJOR WORK TASK	HAZARD	CAUSE	PREVENTATIVE MEASURES
Cut out piping systems in rooms or work areas.	Cutting of body limbs or body parts with mechanical equipment. Piping falling on feet, pinch points of rolling pipe, liquid splashes if piping is not drained, Rebound of pipe can cause body injuries.	Improper use of mechanical equipment including no training of equipment being used, piping not rigged or restrained properly, piping not drained prior to cutting.	• Proper training with cutting equipment. • Develop and utilize AHA for job tasks. • Rig and restrain piping properly. • Utilize pipe caps after cutting to keep debris from falling out and cover sharp edges of pipes after cutting. • Ensure piping has been properly taken out of service. • Utilize proper PPE as described in the AHA and RWP.
Hoist, rigging and lifting forklift operation	Bodily injuries due to falling objects or pinching of workers due to space limitations.	No rigging plan, improper rigging techniques, improper worker body positioning.	• Develop rigging plan. • Comply with all RFETS standards for rigging • Develop AHA and implement. • Perform pre-job walkdown and conduct pre-evolution. • Walkdown rigging path - all phases. • Perform pre and post job inspections on all rigging equipment. • Ensure all workers are properly trained. • Follow all required steps in the IWCP.

DISMANTLEMENT AND DECOMMISSIONING PHASE (con't.)

MAJOR WORK TASK	HAZARD	CAUSE	PREVENTATIVE MEASURES
Packaging waste into containers for storage and shipment.	Pinching of extremities on container lids, barrels rolling on feet, back strains, foot injuries as vehicle wheels impact or roll onto extremities, cuts/gashes of hands by tooling.	Improper lifting and handling techniques, wrong tooling used to put lids on containers, pallet jack or forklift ramming into workers, job rushed or not planned properly.	• Use of trained certified waste generator, as appropriate. • Develop AHA and implement. • Review lessons learned from previous waste handling operations. • Develop proper tool list before starting job.
Segregate waste to meet WAC of accepting facility.	Containers must be repackaged.	Package does not meet WAC.	• Ensure all waste containers are properly staged before starting job. • Ensure all building notifications are made before moving and handling waste. • Follow appropriate RFETS requirements for waste handling and movement. • Follow all IWCP requirements.
Cut out and remove gloveboxes in rooms or work areas.	Pinch points, foot and hand injuries, cutting of hands/arms, eye and head injuries, burning of skin or extremities.	Improper use of grinders or no guards on grinders, cramped working conditions, bad lighting, limited vision, breaking of leaded glass, plasma slag burns through clothing, improper use of PPE.	• Proper training with cutting equipment. • Develop and utilize AHA for job tasks. • Rig and restrain gloveboxes properly. • Utilize pipe caps on glovebox piping after cutting. • Ensure gloveboxes have been properly taken out of service before work starts.
	Release of radioactive contamination and inhalation.	Improper use of fixant. Improper use of respirator.	• Utilize proper PPE as described in the AHA. • Perform tooling and respirator inspections before each use. • Follow all IWCP requirements.

DISMANTLEMENT AND DECOMMISSIONING PHASE (con't.)

MAJOR WORK TASK	HAZARD	CAUSE	PREVENTATIVE MEASURES
Construct and utilize scaffolding to perform job tasks.	Fall hazards, workers struck by failing objects, hand injuries.	No use of fall protection, improper training, no use of PPE, improper use of tooling, improper rigging and transport of scaffling pieces, no scaffold inspections, scaffold collapse.	• Proper training for scaffold erection and use. • Fall protection and rigging training. • Proper use of PPE. • Develop AHA. • Perform and document scaffolding inspections. • Ensure all scaffolding is tagged properly. • Ensure all toeboards and side rails are in place.
Perform radiological decontamination operations using scrabbling machines, hydrolysing techniques, hand wiping methods or by applying stripcoat decontamination paint.	Extremity injuries of hand and feet by gouging, cutting or impact. Inhalation, ingestion or skin exposure to radioactive materials and ammonia vapors. Electrocution Falls	Improper or no training on equipment used for decontamination, improper work area ventilation, improper use of PPE, no job planning. No LO/ TO of work area No fall protection.	• Conduct mock up training on decontamination equipment and stripcoat operations. • Develop AHA for job tasks. • Ensure work area is properly ventilated before applying stripcoat. • Ensure LO/TO operations have been performed. • Wear prescribed PPE as determined by IH&S and Radiological Protection. • Utilize fall protection, when required. • Follow all IWCP, AHA and RWP requirements.

DISMANTLEMENT AND DECOMMISSIONING PHASE (con't.)

MAJOR WORK TASK	HAZARD	CAUSE	PREVENTATIVE MEASURES
HVAC duct removal	Pinch points, cutting hands fall from scaffold, release of contamination	Improper use of cutting equipment. Non-existent or loose guard rail. Improper use of fixant. Improper use of respirator.	• Proper training in use of tools and PPE. • Scaffold inspection prior to use. • Developed AHA for job. Training in use of fixant.
Perform final cleanup of building/structure.	Tripping, falls, head wounds, pinch points, punctures, contusions, skin contamination, inhalation, absorption of radioactive materials.	Housekeeping, falling objects, non use of PPE, improper use of PPE, sharp edges or sharp objects not protected, no fall protection, improper ladder use.	• Perform weekly housekeeping inspections. • Utilize fall protection, when applicable. • Develop AHA for job task. • Utilize PPE properly and as described by IH&S and Radiological Protection. • Follow all ALARA reviews, AHAs, RWP and IWCP requirements.
Perform final survey of building.	Falls, head wounds, electric shock, abrasions, cuts, pinches.	No fall protection, improper use of instrumentation, working in tight spaces, tripping hazards, bad housekeeping, improper termination of wiring.	• Develop AHA. • Perform pre-job walkdowns. • Utilize fall protection when required. • Complete ladder training as required. • Utilize two person rule when working in elevated locations. • Procure confined space permits and training when required. • Follow all AHA and RWP requirements.

MAJOR WORK TASK	HAZARD	CAUSE	PREVENTATIVE MEASURES
Perform demolition activities of building/ structure.	Body contusions, head injuries, suffocation, fatalities, and breathing hazards.	Wetting of concrete surfaces not utilized, barriers not used properly, thorough inspections of work area not performed prior to demolition activities, lack of attention to detail.	• Develop job AHA. • Perform pre-job walkdowns. • Utilize PPE as prescribed by IH&S. • Maintain wetting of debris with fire hoses as demolition occurs.

7.0 WASTE MANAGEMENT

Waste types which will result from the decommissioning of the 779 Cluster are radioactive, mixed, hazardous, toxic and solid waste. Waste generated as a result of decommissioning activities will be managed in accordance with relevant RFETS waste operations procedures. State and federal regulations and DOE Orders have been incorporated into the RFETS Waste Operations Procedures. The 779 Waste Management Plan provides the details associated with characterization, storage, disposal and overall waste management for the 779 Cluster. Table 7.2, Summary of Waste Management for the 779 Cluster, identifies the estimated volumes, types of waste anticipated, and the final dispositioning for the waste form.

7.1 TRANSURANIC WASTE

Transuranic waste is defined as waste that is contaminated with alpha-emitting transuranic radionuclides having half-lives greater that 20 years and concentrations greater than or equal to 100 nCi/gram at the time of assay. Transuranic waste, as defined, may result from the decommissioning of Building 779. Less than 5% of the radioactive waste resulting from decommissioning is expected to be greater than 100 nCi/gram. Duct and glovebox work activities may result in the production of TRU waste. TRU and TRU Mixed Waste will be generated, characterized and packaged in accordance with the RFETS TRU Waste Management Plan (WMP) and the RFETS WIPP Waste Characterization Quality Assurance (QA) Project Plan. The area located northeast of the Building 779 loading dock may be used to store full TRU waste shipping containers prior to movement to WIPP.

7.2 LOW LEVEL WASTE

Low level waste is defined as radioactive waste that is not classified as TRU waste, spent nuclear fuel, or by-product material as identified in DOE Order 5820.2A, Radioactive Waste Management. Low level waste contains less than 100 nCi/gram TRU radioactivity. Approximately 95% of the contaminated waste produced as a result of the 779 Cluster decommissioning activities are anticipated to be low level in nature. Based on economical and technical constraints, items will be decontaminated to free release conditions. Section 4.0, Building Cleanup Criteria and Appendix B, Decontamination Options, provide additional information regarding cleanup criteria and options available for decontamination of radiologically contaminated materials. Items that have been decontaminated to a free release condition (Reference Radioactive Material Transfer and Unrestricted Release of Property and Waste, 1-P73-HSP-1810) will be transferred for use at a different location within RFETS, for use at a different DOE facility, or sent to the Property Utilization and Disposal (PU&D) organization for appropriate handling. Only materials that meet recycle/reuse criteria identified in the Property Management Manual will be sent to PU&D. As appropriate, low level and low level mixed waste will be generated, characterized, and packaged in accordance with the RFETS Low Level WMP.

7.3 MIXED WASTE

At RFETS, mixed waste is defined as RCRA hazardous waste containing measurable amounts of radioactive isotopes. Mixed waste is characterized as either low level or TRU based upon the amount of radioactivity at the time of assay. The 779 Cluster Decommissioning Project anticipates a minimum amount of mixed waste will be generated. The type of mixed waste that may be generated includes, but is not limited to, radioactively contaminated lead, glovebox gloves, used pump oil, and leaded glovebox windows. Mixed waste generated from decommissioning activities will be stored in temporary units prior to shipment to an approved off-Site disposal Site. Treatment of mixed waste will be performed in accordance with the Site RCRA permit.

7.4 HAZARDOUS WASTE

Hazardous waste is defined as waste that is listed or exhibits the characteristics of corrosivity, ignitability, reactivity, toxicity or that is listed in 6 CCR 1007-3, Section 261, or 40 CFR 261, Subpart D. The 779 Cluster Decommissioning Project anticipates some amount of hazardous waste in addition to the mixed waste mentioned in Section 7.3.

7.5 INDUSTRIAL WASTE

Industrial waste is characterized as that waste which meets RCRA Subtitle D requirements. Industrial waste will be generated as a result of the 779 Cluster Decommissioning Project. This waste will be managed in accordance with applicable rules and regulations.

7.6 TOXIC SUBSTANCES CONTROL ACT WASTE AND MIXED WASTE

The Toxic Substances Control Act addresses all chemical substances manufactured or processed in or for the United States. A chemical substance is defined in broad terms as any organic or inorganic substance of a particular identity including those substances identified in 15 CFR, Paragraph 2602(2)(A)(i-vi.) and which may present unreasonable risk of injury to health and the environment. Of particular significance to the 779 Cluster are PCBs as regulated under 40 CFR Part 761. The project estimates that 101 ft^3 of potential PCB containing ballasts exist within the 779 Cluster. This estimate assumes that all of the ballasts are non-radioactive and PCB containing until the ballasts are removed, radiologically surveyed, and examined. Further segregation may occur as in-process characterization is performed in support of the waste determination.

In addition, other suspect PCB containing materials include oils, paints, adhesives and roofing tars. Characterization of suspect materials will be performed in suspect areas prior to decommissioning of that area. Materials characterized as TSCA regulated will be managed in accordance with 40 CFR Part 761 if determined to contain $\geq$ 50 ppm PCBs.

7.7 WASTE MINIMIZATION

Waste minimization, as committed to in the FY97 Waste Minimization Program Plan, will be integrated into the planning and management of the 779 Cluster decommissioning wastes. Project Management and Decommissioning workers will incorporate waste minimization practices into work procedures. Unnecessary generation of radioactive and mixed waste will be controlled by utilizing work techniques that prevent the unnecessary contamination of areas and equipment, preventing unnecessary packaging, tools and equipment from entering radiologically contaminated areas and reusing contaminated tools and equipment when practical. Waste minimization will be accomplished using a waste life cycle cost approach. If the cost to demonstrate that the item is not contaminated exceeds the cost for waste disposal, the item will be disposed of as waste in accordance with the Property Management Manual, 1-MAN-009-PMM. The evaluation may include disassembly, decontamination, and survey costs. Elimination and reduction of waste generated as a result of decommissioning is high priority. Standard decontamination operations and processes will be evaluated for waste minimization potential and suitable minimization techniques will be implemented. Most of the bulk building structural material is expected to be free released and will be removed from the Site for recycle or disposal as appropriate. Table 7-1 identifies the amount and types of waste which are expected to be generated.

7.8 WASTE MANAGEMENT STRATEGY

The overall strategy for managing waste resulting from the decommissioning of the 779 Cluster is to evaluate the generation and waste management on a room-by-room basis. In general, waste materials will be sorted at the time of removal and prepared for further decontamination, survey, recycle, processing and packaging in another area of the 779 Cluster, away from the point of generation. The existing RFETS Waste Management Program and procedures will be used to ensure the waste has been generated, packaged, and surveyed to meet the final disposal Sites Waste Acceptance Criteria (WAC). See Section 2 for a general discussion of the expected work sequence. The estimated volumes over time (generation) can be calculated using the project schedule and Table 7-1.

Materials identified for transferral to PU&D include, but are not limited to, office equipment such as desks, chairs, tables, carts, bookshelves, equipment and instruments which are located in non-contaminated areas or have been located in contaminated areas but confirmed as non-contaminated through radiological survey. Utilizing waste minimization, (Section 7.6), the maximum amount of materials (economically feasible) will be released and sent to PU&D for disposition. The estimated volume of materials designated for PU&D is 73,900 ft^3.

The waste generation estimates anticipated as a result of the 779 Cluster Decommissioning Project are summarized in Table 7-1. A summary of how waste will be managed is included in Table 7-2. The types and volumes of waste have been estimated based on the following assumptions:

- If a room was not posted as a radiological hazard, all materials contained in the room were considered non-contaminated and therefore suitable for dispositioning through PU&D.
- Materials contained in rooms identified as Radiological Buffer Areas (RBAs), that were not suspected of being contaminated and can be confirmed as non-contaminated through smear surveys, were considered suitable for reuse or recycle. Examples of such materials are desks, cabinets, and chairs.
- Any materials that were located in a RBA and were not suitable for smear surveys were considered low level waste. Examples of such material are electronic equipment that cannot be surveyed sufficiently to confirm non-contamination.
- Material and waste segregation was considered appropriate in Contaminated Areas (CAs) providing an item could be surveyed.
- Office equipment, excluding computers, located in a CA were deemed suitable for dispositioning to PU&D. Survey data will be used to confirm this assumption.
- Gloveboxes containing plutonium residuals are anticipated to produce TRU waste through the decontamination process, such as STRIPCOAT™ application. Additional volumes of TRU waste may result from decommissioning activities such as ducting removal will be estimated in future revisions to the 779 Cluster Decommissioning WMP.
- All other materials that were located in a CA were considered low level waste although materials may require decontamination to achieve low level status.

An estimate of the waste in each room was calculated by summing the cubic feet of materials inventoried in a room (see Table 7-1). The low level waste volume was determined by subtracting the PU&D volume. The resulting LL volume was then multiplied by 125% to compensate for container size limitations. (Not all of the volume of a waste crate can be utilized.) The LLM waste volume waste was determined by estimating the volume of lead affixed to a glovebox and final volume which would result from size reduction.

The TRU waste volumes estimated in Table 7-1 are primarily derived from plutonium contaminated gloveboxes. Approximately, 66 gloveboxes have been identified for decontamination using STRIPCOAT™ (or equivalent). Each glovebox is anticipated to generate 1.5 drums of TRU waste, resulting in 100 drums of TRU waste.

The quantity of crates and drums were estimated using the following information. On average, 7.8 cubic feet of material can be contained in a 55-gallon drum while 112 cubic feet can be contained in a standard waste crate. Lead and waste resulting from decontamination (such as dry combustibles) will be placed into 55-gallon drums. All other materials will be placed into standard waste containers except those materials designated for PU&D which will be shipped directly to PU&D. The number of standard waste containers (crates) was calculated by dividing the volume by 112 cubic feet and rounding up to the nearest whole number. The number of 55 gallon drums was calculated by dividing the volume of waste designated for containment in drums by 7.8 cubic feet then rounding up to the nearest whole number.

7.9 WASTE CHARACTERIZATION

The characterization process discussed in Section 3.0 was used to estimate the type and volume of waste to be generated by the project. The Building 779 WSRIC book is used to describe each of the processes which are performed in Building 779. The process descriptions identify the different types of chemicals used and wastes which are generated in completing the various processes. The WSRIC is being used to assist in characterization of the residual materials left in Building 779 (Reference Section 3.0).

The Building 779 WSRIC has been revised to include anticipated decommissioning waste streams. The WMP for the 779 Cluster was developed using the WSRIC information to forecast waste types which will be generated during the decommissioning effort.

In general, waste generated from decommissioning includes contaminated and uncontaminated equipment, tools, electrical conduit systems, piping systems, gloveboxes and facility structural materials. Decontamination will be performed to remove radiological contamination and hazardous constituents as appropriate. Hazardous materials and excess chemicals will be managed in accordance with the ARARS identified in this DOP. Mixed waste will be stored on-Site, in accordance with the Hazardous Waste Requirements Manual until the material can be shipped for final disposal. Initial Waste Volume Estimates are identified in Table 7-1.

The 779 Cluster contains many pieces of equipment which will be released to PU&D for redistribution, disbursement or recycle as scrap material.

7.10 RCRA UNITS

Presently, there are three RCRA units located in Building 779. They are: Units 90.37, Room 131, GB-131A, 131B, 131C, 131D; 90.39, Room 137, GB-106-3, 106-4, 106-5; and 90.43, Room 160, GB-860. The 779 Cluster Decommissioning Project will close these units in accordance with requirements identified in the Part B Site RCRA Permit, Part X.

The project will not establish any RCRA permitted waste storage units within the 779 Cluster. Hazardous remediation waste will be managed in temporary units until final dispositioning.

7.11 IDLE EQUIPMENT

Presently, hazardous materials contained in idle equipment are processed by building operations personnel in compliance with the Management Plan for Material Contained In Idle Equipment, 94-MP/IE-0017. Hazardous materials contained in idle equipment in the 779 Cluster have been identified for dispositioning during deactivation. Remaining idle equipment will be managed in accordance with the Idle Equipment Consent Order during decommissioning and residual wastes will be considered remediation wastes.

7.12 OFF-SITE RELEASE OF WASTES AND APPLICABILITY

CERCLA wastes that are managed on-site are excluded from the land disposal restriction (LDR) standards. However, CERCLA wastes are not exempt from the LDR standards when they are transferred off-site for management. These wastes must meet all applicable LDR standards prior to land disposal.

In addition, the facility accepting CERCLA wastes must meet the requirements of the final Off-Site Rule (58 CFR 49200). The primary purpose of the Off-site Rule is to clarify and codify CERCLA's requirement to prevent wastes generated from remediation activities conducted under CERCLA from contributing to present or future environmental problems at off-site waste management facilities. Only facilities that meet EPA's acceptability criteria can be used for off-site management of CERCLA waste. The Off-Site Rule applies to both hazardous and non-hazardous wastes generated from remedial and removal actions funded or authorized, at least in part, by CERCLA.

Release of non-contaminated material, debris, and equipment from a site contaminated with hazardous materials is accomplished by:

- demonstrating the materials or wastes do not exhibit any of the characteristics of hazardous waste, and are not listed hazardous waste, as identified in Subpart C of 6 CCR 1007-3 SS261,
- or are excluded under the provision in 40 CFR 268, Subpart D, and
- the off-site waste management facility meets the requirements of the CERCLA Off-Site Rule.

Process knowledge and operating history related to the facilities can also be used to segregate hazardous contaminant areas from unaffected areas. Further sampling and analysis of wastes may be required during the project to determine if the wastes are regulated as LDR, or if the wastes can be exempted under the "hazardous debris rule." LDR requirements are integrated into RFETS waste and characterization procedures to ensure compliance with designated TSD facilities and on-Site WAC.

The release of hazardous and/or mixed hazardous waste from the Site to an off-site waste management facility is accomplished by:

- identifying all applicable LDR standards;
- meeting all DOT requirements;
- ensuring that the off-site waste management facility meets the requirements of the CERCLA Off-Site Rule;
- using approved waste management vendors; and
- meeting the receiving facility's waste acceptance criteria.

Under the "hazardous debris rule" provision, and in accordance with the debris treatment standards defined in 6 CCR 1007-3 §268.45, treated hazardous debris is exempted from the definition of hazardous waste, provided that the debris is treated to the performance or design and operation standards by an extraction or destruction technology, and the treated debris does not exhibit the characteristic of a hazardous waste. The exempted debris can be disposed in an industrial landfill (6 CCR 1007-3, Section 268, Subpart D) rather than a RCRA permitted landfill (6 CCR 1007-3, Section 268, Subtitle C). Note that these exemptions apply to disposal of certain

LL radioactive mixed wastes if they meet the receiving Sites WAC for hazardous debris.

TRU and TRU Mixed Waste destined for disposal at WIPP are not subject to the LDR standards since the facility has received approval of its No Migration Petition. These wastes must meet the following standards prior to shipment to WIPP:

- all applicable DOT requirements;
- WIPP WAC; and
- that the off-site waste management facility meets the requirements of the CERCLA Off-Site Rule.

7.13 CHEMICAL COMPLIANCE ORDER ON CONSENT

The Compliance Order on Consent for Waste Chemicals, 97-8-21-02, was issued to DOE on August 21, 1997 by CDPH&E to establish compliance objectives and resolve RCRA violations concerning management of waste chemicals. The "Order on Consent" requires DOE and K-H to manage waste chemicals, unless excluded, in accordance with the Waste Chemical Plan, hereafter call the Plan. The Plan provides the requirements for the management, storage and disposal of waste chemicals located at RFETS. Activities associated with the Waste Chemical Management Plan require completion by December 31, 1999.

Waste chemicals located within the 779 Cluster will be managed in accordance with the "Order on Consent." As each facility comes into compliance in accordance with the "Order on Consent," waste chemicals will be managed in regulatory compliance with RCRA.

7.14 INDIVIDUAL HAZARDOUS SUBSTANCE SITES

There are Individual Hazardous Substance Sites (IHSSs) within the boundaries of the 779 Cluster. The IHSSs that fall within the 779 Cluster boundaries are:

- Unit 121, Operable Unit 9, the original process waste lines
- Unit 138, Operable Unit 8, Cooling Tower Blowdown Building 779
- Unit 144, Operable Unit 8, Sewer Line Overflow
- Unit 150.6, Operable Unit 8, Radioactive Site South of Building 779
- Unit 150.8, Operable Unit 8, Radioactive Site Northeast of Building 779.

In addition, Building 779 was erected over the Site of one of the original solar evaporation ponds; uranium contamination (11 to 150 dpm/l) was detected during construction of the building. Demolition of the 779 Cluster will not include the basement of the Building 779. This structure will be left intact. The basement will be addressed during environmental restoration of the Individual Hazardous Substance Sites (IHSSs) associated with the 779 Cluster.

PCB contaminated soil exists north of Building 779 as the result of two transformers leaking in June 1986. One of the transformers was subsequently drained and remains in its original location. The other transformer was drained and removed. The cement pad which housed one of the transformers and the surrounding grounds have been posted as PCB contaminated.

Appropriate precautions will be taken by the project to ensure minimum disturbance of these areas. These areas will be remediated by following D&D of the 779 Cluster.

BUILDING	ROOM NUMBER	ROOM CLASSIFICATION	ROOM ESTIMATE ft3	L L WASTE ft3	LL MIXED WASTE ft3 (lead)	TRU WASTE ft3	PU&D ft3	DRUMS	CRATES
779	001	**RBA	246	0	0	0	246	0	0
779	Main Hallway 1 floor	Non Contaminated	215	0	0	0	215	0	0
779	100 Vestibule	Non Contaminated	187	0	0	0	187	0	0
779	101 Hall	Non Contaminated	215	0	0	0	215	0	0
779	101A	Non Contaminated	57	0	0	0	57	0	0
779	103/103A 103B Mens Locker Room	Non Contaminated	2572	0	0	0	2572	0	0
779	104 Elevator	Non Contaminated	0	0	0	0	0	0	0
779	105	Non Contaminated	152	0	0	0	152	0	0
779	106	Non Contaminated	261	0	0	0	261	0	0
779	107	Non Contaminated	513	0	0	0	513	0	0
779	108	Non Contaminated	74	0	0	0	74	0	0
779	109	Non Contaminated	249	0	0	0	249	0	0
779	110	Non Contaminated	248	0	0	0	248	0	0
779	110A	Non Contaminated	171	0	0	0	171	0	0
779	111 Hallway	Non Contaminated	250	0	0	0	250	0	0
779	113	Non Contaminated	2960	0	0	0	2960	0	0
779	114	Non Contaminated	27,428	0	0	0	27,428	0	0
779	115	Non Contaminated	3189	0	0	0	3189	0	0
779	115A	Non Contaminated	826	0	0	0	826	0	0
779	116 Hallway to Dock	Non Contaminated	646	0	0	0	646	0	0
779	116A	Non Contaminated	130	0	0	0	130	0	0
779	117	Non Contaminated	908	0	0	0	908	0	0
779	118 Dumb Waiter	*CA	0	0	0	0	0	0	0
779	119 Hallway	RBA	0	0	0	0	0	0	0
779	120, Changing Room	Non Contaminated	103	0	0	0	103	0	0
779	121	Non Contaminated	1628	0	0	0	1628	0	0
779	121A	Non Contaminated	414	0	0	0	414	0	0
779	121B Guard Station	Non Contaminated	174	0	0	0	174	0	0
779	122	RBA	1348	0	0	0	1348	0	0
779	123, Decon Room	RBA	0	0	0	0	0	0	0
779	124	RBA	332	0	0	0	332	0	0

*CA- Contamination Area
**RBA- Radiological Buffer Area
***HCA- High Contamination Area

BUILDING	ROOM NUMBER	R0OM CLASSIFICATION	ROOM ESTIMATE ft3	L L WASTE ft3	LL MIXED WASTE ft3 (lead)	TRU WASTE ft3	PU&D ft3	DRUMS	*CRATES
779	125	RBA	512	0	0	0	512	0	0
779	126	RBA	1055	1271	0	0	38	0	11
779	127	RBA	6989	8244	0	0	395	0	74
779	128	RBA	174	13	0	0	173	0	0.5
779	129, Stairwell	RBA	0	0	0	0	0	0	0
779	130	RBA	57.5	72	0	0	0	0	1
779	131	*CA	962	1046	31	16	125	6	9
779	132	RBA	374	253	0	0	172	0	2
779	133	CA/***HCA	1485	1843	80	80	111	20	17
779	134	RBA	163	0	0	0	163	0	0
779	135	RBA	122	0	0	0	122	0	0
779	136	RBA	236	0	0	0	236	0	0
779	137	RBA	1421	1323	20	64	363	13	12
779	138 Hall	RBA	292	233	0	0	106	0	2
779	139	RBA	642	503	0	0	240	0	5
779	140	RBA	531	664	0	0	0	0	6
779	140A	RBA	289	330	0	0	25	0	3
779	140B	RBA	172	120	0	0	76	0	1
779	141	RBA	374	170	0	0	238	0	2
779	141A	RBA	348	276	0	0	128	0	3
779	141B	RBA	345	276	0	0	124	0	3
779	141C	RBA	200	149	0	0	81	0	1
779	142	RBA	819	539	0	0	460	0	5
779	143 Airlock	CA	0	0	0	0	0	0	0
779	144 Elevator	CA	0	0	0	0	0	0	0
779	145	CA	174	35	0	0	146	0	0.5
779	146	CA	653	3	0	0	651	0	0
779	147	CA	26	8	0	0	18	0	0
779	148, Airlock	CA	0	0	0	0	0	0	0
779	149, Annex Hallway	CA	420	450	0	0	60	0	4
779	150	CA	4007	4720	0	16	860	2	42
779	151	CA	225	0	0	0	225	0	0
779	152	CA	606	494	17	32	277	6	4
779	153	CA	36	54	0	0	0	0	0.5
779	153A	CA	55	83	0	0	0	0	1
779	153B	HCA	49	0	0	49(1)	0	0	0.4

*CA- Contamination Area
**RBA- Radiological Buffer Area
***HCA- High Contamination Area

Table 7-1
779 Cluster Waste Matrix

BUILDING	ROOM NUMBER	ROOM CLASSIFICATION	ROOM ESTIMATE ft3	L L WASTE ft3	LL MIXED WASTE ft3 (lead)	TRU WASTE ft3	PU&D ft3	DRUMS	CRATES
779	154	CA	1938	2081	84	96	273	23	19
779	155	CA	1157	1201	0	48	196	6	11
779	156	CA	291	426	0	0	18	0	4
779	157	CA	971	1041	0	0	138	0	9
779	159	CA	658	662	0	0	128	0	6
779	160	CA	2217	2361	62	64	328	16	21
779	160A, Vault	CA	112	65	0	0	112	0	1
779	161	CA	57	72	0	0	0	0	1
779	162	Non Contaminated	1626	0	0	0	1626	0	0
779	163	CA	83	104	0	0	0	0	1
779	164 Airlock	CA	0	0	0	0	0	0	0
779	165, Womens Locker	CA	0	0	0	0	0	0	0
779	166, Womens Locker	Non Contaminated	0	0	0	0	0	0	0
779	167, 167A Womens Locker	Non Contaminated	758	0	0	0	758	0	0
779	170 Dumb Waiter	CA	0	0	0	0	0	0	0
779	171, Vault	CA	4415	5481	151	0	30	19	49
779	172, Vault	CA	476	675	26	0	476	3	6
779	173, Vault	CA	216	269	0	0	1	0	2
779	2 floor hallway	CA	32	4	0	0	29	0	0
779	201	Non Contaminated	289	0	0	0	289	0	0
779	201A/B	Non Contaminated	322	0	0	0	322	0	0
779	202	Non Contaminated	633	0	0	0	633	0	0
779	202A	Non Contaminated	190	0	0	0	190	0	0
779	203	Non Contaminated	357	0	0	0	357	0	0
779	204	Non Contaminated	90	0	0	0	90	0	0
779	204A	Non Contaminated	7	0	0	0	7	0	0
779	204B	Non Contaminated	306	0	0	0	306	0	0
779	205	Non Contaminated	668	0	0	0	668	0	0
779	206	Non Contaminated	462	0	0	0	462	0	0
779	207	Non Contaminated	104	0	0	0	104	0	0
779	207A	Non Contaminated	70	0	0	0	70	0	0
779	207B	Non Contaminated	169	0	0	0	169	0	0
779	207C	Non Contaminated	67	0	0	0	67	0	0

*CA- Contamination Area
**RBA- Radiological Buffer Area
***HCA- High Contamination Area

Table 7-1
779 Cluster Waste Matrix

BUILDING	ROOM NUMBER	R00M CLASSIFICATION	ROOM ESTIMATE ft3	L L WASTE ft3	LL MIXED WASTE ft3 (lead)	TRU WASTE ft3	PU&D ft3	DRUMS	CRATES
779	208	Non Contaminated	425	0	0	0	425	0	0
779	209	Non Contaminated	289	0	0	0	289	0	0
779	210, 210A	Non Contaminated	183	0	0	0	183	0	0
779	211	Non Contaminated	60	0	0	0	60	0	0
779	212, 212A	Non Contaminated	195	0	0	0	195	0	0
779	213	Non Contaminated	844	0	0	0	844	0	0
779	214	Non Contaminated	432	0	0	0	432		
779	215 Airlock	RBA	0	0	0	0	0	0	0
779	216 Hallway	CA	326	104	0	0	243		1
779	217	CA	1062	1063	0	64	212	8	10
779	218	CA	1155	1178	0.4	48	370	7	11
779	219, Abandoned Womens Restroom	CA	77	0	0	0	77	0	0
779	220	CA	1196	1029	14	48	373	8	9
779	221	CA	245	139	0	0	134	0	1
779	221A	CA	126	55	0	0	82	0	0.5
779	221B	CA	145	64	0	0	94	0	1
779	221C	CA	79	46	0	0	42	0	0.5
779	222	CA	3130	3675	54	80	190	17	33
779	222A	CA	185	50	0	0	0	0	0.5
779	223	CA	838	1018	0	0	24	0	9
779	224	CA	116.3	145	0	0	0	0	1
779	225	CA	463	394	0	0	149	0	4
779	226 Stairwell	CA	0	0	0	0	0	0	0
779	228	CA	4553	3641	8	64	1640	9	33
779	229	CA	245	19	0	0	230	0	0
779	230	CA	159	40	0	0	127	0	0
779	231	CA	386	365	0	0	94	0	3
779	232	CA	227	0	0	0	227	0	0
779	233	CA	333	13	0	0	323	0	0
779	234	CA	947	655	0	64	423	8	6
779	234A	CA	64	76	0	0	3	0	1
779	234B	CA	269	336	0	0	0	0	3
779	235	CA	446	520	0	0	30	0	5
779	236 Airlock	CA	0	0	0	0	0	0	0
779	237 Hallway	CA			0	0			

*CA- Contamination Area
**RBA- Radiological Buffer Area
***HCA- High Contamination Area

Table 7-1
779 Cluster Waste Matrix

BUILDING	ROOM NUMBER	ROOM CLASSIFICATION	ROOM ESTIMATE ft3	LL WASTE ft3	LL MIXED WASTE ft3 (lead)	TRU WASTE ft3	PU&D ft3	DRUMS	CRATES
779	270	CA	593	566	10	0	140	2	5
779	271	CA	216	149	0	0	97	0	1
779	272	CA	578	631	0	0	72	0	6
779	273	CA	65	21	0	0	48	0	0
779	274	CA	123	99	0	0	44	0	1
779	275	CA	192	115	0	0	100	0	1
779	277	CA	100	53	0	0	58	0	0.5
779	Docks	Non Contaminated	2026	0	0	0	2026	0	0
727	N/A	Non Contaminated	1508	0	0	0	1508	0	0
782	N/A	Non Contaminated	2723	0	0	0	2723	0	0
783	N/A	Non Contaminated	101	0	0	0	101	0	0
			SUM	53873	557.4	784	73900	173	486.9

[1] Room 153B contains a contaminated downdraft table and a GB window that are expected to be TRU waste.

The low level mixed waste estimates are specific to potentially contaminated lead affixed to gloveboxes.

The estimate for industrial waste, specifically structural rubble, for the demolition of the 779 Cluster is 175,000 ft3.

The estimate for asbestos waste contained in the 779 Cluster is 46,572 ft3.

*CA- Contamination Area
**RBA- Radiological Buffer Area
***HCA- High Contamination Area

Table 7-2 Summary of Waste Management for the 779 Cluster

WASTE STREAM	ON-SITE STORAGE	FINAL DISPOSITION	ESTIMATED WASTE VOLUME
ASBESTOS, NON-RADIOACTIVE • Friable • Non-friable	Gray 55 gallon drum or strong tight boxes; friable 6 mm plastic double bagged.	• Friable-Kettlemen • Non-friable- U.S.A. Waste	• Total estimate for friable, non-friable, radioactive and non-radioactive is 46,572 cu.ft.
ASBESTOS, RADIOACTIVE • Friable • Non-friable	White 55 gallon drum or crate; 6 mm plastic double bagged, or strong tight boxes/crates.	• No disposal facility currently available.	• Volume of Rad asbestos included in total above.
PCBs, NON-RADIOACTIVE • ballasts non-leaking	Black and yellow drum with a plastic liner	• Chem Waste contract to Rollins Inc. at Deerpark, TX.	• Estimate of 101 cu. ft. includes radioactive and non-radioactive.
PCBs, NON-RADIOACTIVE • leaking ballasts and all other regulated PCBs (articles, etc.)	Black and yellow drum with plastic liner; document on traveler if TSCA regulated.	• Chem Waste contract to Rollins Inc. at Deerpark, TX.	• Segregation of radioactive from non-radioactive materials will occur when these materials are surveyed.
PCBs, RADIOACTIVE • ballasts, non-leaking (LLW only, not TSCA regulated)	White drum with a plastic liner.	• Oak Ridge	• Segregation of radioactive from non-radioactive materials will occur when these materials are surveyed.
PCBs, RADIOACTIVE • Leaking ballasts and all other rad contaminated (LLW) and TSCA regulated wastes	White drum with a plastic liner.	• Oak Ridge	• Segregation of radioactive from non-radioactive materials will occur when these materials are surveyed.
Hazardous Waste, NON-RADIOACTIVE • florescent tubes • Solvents, paints, lead, chemicals, metals	Black and white drum • tubes crushed on-site	• Chem Waste Contract	• Estimates included below.
Mixed Wastes, RADIOACTIVE • Non-homogeneous • Homogeneous	White 55 gallon drum	• Non homogeneous LLMW does not have a designated disposal site at this time. • Oak Ridge (LLM and LL solvents) • Envirocare, Utah	• Conservative estimate of 507 cu.ft; mixed waste will be segregated from hazardous through radiological survey.
Low Level Waste • plaster, wall materials, windows, panels, cement, etc.	White drum or white boxes, half crates, or full size wooden crates complying with WO 1100 or WO 4034	Nevada Test Site	• 53,873 cu.ft.

Table 7-2 (cont'd)

WASTE STREAM	ON-SITE STORAGE	FINAL DISPOSITION	ESTIMATED WASTE VOLUME
Sanitary or Industrial Waste NON-RADIOACTIVE	Roll offs, either 20 or 30 yard.	• U.S.A. Waste Erie, Colorado	• 175,000 cu.ft.
TRU Waste	On-site storage	• WIPP Carlsbad, NM	Estimate of 784 cu.ft includes both TRU and TRU Mixed.
TRU Mixed Waste	On-site storage	• WIPP Carlsbad, NM	• Included above.

8.0 REGULATORY AND ENVIRONMENTAL CONSIDERATIONS

Decommissioning the 779 Cluster will require the closure of three RCRA permitted units. This section identifies the process for completing the closure activities.

Decommissioning at RFETS is conducted under CERCLA removal action authorities. (See RFCA ¶70). Pursuant to the CERCLA removal authorities embodied in RFCA, decommissioning performed under a DOP must attain, to the maximum extent practicable, federal and state ARARs. (See RFCA ¶5 and 40 CFR §300.415(i)). As a result, this second part of this section will identify the substantive attributes of the federal and state ARARs.

Decommissioning activities conducted in the RFETS Industrial Area are subject to the terms of the Interim Measures/Interim Remedial Action Decision Document (IA IM/IRA, DOE, 1994x). The applicability of performance monitoring requirements in the IA IM/IRA are discussed in the third part of this section.

Finally, RFCA requires that NEPA values be incorporated into RFETS decision documents. (See RFCA¶ 95). In recognition of that requirement, the final part of this section provides an alternative analysis, including no action, and a description of potential environmental impacts which may be associated with the decommissioning of buildings, facilities, and equipment.

8.1 RCRA CLOSURES

Paragraph 97 of RFCA and Part X, Section A, of the RFETS RCRA Permit provide that the closure of RCRA permitted or interim status units may be accomplished using either a separate closure plan or a decision document. Consistent with Paragraph 97, the closure requirements for the three permitted RCRA units present in the 779 Cluster will be addressed in this DOP. The Rocky Flats Technology Site RCRA Permit stipulates that the DOP must also contain the Closure Description Document information specified in Part X, Section B (2), Content of the Closure Plan and Closure Description Document. Section 8.1 of this document incorporates the Closure Description Document requirements. Because the closure is being conducted consistent with the closure requirements presented in Section X of the RCRA permit, no modification of the RCRA permit will be required.

8.1.1 Background

There are three RCRA permitted container storage units (glovebox units) that are included as part of this RCRA Closure Description Document. These units are identified as: 90.37, 90.39, and 90.43. (See Table 8-1 for a detailed description of the units.)

Initial RCRA closure of these units commenced under the original Rocky Flats RCRA permit in 1996. However, final closure was not achieved because the units did not meet final closure performance standards for the following reasons:

- Units 90.37 and 90.39 have discoloration of the glovebox surfaces; the closure performance standards for a clean surface debris could not be reasonably attained due to the stained surfaces;
- Unit 90.43 previously contained listed waste and would require rinsing and sampling to meet closure performance standards. Due to the configuration of fixed equipment in the glovebox, and the extent of radiological contamination present, it was not cost effective to perform closure of this glovebox until D&D operations commence.

Since these units did not meet RCRA closure standards in accordance with Part X of the RFETS

RCRA permit, the following actions were taken to brings these units into RCRA compliance:

- All RCRA regulated waste was removed from these units;
- The units were rendered RCRA stable as defined in the Site RCRA permit;
- Quarterly inspections were instituted to verify this continued condition; and
- DOE sent the State a request for deferral from the RCRA closure requirements until decontamination and decommissioning of Building 779 commences.

Table 8-1: Decommissioning the 779 Cluster

Table 8-1: Decommissioning the 779 Cluster will require the closure of three RCRA permitted units. The three RCRA storage units are described as follows:

UNIT #	BUILDING	UNIT NAME	TYPE OF UNIT	WASTE CODES	UNIT DESCRIPTION	VOLUME	WASTE DESCRIPTION
90.37	779	Room 131 GB	Container Storage Gloveboxes	D002, D003, D004, D005, D006, D007, D008, D009, D010, D011	90.37 consists of four gloveboxes in Bldg. 779 and is used for container storage: Gloveboxes 131A, 131B, 131D, and 131E	Liquid capacity 12 gallons each	Solid and Liquid mixed residues, TRU mixed waste, and low-level mixed waste
90.39	779	Room 137 GB	Container Storage Gloveboxes	D002, D003, D004, D005, D006, D007, D008, D009, D010, D011, F001	Unit 90.39 consists of three gloveboxes in Bldg. 779 and is used for container storage. Gloveboxes 106-3, 106-4 and 106-5.	Liquid capacity 8 gallons each	Solid and Liquid mixed residues, TRU mixed waste, and low-level mixed waste
90.43	779	Room 160 GB	Container Storage Glovebox	D003, D004, D005, D006, D007, D008, D009, D010, D011,	Unit 90.43 is a glovebox in Bldg. 779 and is used for container storage. Glovebox 860 level waste	Liquid capacity 17 gallons	Solid and Liquid mixed residues TRU mixed waste, and low-

8.1.2 RCRA CLOSURE DESCRIPTION DOCUMENT

Final closure of these units will be conducted in accordance with the substantive requirements of the RFETS RCRA permit dated June 30, 1997 and the RFCA decision document for this facility, the Decommissioning Operations Plan for the 779 Cluster. Because there has never been a documented release from any of these units, it is expected that RCRA Closure can be achieved using one or more of the three Closure Options outlined below. The following discussion is not intended to modify the RCRA permit language.

Option #1, Management of TRU Mixed Waste

If the concentration of plutonium associated with the RCRA unit exceeds the one gram standard, the glovebox will be designated a TRM. Waste DOE plans on disposing of all TRU and TRM waste at WIPP. EPA has approved WIPP's "No Migration Petition"; therefore, the disposal of hazardous wastes in this unit does not trigger LDR requirements. Rocky Flats will still have to meet WIPP's Waste Acceptance Criteria.

Note: None of the EPA waste codes associated with these glovebox units are precluded from disposal at WIPP. However, to meet the plutonium gram loading limitations, some of these gloveboxes may have to undergo decontamination to remove plutonium, and or be size reduced to fit into DOT/WIPP approved packaging.

Gloveboxes that meet both the TRM waste category and the WIPP WAC will be packaged in DOT approved containers and placed in a CERCLA temporary unit for storage until final shipment and disposal at WIPP can be arranged. Since an entire unit is being removed and there are no recorded releases from these units to the environment, the following are the RCRA closure performance standards identified for units closed under Option #1:

- Characterize wastes sufficient to meet WIPP WAC; and
- Package the waste in containers meeting National Regulatory Commission (NRC), Department of Transportation (DOT) and WIPP standards.

Any residuals from size reduction or radioactive decontamination will carry the same EPA waste codes as the unit being treated. These residuals will be characterized for their radioactive isotope content to ensure the gram loading requirements for WIPP can be met before the residuals are placed back into containers destined for disposal at WIPP.

If any LLM waste is generated, these wastes will be containerized and placed in storage pending disposal at an off-Site approved TSD facility. If any Low Level Waste are generated, these wastes will be containerized and placed in storage pending disposal at an approved disposal facility (e.g., Nevada Test Site).

Gloveboxes characterized as TRM Waste will either be packaged in a single container in one piece or size reduced to fit into DOT/WIPP containers.

Decontaminate to the Point the Waste Meets the LLW Criteria

Closure Options #2 and #3 are dependent upon the waste stream being classified as a LLM Waste. To make use of any of the following options, the gloveboxes must either be classified as LLM waste or be decontaminated to meet the LLM waste categorization. For those gloveboxes that do not meet the LLM Waste categorization, an evaluation must be conducted to determine the feasibility and benefits of reducing the plutonium content by strip coating or other decontamination methods. For a waste stream to be eligible for decontamination, the generator would have to answer "Yes" to each of the following questions:

- Does decontamination ensure that the LL waste criteria are achievable?;
- Can the decontamination process be conducted in accordance with ALARA?;

- Does the decontamination process make economic sense?

If the answer to all of these questions is "Yes," then Option #2 and Option #3 may be viable.

Option #2, Use of Rinsate as an Indicator of Clean Closure

Removal of Inherently Hazardous Waste and Microencapsulation of Radioactive Lead Solids

All "inherently hazardous waste" (e.g., lead shielding and lead glass) must be removed from the gloveboxes prior to packaging and final disposal. Where feasible, the lead shielding will be recycled as scrap metal. If reclamation is not practicable, these materials will be handled as LLM waste (D008). Since radioactive lead solids are specifically excluded from being "debris", there is no alternative treatment standard for radioactive lead solids. The specific treatment technology identified in 40 CFR 268.40 (Microencapsulation) must be followed if the waste is to be land disposed. Microencapsulation of radioactive lead solids may be conducted on-Site to meet LDR standards or shipped off-Site for treatment and disposal. Microencapsulation of radioactive lead solids will be conducted in accordance with the following definition (40 CFR 268.42):

> *Microencapsulation with surface coating materials such as polymeric organics (e.g., resins and plastics) or with a jacket of inert inorganic materials to substantially reduce surface exposure to potential leaching media. Microencapsulation specifically does not include any material that would be classified as a tank or container according to 40 CFR 260.10. A Waste Analysis Plan will be prepared prior to any on-Site treatment and submitted to the LRA for review and approval.*

Decontamination and Performance Standards

If Option #2 is selected, the gloveboxes must be decontaminated in accordance with the RFETS RCRA Permit, Part X, Closures, Section C, Clean Closure by Decontamination. Requirements identified in that section of the Permit include selection of an appropriate solution for decontamination. Selection of this solution will be based on the types of wastes previously managed in the unit and the contaminants that are present. Water containing sodium carbonate and trisodium phosphate or other solutions capable of solubilizing the contaminants of concern will be used as the decontamination solution. The final rinsate volume for the internal surfaces of the glovebox will not exceed two gallons per 100 square feet of surface area rinsed.

A glovebox will be considered successfully decontaminated and meeting final performance closure standards when:

- All visible residuals are removed; and
- The final rinsate contains concentrations of priority pollutants [identified as being managed in the Unit, and heavy metals (268.48 UHC listing)] are below the standards identified in RFCA, Attachment 5, Table 2, Tier 2; and
- The pH of the rinsate is between 6 and 9.

If the rinsate meets the final performance standards, the entire glovebox (minus the lead shielding and leaded glass) will be considered successfully decontaminated and no longer RCRA regulated regardless if listed hazardous waste was handled in the unit or not. The glovebox will then be handled as LL Waste.

Residues and Rinsate Management

Residues and rinsate from the decontamination of glovebox(es) will be regulated as follows:

1. Residues and rinsate above RCRA characteristic levels will be managed as mixed hazardous waste. This waste is subject to LDR. These wastes will be containerized and either:

   - Put into storage as LLM waste; or
   - Shipped to a Waste Water Treatment Unit; or
   - Solidified on-Site. Waste treated on-Site will be sampled and analyzed to ensure compliance with LDR standards. A Waste Analysis Plan will be submitted to the State for review and approval prior to treatment of characteristic waste(s) in the 779 Cluster.

2. Characteristic rinsate above RFCA Tier 2 levels but below RCRA TCLP from Unit 90.37. Since this unit handled only characteristic wastes, if the rinsate is not characteristic, then the waste is not RCRA regulated. It will be handled as a LL waste and be sent to Building 374 for treatment as a waste water. If the rinsate does not meet the Building 374 WAC, (exceeds radioactive levels), the rinsate will be solidified on-Site in Building 779 and managed as LL waste.

3. Residues and rinsate from Units 90.39 and 90.43 that contain listed contaminants above Tier 2 levels must be managed as RCRA hazardous wastes (Derived from Rule). If the rinsate meets the Building 374 WAC, the rinsate will be treated in this wastewater treatment unit. If the rinsate does not meet the Building 374 WAC, the waste will be containerized and placed in storage unit until it can be shipped off-Site for treatment and disposal at an approved TSD facility. If residues are generated, these wastes will be managed as LLM waste. The residues will be containerized and placed in storage pending shipment to an off-Site TSDF for treatment and disposal. Both residues and rinsate may be treated on-Site using stabilization/ solidification to meet LDR standards prior to shipment off-Site as LLM waste. Waste treated on-Site will be tested to demonstrate compliance with LDR standards. A Waste Analysis Plan will be submitted to the State for review and approval prior to treatment of any listed waste(s) in the 779 Cluster.

4. Residues and rinsate from Units 90.39 and 90.43 that contain listed waste contaminants below Tier 2 standards are not RCRA regulated hazardous wastes. If the rinsate meets the Building 374 WAC, the rinsate will be treated in this unit. If the waste does not meet the Building 374 WAC, the waste will be containerized. Rinsates that do not meet the Building 374 WAC may be solidified on-Site to meet the final disposal facility WAC (i.e., no liquids). Both rinsates and treated rinsate will be placed in an on-Site storage unit until shipment to an off-Site disposal facility (e.g., Nevada Test Site). If residues are generated, these wastes will be managed as LL waste. The residues will be containerized and placed in storage pending shipment to an approved disposal Site (e.g., Nevada Test Site).

If the rinsate is above the RFCA Table 2, Tier 2 standards and the operator determines that it is unlikely that additional rinsing will achieve the closure performance standards, this Unit will be closed using Option #3, Treatment and Management as Debris.

Option #3, Treatment and/or Management as Debris

If the gloveboxes are characterized as LLM waste, the gloveboxes may be considered hazardous debris. Debris treatment of the gloveboxes will be conducted in accordance with Part X of the Rocky Flats RCRA Permit, Section D, "Debris Rule" Decontamination and all substantive requirements of 6 CCR 1007-3, Part 268.45. In general, materials that are treated using a destruction or extraction technology and meet the Debris Treatment performance standards identified in Part X of the RFETS RCRA Permit, are no longer RCRA regulated and are managed as Low Level Waste. This generality does not apply to "inherently hazardous waste" such as lead shielding and lead glass that fails TCLP or materials specifically excluded from the definition of "debris" such as radioactive lead solids, cadmium batteries and lead acid batteries.

Performance Standards

Hazardous debris will be considered decontaminated if the debris meets the performance standards identified in the Rocky Flats Environmental Technology Site RCRA Permit, Part X, Closure, Section D, Debris Rule Decontamination. The requirements identified in this section include, but are not limited to:

- All inherently hazardous waste (lead shielding, lead glass, etc.) will be removed from the gloveboxes using previously tested techniques prior to disposal. As feasible, the lead shielding will be recycled as scrap metal. If reclamation is not practicable, these materials will be handled as LLM waste (D008). Microencapsulation of radioactive lead solids may occur on-Site. (Note: Radioactive lead solids are not debris, see discussion of microencapsulation of radioactive lead solids, that follows.)
- Material must meet the definition of debris as identified in 40 CFR 268.45; and
- An extraction or destruction technology (as identified in 40 CFR 268.45) will be selected for decontamination of the gloveboxes (e.g., acid/base washing; solvent extraction; abrasive blasting; scarification; spalling; high pressure steam; or water spray); and
- Clean debris surface is attained as specified in 40 CFR 268.45; and
- All debris treatment residuals generated from the use of extraction and/or destruction technologies and/or size reduction, and/or radioactive decontamination will be characterized and managed and treated in compliance with the ARARs listed in this document. These treatment residuals are not RCRA Debris.

Microencapsulation of Radioactive Lead Solids

Radioactive lead solids are specifically excluded from the "debris" definition. The specific treatment technology identified for radioactive lead solids in 40 CFR 268.40 is microencapsulation. This specified technology is required if the waste is to be land disposed.

Microencapsulation of radioactive lead solids may be conducted on-Site in Building 779 or shipped off-Site for treatment and disposal. Microencapsulation of radioactive lead solids will be conducted in compliance with the following definition: (40 CFR 268.42), "Microencapsulation with surface coating materials such as polymeric organics (e.g., resins and plastics) or with a jacket of inert inorganic materials to substantially reduce surface exposure to potential leaching media. Microencapsulation specifically does not include any material that would be classified as a tank or container according to 40 CFR 260.10"

Residues and Rinsate Management From Debris Treatment

Residues and rinsate from the debris treatment of the gloveboxes will be managed in the same manner as described in the above mentioned section.

Table 8-1: Decommissioning the 779 Cluster will require the closure of three RCRA permitted units. The Unit Information Sheets are contained in Attachment 1.

TRU Mixed Waste

If the concentration of plutonium associated with the RCRA unit exceeds the one gram standard, the glovebox will be designated a TRU Mixed Waste. The feasibility of decontaminating the TRU Mixed glovebox would then be evaluated. If determined:

- Not achievable; or
- Likely to result in an unacceptable radioactive dose to the employees (ALARA); or
- Too costly,

the glovebox will be handled as TRU Mixed Waste and either packaged in one piece in a DOT/WIPP approved container or size-reduced to fit into standard DOT packaging (containers/boxes). In either event, TRU Mixed Waste generated from this unit will be stored on-Site for subsequent shipment to WIPP for final disposal.

Decontamination to the Low Level or Mixed Waste Category

The gloveboxes may be decontaminated in accordance with the Rocky Flats Environmental Technology Site RCRA Permit, Part 10 Closure, including Section C, Clean Closure by Decontamination. Requirements identified in that section of the Permit include selection of an appropriate solution for decontamination. Selection of this solution will be based on the types of wastes previously managed in the unit and the contaminants that are present. Water with sodium carbonate and trisodium phosphate or other solutions capable of solubilizing the contaminants of concern will be used as the decontamination solution. The final rinsate volume for the internal surfaces of the glovebox will not exceed two gallons per 100 square feet of surface area rinsed.

A glovebox will be considered decontaminated and meeting final performance standards when:

- All visible waste residuals are removed; and
- The final rinsate contains concentrations of priority pollutants (identified as being managed in the Unit, and heavy metals (268.48 UHC listing)) below the standards found in RFCA, Attachment 5, Table 2, Tier 2; and
- The pH of the rinsate is between 6 and 9.

If the rinsate is above the RFCA, Table 2, Tier 2 standards and it is unlikely that additional rinsing will achieve the closure performance standard, the glovebox will be closed using the treatment and/or management as debris, described below.

Treatment and/or Management as Debris

If the gloveboxes are classified as low level mixed waste, the gloveboxes may be handled as hazardous debris. Debris treatment of the gloveboxes would be conducted in accordance with Section 10 of the Rocky Flats RCRA Permit, Section D, "Debris Rule" Decontamination and all substantive requirements of 6 CCR 1007-3, Part 268.45. All inherently hazardous waste (lead shielding, lead glass, etc.) will be removed from the gloveboxes using previously tested techniques prior to disposal. Lead shielding and lead glass (that fails TCLP) will be handled as mixed waste and appropriately treated and disposed.

Hazardous debris will be considered decontaminated if the process meets the performance standards identified in the Rocky Flats Environmental Technology Site RCRA Permit, Part 10

Closure, Section D, Debris Rule Decontamination. The requirements identified in this section include, but not limited to:

- Material must meet the definition of debris found in 40 CFR 268.45; and
- An extraction or destruction technologies will be selected for decontamination from the 268.45 listing, such as: acid/base washing; solvent extraction; abrasive blasting; scarification; spalling; high pressure steam; or water spray;
- Clean debris surface is attained as specified in 40 CFR 268.45; and
- All debris treatment residuals generated from extraction and/or destruction technologies used in the closure are managed and treated in compliance with ARARs listed in this document. These treatment residuals are not RCRA debris.

As an alternative to treatment or if the 268.45 standards are not achieved (i.e., clean debris surface) following treatment, representative sampling may be used to demonstrate that the debris meets the treatment standards for the associated hazardous waste. In this circumstance, the debris may be disposed as low level mixed waste because the debris would no longer be prohibited from land disposal.

8.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

As noted earlier, decommissioning actions at RFETS must attain, to the maximum extent practicable, compliance with Federal and State ARARs. The general ARARs, relating to this proposed action are identified in this section and summarized in Table 8-1. In addition, Table 8-1 identifies whether the requirement is applicable, relevant and appropriate, or To Be Considered (TBC).

Pursuant to RFCA¶ 16.6., the procedural requirements to obtain federal, state, or local permits are waived as long as the substantive requirements that would have been imposed in the permit process are identified (RFCA ¶17). Furthermore, the method used to attain the substantive permit requirements must be explained (RFCA ¶17c). The following discussion is intended to compliment other descriptions provided in this DOP in a manner that satisfies the RFCA permit waiver requirements.

8.2.1 Air

Decommissioning has the potential to generate particulate, radionuclide, fugitive dust, and Hazardous Air Pollutant (HAP) emissions. 5 CCR 1001-3, Regulation No. 1, governs opacity and particulate emissions. Regulation No. 1, Section II addresses opacity and require that stack emissions from fuel-fired equipment must not exceed 20% opacity. Regulation No. 1, Section III addresses the control of particulate emissions. Fugitive particulate emissions will be generated from demolition and transport activities. Control methods for fugitive particulate emission should be practical, economically reasonable, and technologically feasible. During demolition activities, dust minimization techniques such as water sprays, will be used to minimize suspension of particulates. In addition, demolition operations will not be conducted during periods of high wind. The substantive requirements will be incorporated into a control plan which defines the level of air monitoring and particulate control for the project.

5 CCR 1001-3, Regulation No. 3, provides authority to CDPHE to inventory emissions. Regulation No. 3, Part A, Section describes Air Pollutant Notice (Apen) requirements. If applicable, RFETS will prepare and APEN to facilitate the CDPHE inventory process.

The Kaiser-Hill Air Quality Management organization provides monitoring support for the Rocky Flats Environmental Technology Site (Site) specifically directed toward compliance with all state and federal environmental laws originating from the Clean Air Act and its amendments. The existing Radioactive Ambient Air Monitoring Program (RAAMP) continuously monitors for potential airborne dispersion of radioactive materials from the Site into the surrounding environment. Thirty-one samplers compose the RAAMP network. Twelve of these samplers are deployed at the Site perimeter and are used for confirmatory measurements of off-Site impacts. The others are used for backup, should there be a need for determining local impacts. The others are used for backup, should there be a need for determining local impacts from decommissioning or clean-up projects. During the demolition of the 779 cluster additional monitors within the existing ambient network located in the immediate area of Building 779 will be identified, and the frequency of filter collection and filter analysis at those locations will be adjusted, if necessary, to provide timely information of potential project emissions. Air emissions from Building 779 strip-out activities will be monitored but the existing effluent air monitoring system currently in place in the 779 cluster plenum facilities.

Additionally, the National Emission Standards For Hazardous Air Pollutants (NESHAP) (5 CCR 1001-10; 40 CFR 61 Subpart H) have been identified as a chemical-specific ARAR to evaluate potential radionuclide emissions. The EDE will be calculated for those emissions anticipated from the operations associated with facility demolition. Estimated controlled radionuclide emissions are not expected to exceed the EPA notification and approval threshold of 0.1 millirem per year EDE (40 CFR 61, Subpart H). Radionuclide emission from the project will be included in the Site radionuclide annual report.

8.2.2 Waste Storage

The waste generated during the closure and decommissioning activities governed by this DOP are remediation wastes. (See RFCA ¶25bf. and RFCA Appendix 3, the Implementation Guidance Document, Section 3.1.10). Remediation waste generated during this removal action will be evaluated consistent with the requirements of RCRA Part 261, Identification and Listing of Hazardous Waste, specifically Subparts A through C. Solid remediation waste will be generated and managed in accordance with the Colorado Solid Waste Disposal requirements, 6 CCR 1007-2. In addition, sections of Part 268, Land Disposal Restrictions, applicable to off-Site shipment and disposal of hazardous waste are ARAR.

If necessary, remediation waste will be managed in a temporary unit established pursuant to §264.553. The requirements governing Temporary Units (TUs) are applicable to tanks and containers used for storage and treatment of hazardous remediation wastes generated in conjunction with the decommissioning. Incompatible wastes, if encountered, will be segregated within the units. An assessment will be performed to determine the need for secondary containment. Secondary containment will be provided, as appropriate, when liquid wastes are stored or treated in tanks or containers. Waste characterization will be provided, as appropriate, in accordance with the RLCR and the 779 Cluster WMP. Inspections, at a minimum of once a week, will be provided during operations in accordance with the Waste Management Plan. Training for individuals generating and handling waste will be implemented using the framework identified in the RFETS Part B permit. To close a TU, waste and contaminated soils will be removed, as appropriate. The information in this paragraph is being provided to satisfy the permit waiver conditions in RFCA ¶16.

8.2.3 Waste Treatment

Any waste, soil/waste mixture, debris, liquid, or remediation wastes that is identified as a hazardous waste requires treatment to the LDR treatment to levels for wastewater or non-wastewaters, as appropriate. (See 40 CFR §268.40, Treatment Standards for Hazardous Wastes).

Solidification of characteristic hazardous remediation wastes may be conducted within a temporary unit. For example, scabbling of low level, RCRA characteristic lead-based paint may result in a remediation waste form amenable to solidification. The solidification would be conducted within competent tanks or containers and subject to waste analysis conditions imposed in the waste management plan. The information in this paragraph is being provided to satisfy the permit waiver conditions in RFCA ¶16.

8.2.4 Debris Treatment

Where appropriate, the project decontamination pad (located in the Protected Area) or one of the Sitewide Decontamination Facilities (located in the contractors yard) may be configured to perform low level, hazardous or mixed waste debris treatment in accordance with 40 CFR §262.34, §268.7(a)(4) and §268.45. The information in this paragraph is being provided to satisfy the permit waiver conditions in RFCA ¶16.

Solid residues from the treatment of debris containing listed hazardous wastes will be collected and managed in accordance with RCRA hazardous waste management ARARs. Any solid residues from debris treatment that exhibit a hazardous waste characteristic will also be managed in accordance with RCRA hazardous waste management requirements.

Liquid residues from the treatment of debris containing listed hazardous wastes are subject to RCRA hazardous waste management ARARs until they are placed into the Building 891 Wastewater Treatment Unit Headworks. Any Building residues that result from the treatment of listed debris will carry the same listing as the listed debris from which it originated. Any B891 residues that exhibit a hazardous waste characteristic will also be managed in accordance with RCRA hazardous waste management ARARs. Alternatively, liquid residues that meet acceptance criteria may also be treated in Building 374 or the sewage treatment plant in compliance with the RCRA and NPDES permits.

8.2.5 Wastewater Treatment

Remediation wastewaters generated during decommissioning may be transferred to the Consolidated Water Treatment Facility (CWTF, Building 891) for treatment. Remediation wastewaters that contain listed RCRA hazardous wastes or exhibit a RCRA characteristic are not subject to compliance with RCRA hazardous waste requirements because the wastewaters are CERCLA remediation wastes being treated in a CERCLA treatment unit. The CWTF will treat the remediation wastewater to meet applicable surface water quality standards under a National Pollution Discharge Elimination System (NPDES) ARARs framework. Waste generated at Building 891 B891 as the result of treatment of a listed remediation wastewater will be assigned the corresponding listed waste code. All wastes generated at Building 891 will also be evaluated for hazardous characteristics. The information in this paragraph is being provided to satisfy the permit waiver conditions in RFCA ¶16.

Alternatively, remediation wastewater that is determined acceptable for treatment may also be transferred to Building 374; to the sewage treatment plant (Building 990) or directly discharged in compliance with the administrative and substantive terms of the RFETs NPDES Permit. Because these wastewater management alternatives are authorized in the NPDES Permit no permit waiver is required.

8.2.6 Asbestos

Compliance with asbestos requirements is an applicable ARAR and will be achieved in accordance with Regulation 8. Specifically, Section III, C.7.6, provides maximum allowable asbestos levels, and Section C.8.2.(b),(d) and (f) provides requirements for handling asbestos waste materials. In addition, regulatory notification requirements for asbestos abatement mandated in Regulation 8, Part B, Section III B will be adhered to.

Regulation 8 also governs work practices aimed at the protection of the worker/public and are virtually identical to the OSHA requirements in 29 CFR 1926.1101. At RFETS this is controlled through the Industrial Hygiene and Safety group in accordance with HSP 1-62200 HSP-9.09.

NESHAP standards for asbestos will be implemented through specific operational directions in IWCPs in accordance with Regulation 8, Part B.

8.2.7 Polychlorinated Biphenyls

Screening for PCBs will be performed on suspect materials prior to demolition. Presently, the painted concrete facility pads are the only areas where special use coatings, which may contain PCBs, are suspect. Any other materials, identified through In-Process Characterization, as suspect of containing PCBs will be managed in accordance with 40 CFR Part 761, Disposal Of Polychlorinated Biphenyls, if determined to contain ≥ 50 ppm PCBs.

Fluorescent light ballasts are also a potential source of PCBs in the 779 cluster. Light ballasts marked "No PCBs" or "PCB Free" will be managed as solid waste and disposed at a sanitary landfill. Ballasts marked "PCBs" or not marked and not leaking will be packaged for disposal at an TSCA-permitted facility. Leaking PCB light ballasts and unmarked light ballasts will be managed as fully-regulated PCB articles.

8.2.8 Radiological Contamination

Due to the likelihood for radiological contamination in the 779 Cluster guidelines contained in DOE Order 5400.5 have been identified as TBC. In the event that radiological contamination is identified, DOE Order 5400.5 will be followed to ensure protection of the workers, the public, and the environment. In addition, DOE Order 5420.2A, "Radioactive Waste Management", has been identified as TBC and contains the requirements for the management and packaging of LLW.

8.2.9 Soil Disturbance

Soil excavation is not anticipated as part of this action. The cement pad for each facility will remain in place and will be addressed during environmental restoration.

8.3 INDUSTRIAL AREA PERFORMANCE MONITORING

The Industrial Area (IA) IM/IRA is a decision document designed to ensure that environmental monitoring is sufficient to detect potential releases to the environment during transition activities such as those actions conducted under this DOP. The objective of the IA IM/IRA is to define a program that proactively addresses monitoring requirements for the RFETS IA.

The IA IM/IRA (DOE, 1994x) provides a methodology for establishing a baseline environmental data set; warning limits and controls; evaluating potential monitoring technologies; outlining the preprogrammed response during verification monitoring; and summarizing the current emergency response procedures. The requirements of IA IM/IRA are applicable to the decommissioning of the 779 Cluster and must be addressed. Prior to demolition of the facility, an evaluation will be made to determine if additional monitoring of air and water is required for the period of demolition.

8.4 ENVIRONMENTAL ISSUES

8.4.1 National Environmental Policy Act

Most of the information in this section is taken from previous Site NEPA documents, including the Rocky Flats Cumulative Impact Document (CID) published by DOE in 1997, which provides examination of the baseline conditions (no action) and Site closure. The closure case addresses activities described in the " Accelerating cleanup: Focus 2006" Planning document. Under Site closure, the CID examines the complete Decontamination, Decommissioning, and Demolition (DD&D) of a generic 100,000 square foot plutonium-contaminated facility. In comparison to the generic facility, Building 779 is an approximately 64,000 square foot structure, 36,409 square feet of which contained process equipment. The support facilities consist of an additional 9000 sq. ft.

Glovebox areas in the generic facility were patterned after configurations in Building 779 because this facility contains numerous processing areas and was the subject of detailed time and cost estimates to complete DD&D. The discussion below describes the data collected and impacts analyzed for these two alternatives as they apply to decommissioning of the 779 Cluster to the extent practical and appropriate.

Alternatives Analysis

The NEPA requires that actions conducted at the RFETS consider potential impacts to the environment. The Memorandum for Secretarial Officers and Heads of Field Elements, dated June 13, 1994, issued by the Secretary of Energy, Hazel O' Leary and entitled "The National Environmental Policy Act Policy Statement" defines the DOE policy for integrating the NEPA process into the CERCLA decision making process. While no separate NEPA documentation is required for this effort, RFCA (and DOE policy) requires DOE to consider environmental impacts of the proposed action and of alternatives as part of this document.

8.4.2 PROPOSED ACTION AND ALTERNATIVES

Several alternatives were considered for the near-term management of the 779 Cluster. The preamble to RFCA and the RFCA Vision statement both contain the objective that buildings will be decontaminated as required for future use or demolition. The evaluation of the scope of work for the 779 Cluster considered the following three alternatives:

Alternative 1 - Decommissioning of the 779 Cluster
Alternative 2 - No Action, Maintain Safe Shutdown
Alternative 3 - Reuse of the 779 Cluster Facilities

The alternatives were evaluated for effectiveness, implementability, and relative cost. These are summarized in Table 8-1. Alternative 1 is the selected alternative. It clearly supports the Site's Vision of safe, accelerated, and cost-effective closure. This alternative has the lowest life-cycle costs, achieves risk-reduction fastest, and is integrated with the operations of the Site. This alternative also maintains long-term protectiveness of public health and the environment. Short-term impacts to the environment (i.e., impacts during the duration of the action) can be physically and administratively controlled. There are no significant negative aspects to decommissioning the cluster at this time.

Alternative 2 does not immediately achieve the Site's goals. It does not accomplish accelerated closure and only defers decommissioning while increasing the life-cycle cost of closure. Short-term protectiveness of human health and the environment is achieved based on inaction, but only until such time as the cluster is decommissioned. Waste and debris requiring treatment and/or disposal, and the risks associated with managing them are not eliminated from the cluster closure under this alternative.

Alternative 3 is not feasible as evident in evaluations indicating reuse of the 779 Cluster is not required or beneficial. As with Alternative 2, implementation of this action will result in the deferral, not elimination, of eventual decommissioning of the cluster which is necessary to achieve the Site's Vision.

TABLE 8-2 ALTERNATIVE ANALYSIS

Alternative	Activity Description	Effectiveness	Implementability	Relative Cost
1 Decommissioning the 779 Cluster	Decommissioning activities will follow a project-specific plan approved by the DOE and CDPHE, the RFCA Lead Regulatory Agency (LRA) for the Industrial Area. Activities consist of: site and facility characterization; decontamination; dismantlement; waste generation. Any remediation waste generated by decommissioning activities would be transported to an appropriate facility for storage followed by disposal.	Decommissioning is effective in achieving the long-term goals of RFCA by not only decontaminating the buildings but also demolishing the structures to grade. The mortgage costs of the cluster are eliminated and the risk remaining following the action will be significantly lower than the risk that exists under the current condition. Once the buildings are removed, the area will available for subsurface remediation to mitigate any remaining risk.	Technology currently exists to achieve the objectives of this alternative both technically and administratively. Integration with other site activities (e.g., waste storage capacity) can be accomplished.	This alternative has the lowest life-cycle cost due to the fact that ultimately the 779 Cluster must go through decommissioning and have this cost included in its baseline. Once decommissioning is achieved, only minimal landlord costs will be needed until the remaining slabs and utilities undergo final restoration.
2 No Action	No Action will maintain the 779 Cluster facilities in their current configuration. No equipment would be removed unless the present safe shutdown status of the facility became compromised.	No Action will delay decommissioning activities that must eventually be performed to meet the goals of RFCA. The alternative is effective in achieving the near-term goal identified in the RFCA preamble which gives priority to the removal of weapon-usable fissile material from RFETS. Deferring the decommissioning of the 779 Cluster could make funding available to the removal of fissile material; however, that program is currently fully funded so additional funding at this time would not accelerate its schedule. Long-term Site goals could be jeopardized if the structural integrity of the mothballed buildings increases risk to workers and the environment.	Administratively, this alternative is not ideally implementable because the integrated sitewide baseline has planned for the decommissioning of the 779 Cluster to occur early in the Site closure. No Action would cause a disruption to the long-term plans of the Site.	This alternative would have the life-cycle costs of decommissioning (adjusted for future value) in addition to landlord/surveillance costs necessary to maintain a mothballed facility (structural continuity, fire prevention, etc.) until demolition occurs.
3 Reuse	Reuse of the 779 Cluster would keep the facilities in their current configuration. A new mission for the facilities would be assigned by the Site Utilization Review Board in support of the present Site Cleanup Mission. Depending of the nature of the new mission, removal of equipment may be necessary. The current configuration of utilities and equipment would be maintained until a new 779 Cluster mission was defined.	Reuse of the 779 Cluster was evaluated by the Site Facilities Use Committee (SFUC). The SFUC determined that there was no further mission for the 779 Cluster. Use of the 779 Cluster for an alternative off-site use was evaluated in accordance with DOE Order 4300.1C, Subparagraph g, Disposal of Government-Owned Land improvements. No future use was identified through this evaluation.	Because no new mission has been identified for the 779 Cluster, and because the sitewide integrated baseline has identified the decommissioning of this area in the near future, implementing this alternative is not administratively feasible.	This alternative could result in the greatest life-cycle costs if the reuse mission requires the expenditures for modifications to the buildings in addition to landlord/surveillance costs and then the decommissioning costs (adjusted for future value) once the mission has expired and the buildings are demolished.

8.4.3 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

Environmental effects associated with the D&D of the 779 Cluster are described in the following:

Environmental Impact Issues

As described in earlier chapters and in Appendix A, the 779 Cluster is located entirely within the (secured) Protected Area of the Site's Industrial Area (see Figure 1-1). Building 779 housed less than 1000 kg (1 ton) of plutonium residues that required treatment (DOE/EA-1120, p. 3-6), and these have since been removed. Initial investigations show that many interior surfaces, process drains, piping, gloveboxes, filters, sumps, and other equipment are radioactively contaminated to various levels (see Section 3.0). Decontamination and decommissioning of Rooms 152 and 154 in Building 779 was one of six pilot projects initiated in 1994 and intended to provide "lessons learned" that could be applied to subsequent projects (Categorical Exclusion RFO/CX23-94). In addition to Building 779, the Cluster consists of two cooling towers and two cooling tower chillers, a cooling tower pump house, a paint and storage facility, a metal storage facility, and a gas bottle storage facility (see Appendix A).

The proposed decommissioning activities for the 779 Cluster involve asbestos abatement, decontamination of interior surfaces and equipment by vacuuming and wiping, disconnection of electrical power, draining of piping systems and equipment, removal of gloveboxes and other equipment, further decontamination by wiping, washing, scabbling, and other methods (see Appendix B), and dismantling and demolition of the facilities. Many of these activities could qualify as categorical exclusions under DOE's NEPA regulations (i.e., removal of asbestos from facilities (B1.16); demolition/disposal of facilities (B1.23); disconnection of utilities (B1.27); and minor activities to place a facility in an environmentally safe condition, no proposed uses (including reducing surface contamination, but not including conditioning, treatment, or processing of spent nuclear fuel, high-level waste, or special nuclear materials) (B1.28).

Given the existing environment and industrial setting, environmental impact issues associated with the proposed decommissioning and decontamination activities for the 779 Cluster are limited in scope. The proposed activities are unlikely to result in discernable adverse effects to biological resources, including vegetation, wetlands, wildlife habitat, and state and federal sensitive (e.g., threatened and endangered) species populations or habitat. The facilities to be decommissioned are not located in a floodplain and the proposed activities will not be affected by, or themselves affect, any floodplain. No wild and scenic rivers, prime agricultural soils, parks or conservation areas, or natural resources will be affected. The proposed activities will provide employment for a very small number of people, most of whom are expected to come from the current Site work force; thus, the activities are also unlikely to result in adverse socioeconomic effects.

Therefore, the discussion of environmental impact issues focuses more intensely on the following areas of potential impacts:

- Mobilization of radioactive and other contaminants into the environment via soils, air, surface waters, or groundwater;
- Health and safety of workers who may be exposed to radioactive and toxic or hazardous materials (including lead, asbestos, and PCBs), and health and safety of the public, both during normal decommissioning activities as well as accidents;
- Environmental issues associated with waste management, including the contribution of wastes generated by the proposed activities to the decreasing Site-wide capacity for interim storage and transportation of waste;
- The physical removal of Building 779 as an historic structure that is eligible for the National Register of Historic Places and a secondary contributor to a potential Historic District comprised of Cold War Era facilities at Rocky Flats; and

- This project's contribution to Site-wide cumulative impacts.

Geology and Soils

Decommissioning the 779 Cluster will disturb minor land acreage, most of which has been previously disturbed. Some recontouring of the soils may occur after facilities are removed to restore soil in areas disturbed by demolition equipment. Disturbed soils will be revegetated as necessary any to avoid soil erosion. Contamination of soils from decommissioning activities is not expected because facility structures will be decontaminated or fixed prior to demolition of the structures themselves.

Air Quality

Potential impacts to air quality resulting from the decommissioning of the 779 Cluster facilities include asbestos emissions resulting from asbestos removal, beryllium emissions resulting from the decontamination and removal of equipment and facility materials, radionuclide emissions resulting from the decontamination and removal of equipment, and fugitive dust emissions resulting from transportation activities associated with the decommissioning and demolition activities. Air emissions from these activities will be controlled and monitored in accordance with the RFETS Health and Safety Practices Manual.

Asbestos is present in several areas of Building 779, primarily in the form of pipe insulation. These materials will be removed by a properly certified contractor in accordance with applicable state and federal regulations. Assuming that the removal, transportation, and final disposition is in accordance with applicable regulations, there is minimal risk of an asbestos release to the air.

Some equipment within Building 779 is potentially contaminated with beryllium. The house cleaning action level for beryllium contamination is 25 μg per square foot. Cleanup and removal of materials and equipment contaminated with beryllium has a very small potential to cause a release to the air. Management of the contaminated materials and equipment in accordance with current Site procedures will result in minimal risk to both on- and off-Site personnel. Cleanup of any building materials to the lowest level practicable will minimize any potential beryllium release during the demolition of Building 779.

Decontamination, size reduction, removal, and ultimate disposal of equipment and materials in Building 779 have the potential to release radionuclides to the air. Decontamination and size reduction activities take place within containment (either glovebox, B-box, or hood) that is equipped with a HEPA filter. In addition, the building room exhaust is equipped with HEPA filters. This essentially eliminates the potential for a radionuclide release short of an accident during the transportation of the contaminated material. Stack monitoring is also conducted to ensure the integrity of the HEPA filtration equipment.

Fugitive dust emissions will result from the transportation of materials and wastes from the 779 Cluster. There is the potential for significant mitigative measures will be taken to minimize dust emission; short term fugitive dust emissions during the demolition of the structure itself without taking mitigation measures. Building 779 is a reinforced concrete and cinder block construction which will require the use of heavy equipment to reduce. Because of the distance of the Cluster from Site boundaries, impacts will be short-term to personnel working in areas proximate to the 779 Cluster. Miscellaneous hazardous materials will be removed from several structures within the 779 Cluster. These materials will be managed in accordance with existing Site procedures and there will be little risk for air emissions.

Water Quality

Because the ground floor and basement of Building 779 will remain in place decommissioning of the Cluster is not expected to impact, storm water runoff, storm water percolation, or surface water flow characteristics.

Existing wastes collected in the facility storage tank located in the basement of Building 779 present only a negligible risk if they are managed in accordance with existing Site procedures.

Building demolition can result in particulate runoff in storm water unless preventative measures are taken. For that reason the terms of the Industrial Area IM/IRA must be satisfied.

Because decommissioning of the 779 Cluster will not remove any portions of structures below ground level, no new bare ground is expected to be exposed to wind or water erosion. If appropriate in specific instances, silt fencing or similar protective devices would be installed to prevent or minimize the possibility of water-borne soil leaving the immediate area and entering drainage ways. Demolition activities may, however, deposit small amounts of debris on the surrounding pavement or ground surface which could be carried away by storm water runoff. Quantities of such material are expected to be small.

Among the techniques that may be used for decontamination of the 779 Cluster is the use of water or steam to remove contamination and loose debris (Appendix B). While this technique is effective in removing contamination, it also generates large volumes of potentially contaminated water and may even contribute to the spread of contamination. Surface water samples from the 779 Cluster drainage sub-basin will be collected using an automated station located to pull samples from the entire sub-basin's runoff. Water used for decontamination will be treated prior to release.

Because no work will be done below ground level, ground water should not be affected. The basement of Building 779 will be left intact with the stairway sealed to prevent in flow of storm water.

8.4.4 Human Health Impacts

Decommissioning has the potential to expose involved workers, non-involved workers, and the public to radiological and other contamination because the nature of the work is to remove or fix-in-place contamination. Disruption of contaminants or hazardous materials increases the chance of the contaminant or materials being dislodged, becoming airborne, and being inhaled by or Deposited on humans.

Radiological Impacts

For involved workers, deactivation and decontamination activities at Building 779 are estimated to result in a total dose of 17 person-rem. This exposure would be expected to result in less than 1 (0.07) latent cancer fatalities, assuming the same worker group conducted both deactivation and decontamination activities. Doses to co-located workers from decommissioning operations at Building 779 alone have not been evaluated. However, the annual radiological exposure of a maximally exposed co-located (unprotected) worker as a result of Site-wide closure activities is estimated at 5.4 millirem (a millirem is 1/1000 of a rem). The corresponding risk of a latent cancer fatality to this worker is two in 1,000,000 (CID, Section 5.8.1).

Annual dose to the maximally exposed off-Site individual from Site closure activities is estimated at 0.23 mrem, with a corresponding excess latent cancer fatality of 1 in 10,000,000. The annual dose to the public as a result of all activities in the RFETS closure project at the peak time of exposure (1997 - 2006) is expected to be 23 person-rem, or a total of 23 rem for all of the 2.7 million people projected to be living within 50 miles of the Site in 2006. This annual dose of 23 person-rem would be expected to result in less than one (0.01) latent cancer fatality in the entire Denver area population. Estimated annual dose to the maximally exposed off-Site individual is well below the applicable standard of 10 millirem/year (CID, Section 5.8.2).

Estimated doses from the 779 Cluster Decommissioning Project are expected to be a small fraction of those estimates for Site-wide activities, as described above. For comparison purposes, DOE's annual limit for occupational exposure as a result of all activities and through all exposure pathways is 5,000 millirem (5 rem) per person. The Site standard for annual exposure is 750 millirem per person. Natural background radiation in the Denver area results in an annual exposure of approximately 350 millirem per person.

Exposures to workers and the public will be controlled and monitored in accordance with the RFETS RCM (Section 6.4).

Non-Radiological Impacts

Non-radiological health effects (from exposure to chemicals) is measured by a hazard index. A hazard index greater than one is considered to be a basis for concern, and the greater the index is above one, the greater the level of concern.

For the full suite of Site closure activities (including decommissioning of all facilities), a hazard index of 1.2 has been calculated for a co-located worker who is chronically exposed to all chemicals of concern simultaneously during working hours over the entire period of Site closure. The corresponding cancer risk is 5 in 100,000 (CID Section 5.8.3).

For the full suite of Site closure activities (including decommissioning of all facilities), a hazard index of 1.5 has been calculated for a member of the public who is chronically exposed every day for 70 years to all chemicals of concern simultaneously (a highly unlikely event). A more reasonable scenario of exposure to a single chemical showed hazard indices of well below one for each potentially released chemical; analysis of potentially carcinogenic air pollutants indicates a cancer risk of 3 in 10,000,000 for the maximally exposed off Site individual (CID Section 5.8.4).

Estimated non-radiological impacts from the 779 Cluster decommissioning are expected to be a small fraction of those estimates for Site-wide activities, as described above. Exposures to workers and the public will be controlled and monitored in accordance with the RFETS HSP Manual (Section 6.3).

Occupational Hazards

In addition to exposure to radiological and chemical hazards, workers at the Site are exposed to a variety of industrial hazards such as heavy machinery, repetitive motion tasks, and physical agents such as heat and cold. Using a general industry rate for construction to estimate injury and illness cases, Site closure activities are estimated to result in 584 cases of injury and illness during the peak activity period (1997 - 2006) (CID, Section 5.8.3). The portion of these cases which would be estimated to result from the Building 779 decommissioning alone would be less than the total Site figure.

The general industry rate of injury and illness is considerably higher than the historic incidence rate for the Site; occupational hazards will be controlled, mitigated, and monitored in accordance with the RFETS HSP Manual (Section 7.2).

8.4.5 Plants And Animals

Because the 779 Cluster is located in the previously disturbed Industrial Area, impacts to plants and animals are expected to be minimal. Possible minor impacts to other vegetative areas may result as fugitive dust may distribute undesirable materials among existing plant species. Additional impacts may occur to vegetation associated with increased traffic in order to accommodate the decommissioning equipment. Increased traffic, both vehicular and pedestrian, could result in some vegetation disturbance.

Mammals such as rats, mice, and raccoons are known to be residents of or visitors to the Industrial Area. These mammals would be displaced, and some mortality would occur as a result of decommissioning activities. Bird nests attached to facilities planned for demolition would be destroyed, although no direct bird mortality is anticipated. The Preble's Meadow Jumping (PMJ) mouse: a species proposed for listing as endangered, is known to exist in downstream areas of the 779 Cluster. Mitigation measures to protect this species are identified in Section 8.4.11. The 779 Cluster activities will not be performed in known PMJ habitat.

8.4.6 Waste Management

Environmental impact issues associated with waste management are related to human health issues, storage capacities, and transportation.

In general, waste generated from decommissioning of the 779 Cluster includes contaminated and uncontaminated equipment, tools, electrical conduit systems, piping systems, gloveboxes and facility structural materials. Decommissioning of the 779 Cluster will generate waste as estimated in Section 7.0.

Decontamination will be performed in conjunction with decommissioning to remove radiological contamination and hazardous constituents. Where feasible, items will be decontaminated to free release conditions. Items that have been decontaminated to a free release condition will be transferred for use at a different location within RFETS, for use at a different DOE facility, or sent to the PU&D organization for appropriate handling. Mixed waste generated from decommissioning activities will be stored on-Site, and where feasible, shipped to an approved off-Site disposal Site. Hazardous wastes and excess chemicals will be managed as waste, where applicable, and disposed of in accordance with established procedures. Materials and waste will be characterized, stored and disposed of in accordance with 779 Cluster ARARs.

Waste minimization will be utilized in the planning and management of the 779 Cluster decommissioning wastes. Elimination and reduction of waste generated as a result of decommissioning is a high priority. Standard decontamination operations and processes will be evaluated for waste minimization potential and suitable minimization techniques will be implemented (Section 7.0).

With respect to transportation of waste, the 779 Cluster decommissioning project would generate and package materials suitable to meet DOT transportation requirements. (Section 7.9).

8.4.7 Historic Resources

The environmental impact issue related to historical resources is the loss of Building 779 as historic structure eligible for the National Register of Historic Places and a secondary contributor to a potential Historic District comprised of Cold War Era facilities. A related cumulative impact is discussed in a Section 8.4.3.

Sixty-four facilities within the Site's Industrial Area, including Building 779, have been identified as important to the historic role of the Site in manufacturing nuclear weapons components during the Cold War. Building 779 was originally constructed in 1965, with additions in 1968 and 1973 (Reference Section 1.2.2 and Appendix A). While this facility, like the others, is less than 50 years old, one of the usual criteria for determining eligibility is that it is considered historically significant as an essential component of the weapons production activities at Rocky Flats.

The agreement between DOE and the State Historic Preservation Officer (SHPO) concerning the appropriate mitigative measures applicable to these facilities has been completed; Building 779 will be subject only to documentation requirements (collection or creation of construction drawings and photographs), rather than preservation. No modification of or damage to the facility will occur prior to completion of documentation according to standards accepted by the SHPO.

The demolition of the 779 Cluster is in support is in support of the Site Mission and is covered under the Atomic Energy Act.

8.4.8 Noise

Decommissioning and demolition of the 779 Cluster is not expected to significantly increase noise levels in the Rocky Flats area. Most activities will take place inside the associated facility so that noise levels, if elevated over ambient levels, will be confined to the 779 Cluster structures in which they are generated. Other, less common activities such as scabbling (use of a machine to remove layers of concrete), blasting (use of various materials such as sand, dry ices, or other abrasives to remove superficial contamination), and demolition by backhoe ram, hydraulic cutters, wrecking ball, or other devices are expected to generate noise levels higher than ambient noise levels. However, workers involved in those activities will use appropriate hearing protection devices during activities expected to generate high noise levels (Section 6.2). Outdoor activities will take place at a distance from unprotected workers and the public and thus are not expected to increase noise levels to these populations to an unsafe level.

8.4.9 Socioeconomic Effects

Potential impacts from the decommissioning of the 779 Cluster would contribute to a net overall loss of employment in the long run. The current on-Site work force in the facility would either be drawn into the D&D activities for the facility (and potentially for the entire Site) or voluntarily lose employment. In the short run, the decommissioning activities could actually increase the employment level due to increased work force levels associated with D&D activities. Additionally; a modest increase of purchases (raw materials, etc.) may result due to D&D activities in the short run.

Under the worse case scenario, if the entire work force currently housed in the 779 Cluster all opted for voluntarily unemployment, the net overall impact would not have a great adverse effect on the Denver Metropolitan area nor would it adversely effect Boulder and Jefferson Counties, where the majority of the work force reside. Taken as a single facility, the net effects are expected to be minimal.

8.4.10 Cumulative Effects

Impacts associated with the decommissioning of the 779 Cluster would contribute incrementally to potential Site-wide cumulative impacts associated with the overall Site closure program.

Some of these cumulative impacts may ultimately prove to be beneficial to the environment, assuming that the activities result, as expected, in the restoration of much of the Site's original, natural condition prior to construction. Removing human occupation, structures, and paved surfaces and reestablishing native grasses and other vegetation could restore native plant communities and increase wildlife habitat, including threatened and endangered species. Cleaning up contamination will reduce health risks to human and animal populations.

As with decommissioning of the 779 Cluster, decontamination and decommissioning of structures Site-wide will generate transuranic, low-level, low-level mixed waste, and industrial (landfill) waste. Existing on-Site interim storage for radioactive waste is limited (DOE/EA-1146), and eventually, as Site-wide decommissioning progresses, additional storage capacity may needed. The same is true for industrial waste; the existing landfill is nearing capacity and is scheduled for closure under the Site restoration program in 2006. All sanitary landfill and special waste will transported to USA'S Front Range landfill in Erie, Colorado.

Also, demolition of the 779 Cluster is part of a potential cumulative effect to historic resources. Demolition will result in the physical removal of an historic structure that is eligible for the National Register of Historic Places and a secondary contributor to a potential Historic District comprised of Cold War Era facilities. Other historic structures within this district are also proposed for decommissioning and presumed demolition. The cumulative effect of these removals may be significant (see mitigation measures below). The landscape would take on a less industrial and more open, rural appearance, similar to the rangeland that characterized the area before the plant was constructed.

8.4.11 Mitigation Measures

Mitigation measures are prescribed to reduce or avoid potentially adverse effects associated with a proposed activity. For the decontamination and decommissioning of the 779 Cluster, mitigation measures will be considered in the areas of human health, worker safety, release of emissions and mobilization of contaminants, and cultural resources.

Decommissioning will be conducted in accordance with applicable worker and public health and safety programs (6.0); activities will be managed so that emissions and discharges are within applicable regulatory limits (Section 8.0). As required, decommissioning will take place within containment of existing facilities or temporarily constructed facilities (e.g., tents) with functioning drainage, air filtration, and other safety and environmental protection systems commensurate with risks inherent in the activities being conducted.

A runoff management plan will be developed and implemented to avoid contamination of groundwater or surface water.

If, during demolition activities, groundwater is encountered, the water will be characterized for contaminants and a determination of its acceptability for discharge obtained.

Precautions will be taken to ensure compliance with the Migratory Bird Act which prohibits destruction of birds or their nests, active or inactive, without a permit. Building surveys for such nests in the 779 Cluster will be conducted prior to demolition.

No decommissioning activities will take place in or near habitat of known threatened or endangered species.

Mitigation measures that will be applied, as appropriate, to ensure protection of the Preble's Meadow Jumping mouse are as follows:

- Containment of any potential contamination (chemical and radiological) associated with decommissioning such that this contamination cannot enter waterways.
- Placement of silt fencing downstream/downhill of any excavation or soil disturbance and construction of diversion ditches and sumps to contain contaminated sediment.

No modification of or damage to facilities determined to be eligible for the National Register of Historic Places will occur prior to completion of documentation according to standards set forth in the programmatic agreement between the DOE/Rocky Flats Field Office, the Colorado State Historic Preservation Office and the Advisory Council on Historic Preservation.

8.4.12 Unavoidable Adverse Effects

The 779 Cluster decommissioning activities, if conducted as proposed, will have the following unavoidable adverse effects:

- Physical removal of an historic structure that is eligible for the National Register of Historic Places and a secondary contributor to a potential Historic District comprised of Cold War Era facilities;

- Short-term increases in air emissions and water discharges;

- Radiation and chemical exposures to workers, co-located workers, and the public, resulting in a small, but increased risk of adverse health effects;
- Possible industrial accidents, resulting in injury and illness; and
- Increased noise levels for the duration of decommissioning activities.

8.4.13 Short-Term Uses And Long-Term Productivity

Unlike most projects which commit a Site to a particular use for a period of time, the effect of decommissioning will be to undo past commitments concerning use of the Site and open up a new and broad range of potential future uses. Decommissioning does not commit the Site to a particular land use, rather, decommissioning of the 779 Cluster will be one step in the process of ending one use and opening consideration for a variety of other possible future short- and long-term uses.

8.4.14 Irreversible and Irretrievable Commitments of Resources

Decommissioning is essentially a destruction project eliminating existing uses, not a construction project consuming land and building materials. Decommissioning of the 779 Cluster will release land and perhaps some facilities for other uses. Funds, labor, equipment, fuel, tools, personal protective equipment, waste storage drums, and similar items are resources that will be irretrievably committed to the decommissioning project. There are no anticipated irreversible or irretrievable commitments of resources natural as a result of the proposed action.

Table 8-3 Federal And State ARARs for the Decommissioning of the 779 Cluster

Action	Requirement	Prerequisite	Citation	ARAR
Air Quality	Compliance with air emissions	Control of emissions for smoke, particulate, and volatiles of concern. Implemented for construction activities, haul roads, haul trucks, demolition activities.	5 CCR 1001-3 Reg 1 5 CCR 1001-9 Reg 7	Applicable
Air Quality	Compliance with NESHAP	Regulates radionuclide emissions from DOE facilities with a limit of ten mrem/yr. Site standard.	5 CCR 1001-10, Reg 8 40 CFR 61 Subpart H	Applicable
Air Quality	Compliance with NAAQS	Maintain quality of ambient air for criteria pollutants.	5 CCR 1001-14	Applicable
Air Quality	Emission standards and compliance with asbestos work practice requirements	Standards for demolition, storage, and handling of waste. Implemented through specific operational directions in IWCPs.	5 CCR 1001-10 Reg 8	Applicable
Air Quality	Compliance with Hazardous Air Pollutant Requirements	Implemented if the remedial action involves a specific regulated pollutant, eg., lead.	5 CCR 1001-10 Reg 8	Applicable
Air Quality	Compliance with ozone depleting compound requirements	Ensure refrigerants are disposed of properly. Approved vessel recovery method must be used.	5 CCR 1001-19 Reg 15	Applicable
Solid Waste	Solid Waste Disposal Act	Requirements for disposal of solid wastes.	6 CCR 1007-2	Applicable
TSCA	Disposal of PCBs	Ensure that any materials with ≥ 50 ppm for PCBs are managed according to TSCA.	40 CFR Part 761	Applicable
Hazardous Waste	Compliance with Colorado Hazardous Waste Act	Identification and characterization of hazardous waste.	40 CFR 261 6 CCR 1007-3, Part 261	Applicable
Generator Standards	Standards Applicable to Generators of Hazardous Waste	Generator prepares a manifest if hazardous remediation wastes are disposed of offSite.	40 CFR, Part 262 6 CCR 1007-3,	Applicable
TSD Facility Standards	Temporary unit container and tank storage requirements	Requirements for operation of temporary tank and container storage areas.	40 CFR 264.553 6 CCR 1007-3, 264.553	Applicable
Closure	Requirement for Closure of Permitted RCRA Units	Implemented if RCRA permitted units are closed.	40 CFR Part 264 6 CCR 1007-3 Part 264	Applicable

Action	Requirement	Prerequisite	Citation	ARAR
Closure	Requirements for Closure of RCRA Interim Status Units	Implemented if RCRA Interim Status Units are closed.	40 CFR Part 265 6 CCR 1007-3 Part 265 as provided in RFCA Attachment 10	Applicable
LDR	Treatment standards for hazardous waste	Requirements for treatment and land disposal of hazardous waste.	40 CFR 268 6 CCR 1007-3, Part 268	Applicable
Universal Waste Management	Requirements for Universal Waste Management	Governs batteries, pesticides and thermostats.	40 CFR Part 273	Applicable
Used Oil Management	Requirements for Used Oil Management	Implemented if used oil is managed.	40 CFR Part 279	Applicable
Water	NPDES Requirements for discharging waster into surface water bodies	Requirements for discharge of stormwater or treated wastewater into surface water bodies.	40 CFR Part 122 and 125 5 CCR 1002-8	Applicable
Low Level Waste Disposal	Low Level Waste Disposal	Requirements governing offSite disposal of low level radioactive waste.	10 CFR Part 61 6 CCR 1007-14	Applicable
Radiation Protection	Standards for radiation protection	Establishes the criteria for the protection of human health and the environment.	DOE 5400.5	TBC
Radioactive Waste Management	Radioactive Waste Management	Requirements for the management and packaging of LLW.	DOE Order 5420.2A	TBC

C - Chemical Specific ARAR
L - Location Specific ARAR
TBC - To Be Considered

9.0 QUALITY

9.1 INTRODUCTION

A contractor will be responsible for the management, control, and oversight of the 779 Cluster Decommissioning Project. The SSOC QA Plan (QAP) will be used to control and monitor the quality aspects of the project activities and will describe roles, responsibilities, and methodologies for ensuring compliance with DOE Order 5700.6C (the Order), and 10 CFR 830.120, (Price-Anderson Amendments Act, also known as the Rule). The 779 Cluster Decommissioning Project will follow the requirements of the set forth in the QAP.

9.2 PURPOSE AND SCOPE

The contractor's QAP will identify the strategy and controls currently employed, or to be developed and implemented by the contractor, to consistently deliver products and services that meet the requirements of customers and stakeholders. The QAP will serve as a map of the current controls employed by the contractor, and will present a concise strategy for the continuing development of the contractor's QA Program.

The QAP is relevant and applicable to the specific operations of the contractor and its subcontractors, and where applicable, to the interface controls between the contractor and Kaiser-Hill, and between the contractor and other Kaiser-Hill subcontractors. When Safety Class or Augmented Quality conditions exist, Project Management may decide to obtain subcontractors who have earned the "Approved Supplier" status. Approved suppliers are required to submit a quality program which meets equivalent standards to the integrator's QAP. The evaluation and approval of such programs is performed by K-H for placement into the Site Approved Supplier List.

9.3 PROGRAM REQUIREMENTS

The QAP will identify the QA elements of the QA Program and defines them in the context of implementing programs and controls. Specific programs and controls are also referenced in the QAP, such as floor level procedures, plans, and documents used to control all activities involved in the 779 Cluster Decommissioning Project. The QAP applies to all project personnel. Project personnel will understand the program's impact from training, indoctrination, and the commitment evidenced by management.

One of the primary aspects of the QA program is management involvement. The project will be implemented through a project management team. This criteria also includes self assessments by the management team.

9.3.1 QA Systems And Description

General

The contractor will require that decommissioning activities be appropriately planned in accordance with the provisions of the QAP, and that when activities deviate from planned outcomes and indicate significant conditions adverse to quality, personnel are required to stop the activity until corrections can be made.

All personnel are responsible for performing activities in accordance with approved documents; identifying and participating in quality improvements; customer interface, supplier interface, and processes with which they are associated. The project team is responsible for exercising stop work authority over significant conditions adverse to quality; and for attending training.

QA Organization

The QA Program is inherent to the work. This is accomplished during the planning of work, through the participation of Quality Engineers. Integration of the QA program at the onset of the project will reduce the need for extensive inspections and assessments. This early integration supports primary principle of a QA program whereby the achievement of quality is embedded in the work processes, and that assessment should only be a tool for monitoring quality and continuous improvement.

9.3.2 Personnel Qualifications And Training

Project personnel are qualified to perform their respective tasks based on a combination of related experiences, education, and training. Education and experience constitute the primary means of qualification. Decommissioning management, in conjunction with training program administrators, are responsible for providing any additional skills and training prior to assigning employees specific project duties. Typical training methods include computer based training, classroom instruction, required reading, and on-the-job training. Qualification requirements and training records are maintained and retrievable through the project manager. These records reside at a centralized training record repository.

The QA Manager establishes requirements for the competency of individuals planning , developing, assessing, and inspecting QA related work activities. Quality Engineers have the training, qualifications, technical knowledge, and experience commensurate with the scope and complexity of the decommissioning activities being evaluated. Evidence of competency, and maintenance of competency have been established and recorded in accordance with the QAP.

9.3.3 Improvement

Employee participation in the assurance of quality, and the continuous improvement process, is achieved through taking ownership of their processes, and actively seeking means to improve those processes. Decommissioning project management will use lessons learned in each phase of the project to improve succeeding phases. The project team approach is one of the management tools employed to enhance productivity and continuity throughout the project.

Items, materials and hardware that do not meet established requirements are identified, segregated, controlled, documented, analyzed and corrected in accordance with the Non-Conformance Reporting (NCR) process. Activities, services and processes that do not meet established requirements are also identified and corrected in accordance with the Quality Condition Reporting (QCR) process. Quality Engineers are responsible for supporting the NCR and QCR processes, and for assisting in the disposition and correction of identified deficiencies.

9.3.4 Documents And Records

Quality affecting documents, such as work plans, operating procedures, and health and safety plans are prepared and controlled in accordance with approved processes. These documents receive the required reviews and approvals; they are uniquely identified, and their distribution is formally established. Other essential policies, plans, procedures, decisions, data, and transactions produced by the contractor are documented to an appropriate level of detail. Document reviews by subject matter experts, management and Quality Assurance are performed as appropriate and as specified in governing procedures. Quality records are prepared and managed to ensure that information is retained, retrievable, and legible. The document and record processes for the 779 Cluster Decommissioning Project are the same as the established controls for all Engineering, Construction, Decommissioning and Facilities (E/C/D/F) projects, and are maintained in a consistent and approved method.

9.3.5 Work Processes

Decommissioning processes and activities are controlled to a degree commensurate with the risks associated with the decommissioning process or activity. Documented and approved instructions are incorporated to control decommissioning processes and activities, maintaining compliance with referenced standards, engineering specifications, workmanship criteria, quality plans or other requirements.

Work is controlled from the onset of the project through project management procedures, engineering procedures, records management procedures, construction management procedures, and work packages. The IWCP is the formalized process that controls the development of the decommissioning work packages. Established Waste Management Procedures and other controls ensure that the generation and handling of waste meets governing requirements.

9.3.6 Design

Sound engineering, scientific principles, and appropriate technical standards are incorporated into all design activities to assure intended performance. Site infrastructure programs, primarily the Conduct Of Engineering Manual (COEM), provide controls for the design of items and processes. Design work includes incorporation of applicable requirements and design bases, identification and control of design interfaces, and verification or validation of design products by independent, qualified individuals, subject matter experts or groups other than those who performed the work. The verification and validation is completed before approval and implementation of the design.

The design control processes for the 779 Cluster Decommissioning Project are existing and well established. The design control process is approved and documented through procedures for the control of design inputs, outputs, verifications, reviews, changes, modifications, and configuration change control. Design control requirements for procured design and engineering services are also incorporated into procurement specifications.

9.3.7 Procurement Of Items And Services

The Decommissioning Program implements a procurement and subcontracts system that complies with the appropriate protocols required by the Site. All procurement documents receive a documented independent quality review by Quality Engineers to assure incorporation of appropriate quality assurance requirements. The QA organization reviews procurement documents to ensure that the requirements for items and services are clearly depicted, including specific performance requirements. Procurement documents are retained and administered in accordance with approved procedures.

The contractor will employ control systems for identification, maintenance, and control of items, including consumables. The controls ensure that items are properly labeled, tagged, or marked, and that only appropriate items are used for the application. Controls ensure that items are identified, handled, stored, transferred, and shipped in a manner that prevents loss, damage, or deterioration.

9.3.8 Inspection And Acceptance Testing

Decommissioning activities or items that require inspections and/or acceptance testing will be specified in work-controlling documentation, such as IWCP work packages, operating procedures, and data management plans. Acceptance criteria and hold points are clearly defined, in accordance with approved procedures. Inspections are designed and controlled in accordance with approved processes. Oversight and acceptance of services is performed in accordance with approved documents by qualified personnel from the Decommissioning Program staff or by the designated Quality Engineer.

Testing is conducted when necessary to verify that items and processes perform as planned. Testing activities are planned and implemented in accordance with approved procedures that include provisions for performing the test, item configuration, environmental conditions, instrumentation requirements, personnel qualifications, acceptance criteria, inspection hold points, and documentation requirements for records purposes. Only controlled and calibrated measurement and test equipment are used for testing, measuring and data collection activities.

9.3.9 Assessment Program

The contractor will establish and maintain an assessment program and procedures for planning and implementing assessments. Assessments are scheduled by an independent branch of the QA organization, based on the risk and QA performance indicators of the activities being conducted. Assessments are conducted by qualified QA personnel, independent of the 779 Cluster Decommissioning Project. The results of assessments are documented, reviewed by appropriate management, and are tracked to verify development and effective implementation of corrective actions.

As previously indicated, the QA organization consists of personnel who participate with and are matrixed to the decommissioning organization. These personnel conduct monitoring and surveillance activities as a continuous barometer of quality assurance compliance and implementation. Decommissioning Program management also performs documented Management Assessments of the decommissioning organization to determine the effectiveness of the QA Program and overall organization performance. In addition to the assessments completed within the QA organization the project management has established the following monthly reviews:

1. Review compliance with IWCP requirements, (2 packages-random selection).
2. Inspect for adequate training requirements, (5 people random selection).
3. Verify proper PPE is being worn, (10 people random selection).
4. Verify RWP requirements are being followed, (2 crews selected random).
5. Verify pre-evolution briefings are adequate, (2 crews selected random).

These inspections are documented in project logs or in the formal report to the project manager.

10.0 FACILITY SECURITY

All the containerized SNM has been removed from Building 779 and the material access area (MAA) has been closed. Building 779 has been downgraded to a Nuclear Material Safeguards Category 3 building (clearance required for free access). After the completion of the SNM consolidation and deactivation activities the building may be further down graded to a Category 4.

The 779 Cluster can only be accessed through the PA. Individuals entering the PA must hold a DOE clearance or be escorted by a cleared individual. The 779 Cluster has been downgraded from a "Classified" plutonium facility to a "Class 3 Security" facility. Visitors must be escorted within the 779 Cluster by a building qualified individual. General public access to these facilities are not permitted.

Attachment 1

Unit Information Sheets for Units Identified for Closure

UNIT INFORMATION SHEET

Unit 779.1

Unit Description:	Building 779 is located on the east end of the industrial portion of the facility and contains multiple storage areas comprised of gloveboxes within rooms.
Maximum Capacity: Liquid Capacity:	89 gallons (337 liters) 72 gallons (273 liters)
EPA Waste Codes:	See specific waste codes below for each type of container storage area.
Waste Types:	Mixed
Special Unit Conditions:	None

Container Storage Areas Within Unit 779.1:

a. Glovebox type areas

The following EPA waste codes apply globally to the "glovebox" type areas within this container storage unit. The individual gloveboxes that are used for container storage in this unit follow the listing of the approved EPA waste codes. Typical container arrangement diagrams are provided after the listing of the individual areas.

EPA Waste Codes: D002-D011, F001-F003, F005.

Room 131 Glovebox 131A, 131B, 131D, and 131E

Maximum capacity: Liquid capacity:	12 gallons each (45 liters) 12 gallons each (45 liters)
Waste types:	LLM, TRM, Mixed residues
Area limitations:	None

Room 137 Glovebox 106-3, 106-4, and 106-5

Maximum capacity: Liquid capacity:	8 gallons each (30 liters) 8 gallons each (30 liters)
Waste types:	LLM, TRM, Mixed residues

Area limitations.

1) The lead shielding in this glovebox will be positioned so that it is not necessary to move the shielding in order to inspect the stored containers.

Room 160 Glovebox 860

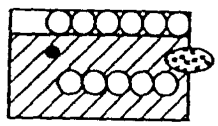
Maximum capacity: 17 gallons (64 liters)
Liquid capacity: N/A

Waste types: TRM, Mixed residues

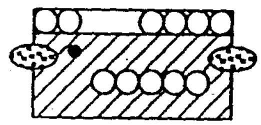
Area limitations:

1) The door to each storage bin will not be opened during routine inspections of this glovebox. Instead, containers will be inspected concurrently on a bimonthly basis during nuclear material accountability inspections in accordance with the Nuclear Materials Safeguards Procedure Manual.

RCRA Unit 779.1 - Container Storage Area (Gloveboxes)
Building 779, Room 131

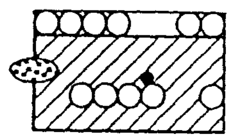


GBox 131A



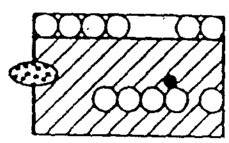
GBox 131B

Secondary containment capability:
Typical inventory = 11 4-liter containers each
Total surface area = 9 sf each
Minimum berm height = 0.6 in



GBox 131E

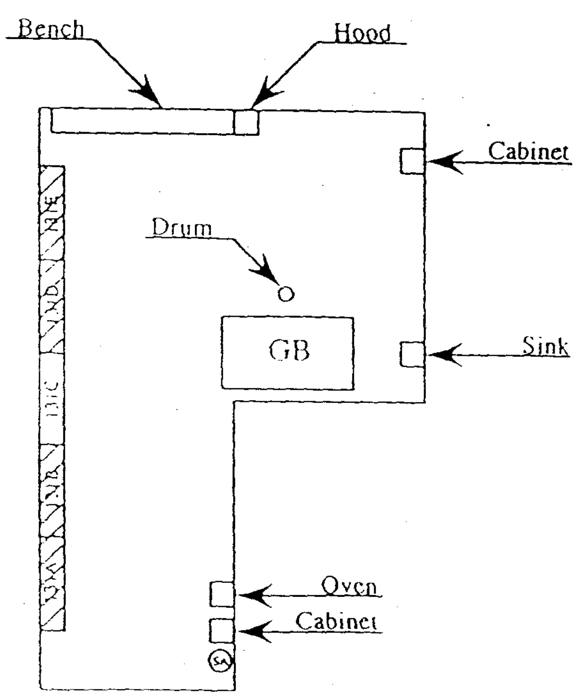
Secondary containment capability:
Typical inventory = 11 4-liter containers
Total surface area = 10 sf
Minimum berm height = 0.5 in



GBox 131D

Secondary containment capability:
Typical inventory = 11 4-liter containers
Total surface area = 9 sf
Minimum berm height = 0.6 in

NOTES:
1) Typical container layout, actual arrangement may vary.
2) In the unlikely event the criticality prevention drain were to overflow, the excess liquid would drain to the floor of the room.

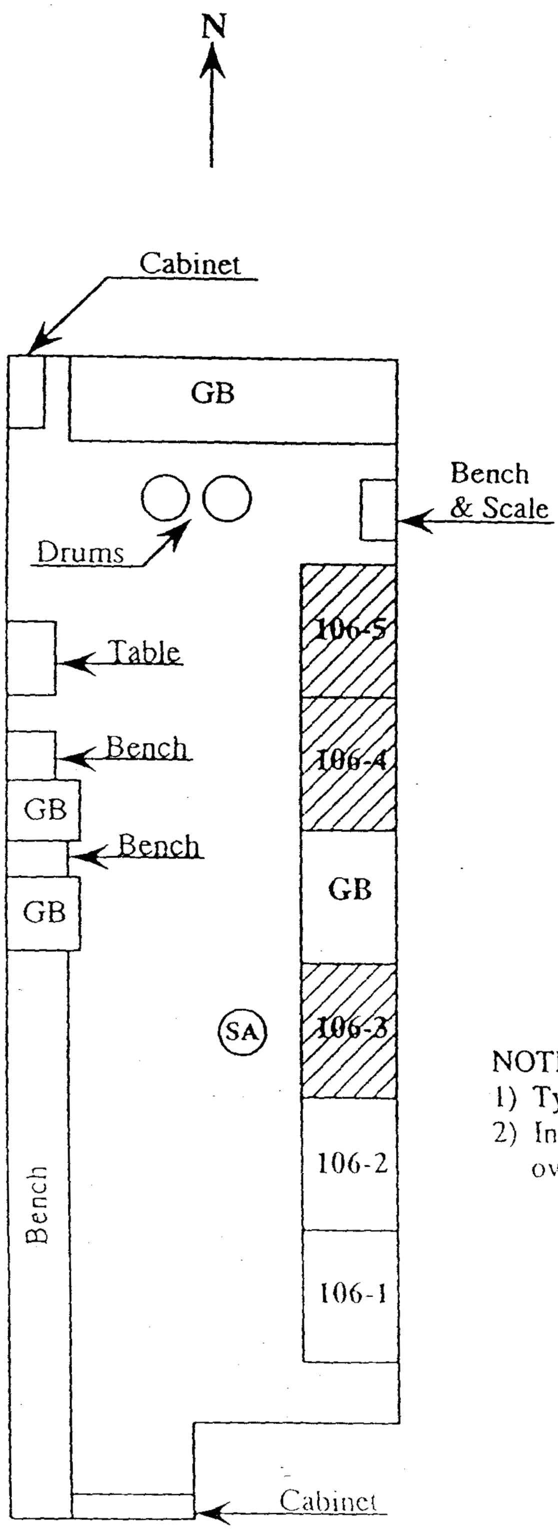


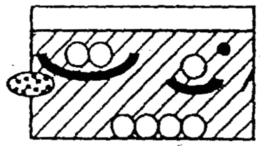
Legend:

Restricted space

Criticality drain

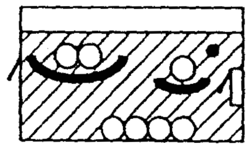
RCRA Unit 779.1 - Container Storage Area (Gloveboxes)
Building 779, Room 137





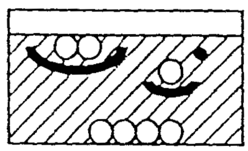
GBox 106-5

Secondary containment capability:
Typical inventory = 7 4-liter containers each
Total surface area = 10 sf each
Minimum berm height = 0.2 in



GBox 106-4

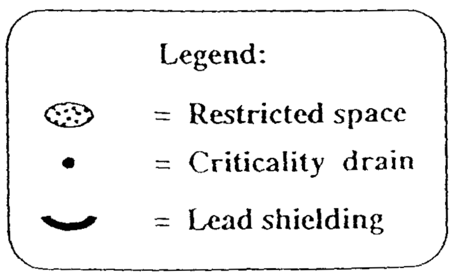
Secondary containment capability:
Typical inventory = 7 4-liter containers each
Total surface area = 10 sf each
Minimum berm height = 0.2 in



GBox 106-3

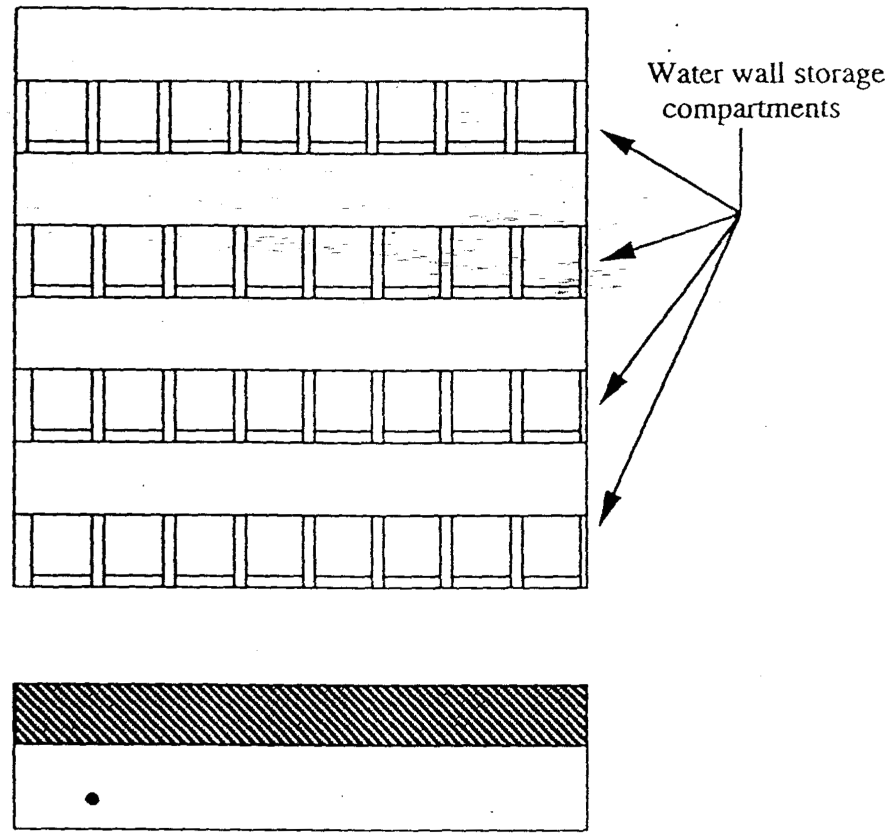
Secondary containment capability:
Typical inventory = 7 4-liter containers each
Total surface area = 10 sf each
Minimum berm height = 0.2 in

NOTES:
1) Typical container layout, actual arrangement may vary.
2) In the unlikely event the criticality prevention drain were to overflow, the excess liquid would drain to the floor of the room



RCRA Unit 779.1 - Container Storage Area (Glovebox)
Building 779, Room 160

Plan view

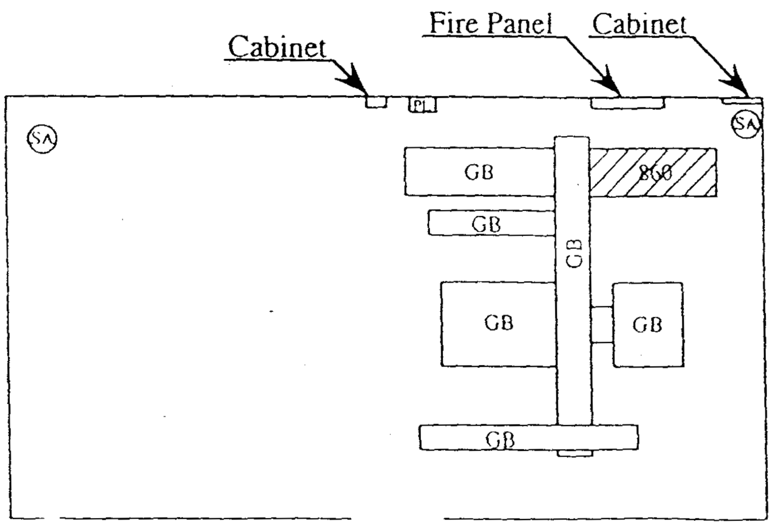


GBox 860

NOTES:
1) There are eight storage locations on each of the four shelves for a total storage capacity of 32 containers.
2) In the unlikely event the criticality prevention drain were to overflow, the exces liquid would drain to the floor of the room.

Legend:

- ● = Crit drain
- (hatched) = Shelving
- PL = plenum



Appendix A

779 Cluster Description

1.0 779 CLUSTER DESCRIPTION

1.1 SCOPE

1.2 SUMMARY DESCRIPTION OF THE 779 CLUSTER

Main structures in the 779 Cluster are the R&D facility, Building 779; a filter plenum and emergency generator building, Building 729; a filter plenum building, Building 782; the emergency generator facility, Building 727; a paint storage facility, Building 780; and a cooling tower, Structure 783. The facility was built in 1965 and has had several additions and modifications since then. Building 779 is located in the north central section of RFETS, east of Buildings 776/777 and north of Building 750.

The building is constructed primarily of filled concrete block. Interior walls are concrete block, transite, gypsum board, and acoustic paneling. Floors are poured concrete, covered with vinyl-asbestos tile, carpet, or paint. The roof is built up over rigid board insulation, supported by poured concrete on a metal pad.

During 1988, the exterior containment of Building 779 was structurally upgraded to withstand a Design Basis Earthquake and Design Basis Wind. The 779 Cluster was used for research and development activities including physical chemistry, physical metallurgy, machining and gauging technology, joining technology and process development. The Cluster supported weapons production activities and was an essential component of the national security operations performed at Rocky Flats. The areas in which these operations were located are described below.

Description of Facility

This section describes the physical arrangement of principal buildings in the 779 Cluster, architectural and structural features, significant equipment, environmental control systems, and safety aspects of each. Building 779 (Identified by the Number 1 in Figures A-1 and A-2) has been in use since May 1965. Since then, two major additions have been constructed. The first addition (Identified by the Number 2 in Figures A-1 and A-2), is also referred to as Building 779A, was built in 1968. The second addition (Identified by the Number 3 in Figures A-1 and A-2 was built in 1973 and is also referred to as Building 779B. Two new filter plenum buildings were also constructed. They are Building 729 in 1971 and Building 782 in 1973.

General Description

Building 779 is the primary structure in the 779 Cluster. Ground-floor area (including a covered dock) is 42,800 square feet (ft^2), the second floor is 24,370 ft^2, and the basement is 540 ft^2, for a total of 67,710 ft^2. The building is roughly L-shaped. The north-south leg is approximately 161 ft. wide and 214 ft. long. The east-west leg is 62 ft. wide and 101 ft. long. At its highest point, the building is 27 ft tall.

Building 729 is one of the two filter plenum buildings supporting Building 779 and is rectangular in shape. Its dimensions are as follows: 72 ft. long (From east to west), 38 ft. wide, and 30 ft high. It is located south of Building 779 and is connected to it via a second-story, 8-ft.-wide duct bridge.

Building 782 is the other filter plenum building supporting Building 779. It is 60 ft. wide by 99 ft. long (From north to south) and is located east of Building 779. The building is 20 ft high. It is connected to Building 779 via an underground duct tunnel, a two-story vertical shaft, and an overhead duct.

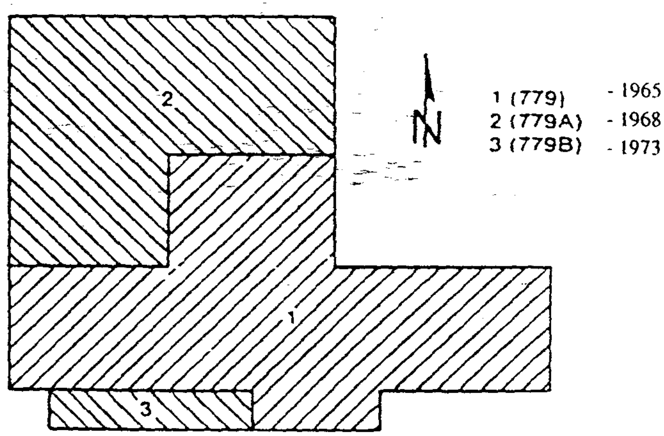


Figure A-1 & A-2 First Floor Key Plan, Building 779

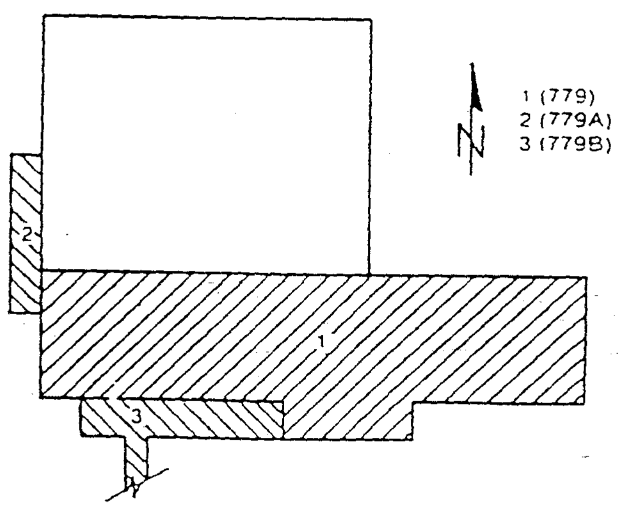


Figure A-2 Second Floor Key Plan, Building 779

The emergency generator for Building 782 is in a separate concrete block structure and is called Building 727. It is located east of Building 779 and north of Building 782.

Building 783 is a cooling tower located east of Building 779 and north of Building 727.

Building 780 is a paint storage facility constructed of sheet-metal. It is located east of the northeast corner of Building 779.

In addition to the structures mentioned, HVAC, electricity, gas and compressed air, steam, water, process waste, sewer, fuel oil, and fire protection utility systems serve the 779 Cluster.

Building 779 Description

The primary function of Building 779 was research and development. There have been two major additions to the building. The first addition (Building 779-2) provided supplemental office, laboratory, mechanical equipment space and two large machine shop areas. The second addition (Building 779-3) supplied more office and laboratory space, plus an environmental storage area and a storage vault.

Floor plans for Building 779 are shown in Figures A-3 and A-4. The facility has joining, electro-refining and coating laboratories. It also contains machine shops, environmental storage areas, offices, loading docks, locker rooms, a duct tunnel to Building 782, a second floor enclosed walkway to Building 777, and a second-floor duct bridge to Building 729.

Building 779 Seismic Modifications

In 1987 and 1988, the concrete-block structure of Building 779 was reinforced to withstand a 0.14g seismic acceleration at bedrock and a 161 mph design basis wind. More recent analysis found the building to be vulnerable to somewhat lower loads. Seismic modifications were made to Building 779 and include:

- Seismic ties installed over the existing north roof area;
- New concrete buttresses, grade beams, and drilled piers were added;
- Horizontal steel strongbacks were installed against block walls;
- Vertical steel strongbacks were installed between the roof and first floor along exterior walls;
- Steel plate seismic collectors were installed on top of the main structural topping;
- A new metal deck panel was installed between the low and high roofs;
- The outer wall of the covered dock area was reinforced and sheathed with metal;
- The ventilation duct support structure at the southeast corner of the building was braced by pairs of diagonal struts at the south and west sides of the tower;
- New tie-downs were installed at the ends of tapered girders;
- Most windows and a number of doors were eliminated.

Foundations

The foundations for Building 779 are horizontal and poured-in-place with reinforced concrete spread footings. Dimensions vary from 1 ft. 6 in. square to 6 ft. 6 in. square and from 10 in. to 16 in. thick. In depth below grade, the footings vary from 3 ft. to 9 ft. Reinforced concrete grade beams, 16 inches to 18 in. wide and 10 in. to 13 in. thick, rest on the spread footings. Concrete grade walls, 10 1/2 in. to 12 in. thick and 4 ft. 6 in. deep, support the exterior walls.

Structural Framing

Three types of framing members have been used in Building 779. Vertical concrete columns, cast-in-place and reinforced (10 in. by 14 to 16 in. rectangular) rest on slab footings. Structural steel columns (8-in. deep) are wide-flange I-beams encased in concrete. The columns support an exterior passageway and an exterior wall of the original building. Concrete block pilasters (16 by 16 in.) which have been reinforced with steel, were used in the single-story portion of the original building.

Exterior Walls

The exterior walls of Building 779 are constructed of mortar filled concrete block from the foundation base to a height of eight feet up the exterior wall. From the eight foot height on the exterior walls are constructed of hollow concrete block except for the 12-in.-thick, poured-in-place, reinforced concrete wall of the storage vault and the metal stud and siding on a storage area on the east side of the first addition (Building 779-2). Concrete block walls are 10 to 12 in. thick on the first floor and 8 in. thick on the second floor. There is horizontal trussed wire reinforcement in both interior and exterior hollow core concrete block walls; however, there is no vertical reinforcement. Walls are insulated with either perlite fill between cavities or 2 in. blanket insulation. Outer surfaces of the concrete blocks are painted. The walls are designed to be the equivalent of 2-hr fire-rated walls.

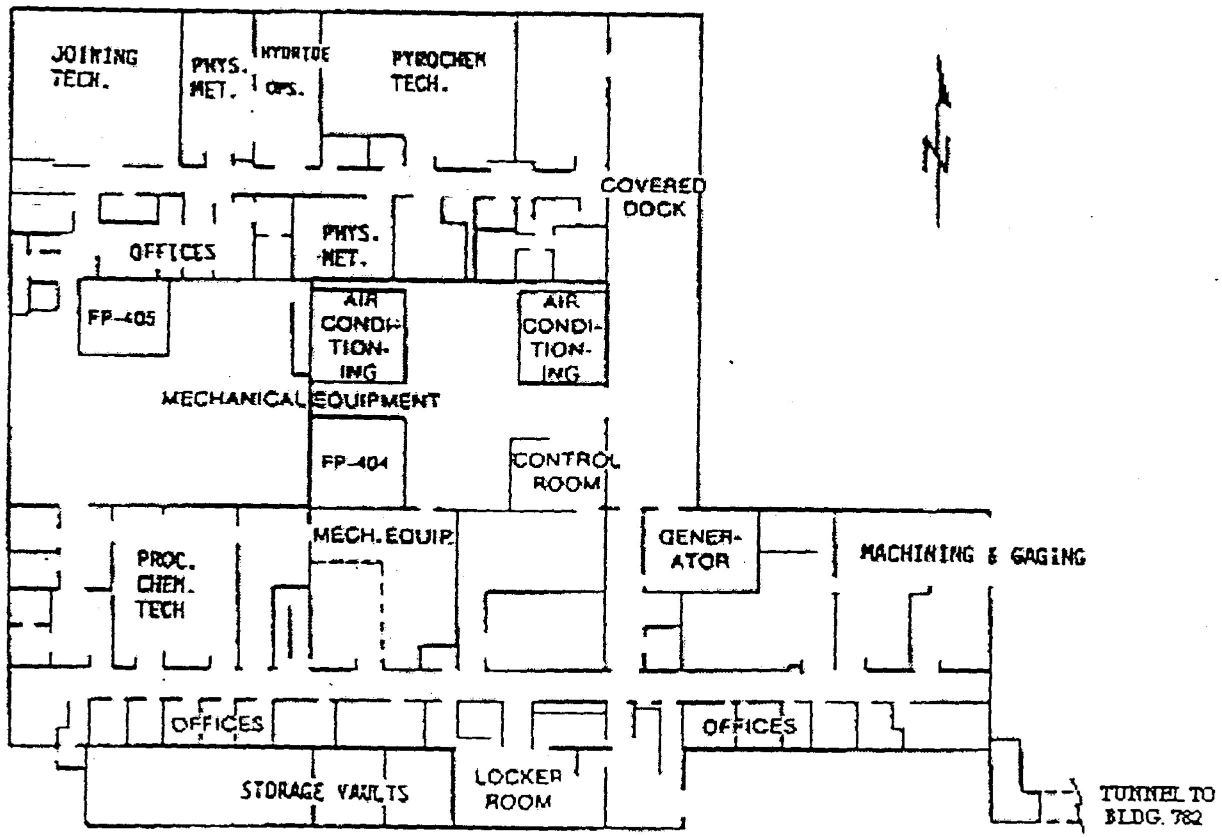


Figure A-3 *First Floor Plan, Building 779*

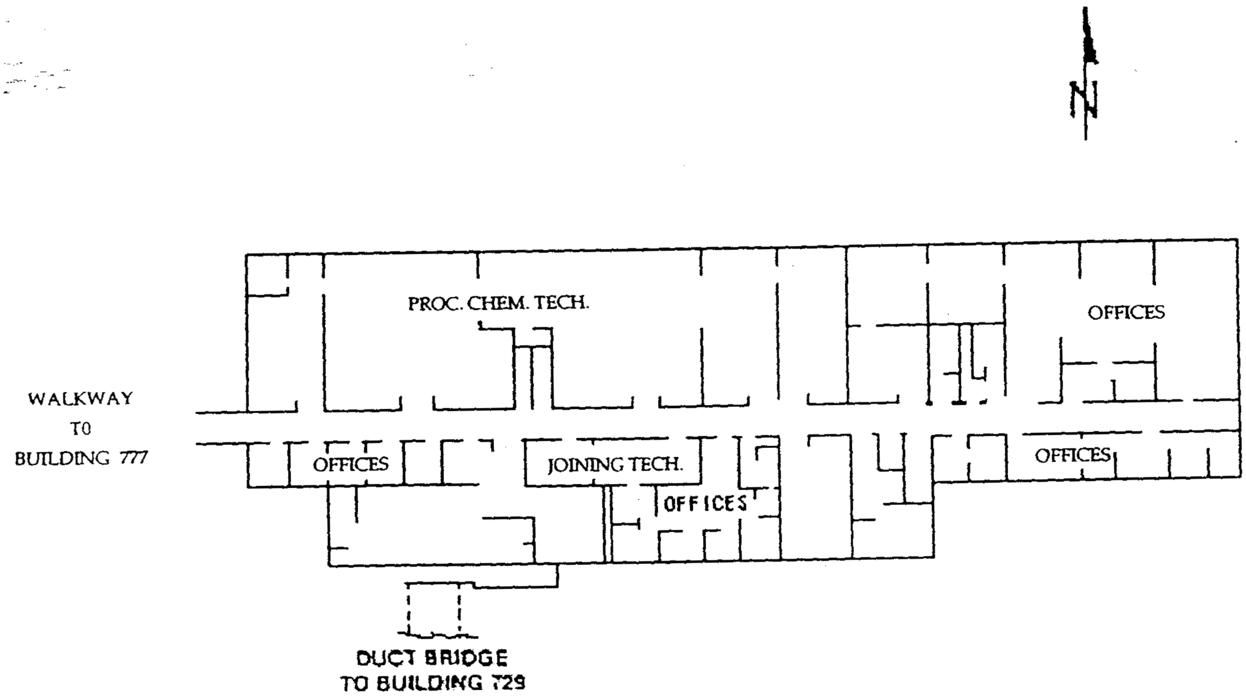


Figure A-4 *Second Floor Plan, Building 779*

Floors

The first-floor slabs in Building 779 are poured-in-place, reinforced concrete 6 to 8 in. thick, with a barrier on a gravel base. The second-floor slab in the original building is 3 1/2-in.-thick reinforced concrete on concrete joists supported by concrete beams. The second-floor slab of the second addition is 8-in. thick reinforced concrete on concrete joists supported by concrete beams.

Roofs

Three different roof systems have been used on Building 779. The single-story portion of the original structure (#1 in Figure A-1) is structural steel with 18-gage steel decking, insulation, and composition roofing. The two-story portion of the original building and the second addition is a poured-in-place, reinforced concrete slab on concrete joists, supported by concrete beams. The original building roof has insulation and composition roofing, whereas the second addition roof has 2 inches of "foamed-in-place" urethane and silicone rubber roofing. The first addition roof consists of precast concrete tees with 2 in. of light-weight concrete, 4 in. of perlite, and elastomeric roofing.

Interior Walls

Most interior and exterior walls in Building 779 are painted concrete block. Storage vault walls, which are of 12-in.-thick reinforced concrete, are also painted. Ceramic tile covers the concrete block in locker room and restroom areas. The interior surface of most exterior walls is gypsum board.

Ceilings

The ceilings in offices and hallways are suspended acoustical tile. In other areas of Building 779 the ceilings are the cement underside of floors and roofs. The major exception is an 8-in. reinforced concrete ceiling over the storage vault.

Doors

Most of the doors in Building 779 are either solid steel, steel with louvers, or steel with safety glass windows. There are double airlock doors separating laboratory and development areas from the outside office and maintenance areas. There are two steel vault doors which close off the environmental storage area and a lead-lined, 4-in.-thick Benelex door for the storage vault.

Windows

There are no windows in Building 779. The addition (Building 779-3) on the south side of Building 779 (Figure A-2) had windows that were sealed during the seismic upgrades.

Surface Finishes

Most interior and exterior walls in Building 779 are painted. Walls in laboratory areas are painted with epoxy. Walls and floors in rest rooms and locker rooms are covered with tile. Floors in laboratories are painted with epoxy and the floors in offices and hallways are vinyl asbestos tile.

Duct Bridge To Building 729

The duct bridge is an enclosed second-story structure that connects Building 779 to Building 729. The interior of the bridge is 6 ft. 8 in. wide by 7 ft .4 in. high and spans 38 ft between the buildings.

The floor is precast concrete twin tees with a concrete overcoat. The walls are concrete block and the roof is 4-in. thick, reinforced concrete with 2-in., foamed-in-place insulation and silicone-rubber roofing. This bridge houses the two exhaust ducts from Building 779-3. The bridge is not used as a walkway.

Overhead Passage To Building 777

The connecting, enclosed walkway from the second floor of Building 779 to Building 777 is approximately 11 ft. wide by 54 ft. long. It has a reinforced concrete floor and roof and concrete block walls. The roof is insulated and has multiple layers of roofing on top.

Exhaust Duct Tower

The tower structure for the exhaust ducts to Building 782 is located along side of Building 779 at the southeast corner. It is 40 ft. high and approximately 12 by 13 ft. in cross-section. Walls are 8-in. thick, reinforced concrete block. The roof is tapered, reinforced concrete slab which is 8 in. at the high point and 5 in. thick at the low end. The roof slab is on top of a metal deck and is covered with multiple layers of roofing material on top of 1 1/2 in. of insulation.

Duct Tunnel to Building 782

Exhaust ducts enclosed in a tunnel run east on the roof of Building 779, pass into the duct tower off the southeast corner of the building, down through the tower, and into a 48-ft.-long underground tunnel, entering Building 782 in the pit area.

The underground duct tunnel is 10 ft. 8 in. wide and 12 ft high on the inside. Walls, floor, and the roof are 12-in.thick, reinforced concrete with an exterior waterproofing. The top of the roof slab is about 3 ft. below grade. Walls are supported by five concrete caissons ranging from 2 ft. to 2 1/2 ft. in diameter and 11 to 14 ft. deep.

Arrangement of Building 779

Building 779 is comprised of three main areas (Figures A-1 and A-2). Section 1 is the original building and is two stories. The first floor contains laboratories, a mechanical equipment room, a maintenance room, an emergency generator, and welding areas. There is also a locker room, offices, radiation monitoring, and other small shop areas. The second floor has two large laboratory areas containing coatings R&D, X-ray, gas diffusion, offices, and small laboratories. There is also a small basement for process waste collection tanks, a fire protection water collection tank, and transfer pumps.

Section 2 has five large research areas which were used for metal joining, electroplating, and machining. Smaller areas contain facilities which were used for measurement, mechanical properties evaluations, and physical evaluation. Offices, a locker room, and a mechanical equipment room are also located in this section.

Section 3 is the second addition to the building. It consists of two stories located at the southwest corner of the building. Section 3 houses a mass spectrometer surveillance lab and an environmental storage area.

Emergency Generator Facility, Building 727

The emergency generator facility houses a 500-kilowatt (kW) generator for emergency power for Building 782. The structure, built in 1973, is 16 ft. wide by 24 ft. long by 12 ft. high. The single-story building has 8-in. concrete block walls that rest on 8-in.-thick by 5-ft-deep foundation walls. Concrete block walls support a 5-in. thick, reinforced concrete roof slab that has asphalt-gravel roofing. The floor slab is 6-in. thick, reinforced concrete. Access is provided by a set of double doors and a single door. Ventilation is provided by six louvered grills. This building has automatic sprinklers which contain an antifreeze solution, and an electric space heater for winter freeze protection.

Filter Plenum Facility, Building 729

Constructed in 1971, this is a one-story building with a small penthouse that serves as the connection for the exhaust-duct bridge to Building 779. The building is approximately 72 ft. long by 38 ft. wide by 16 1/2 ft high. The penthouse is 22 ft. long by 10 ft. wide and 7 ft. 4 in. high. Building 729 contains one two-stage and one four-stage filter plenum that filter room and glovebox air from Building 779-3. There is also a 150-kW emergency diesel generator used to maintain power to critical equipment within Building 729 in the event of a power failure.

Reinforced concrete spread footings, 2 ft. high by 3 ft. 4 in. wide by 1 ft thick, support reinforced concrete grade walls 13 to 19 in. thick and 3 to 5 ft deep. The floor slab is reinforced concrete 6 in. thick. There are two pits. One is approximately 2 1/2 ft deep, the other is approximately 6 ft. deep. Both pits are lined and have 12-in. thick floor slabs. The pits were constructed to hold used fire suppression system water that could be contaminated. Figure A-5 illustrates the first floor plan of the building.

Outside walls are actually two separate walls two inches apart, made of concrete block. The exterior wall is 4 in. thick and the interior wall is 6 in. thick with 2 in. of loose perlite between the walls.

The roof consists of precast concrete twin-tee joists topped with a 4-in. thick concrete slab, 2-in. thick foamed-in-place urethane, and finished with silicone rubber roofing. It is supported by cast-in-place concrete beams resting on reinforced concrete columns.

There is a second-floor mezzanine above the control room in Building 729. The floor is a cast-in-place, reinforced concrete slab.

For fire protection, the building has wet-pipe sprinklers throughout, heat detectors, and manual and automatic sprays in the plenum.

Paint Storage Facility, Building 780

This building provides storage for paint and solvents. It is a corrugated sheet-metal shed with a reinforced concrete slab floor and sheet-metal roof. Interior walls and ceiling are gypsum board. The building has approximately 140 ft^2 of floor space.

Cooling Tower, Structure 783

The cooling tower, in use since 1967 and rebuilt in 1985, supplies cooling water to Building 779. Building 779-2 cooling water is provided by the Building 776 system. Structure 783 is constructed of aluminum and steel on reinforced concrete pedestals on a reinforced concrete foundation. Since it consists entirely of metal and concrete, a fire protection system was considered unnecessary.

Filter Plenum Facility, Building 782

This filter plenum facility serves the original Building 779 and Building 779-2. It has three exhaust plenums to support building, glove-box, and hood exhausts, plus a supply plenum for Building 782 supply air. The building has been in use since February 1973. It is 100 ft. long by 61 ft. 8 in. wide by 15 ft. 9 in. high. Figure A-6 is a floor plan of the building.

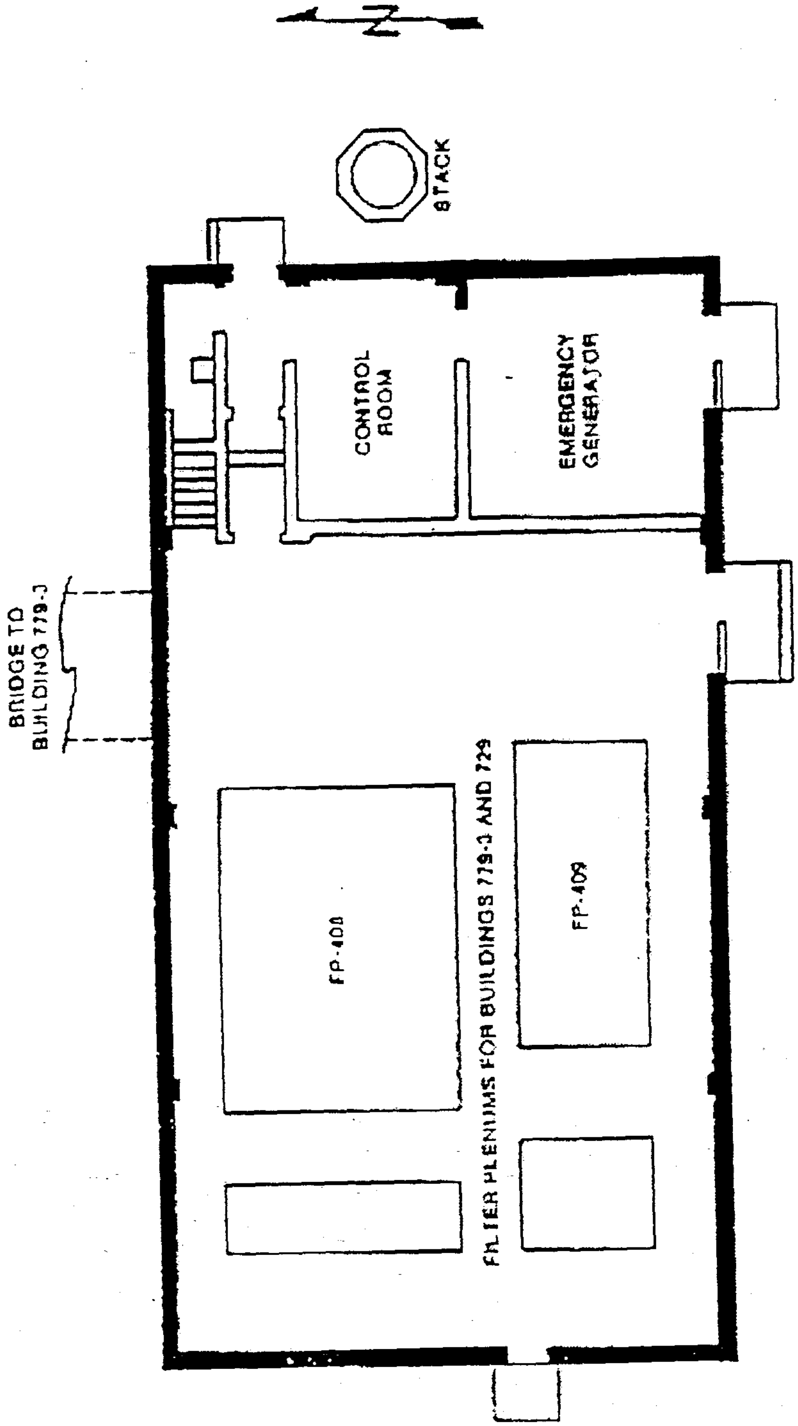


Figure A-5 *First Floor Plan, Building 729*

Reinforced concrete caissons, varying from 2 to 2 1/2 ft. in diameter and from 6 to 24 ft. deep, support reinforced concrete grade beams which are 10 in. thick by 5 ft. deep. The floor slab is reinforced concrete varying from 6 to 9 in. thick. There is one large pit at the west side of the plenum building that holds the fire suppression system water tank and provides access through the duct tunnel to Building 779. The pit is 23 ft. high by 22 ft. wide by 17 ft. deep. The walls are 12-in-thick, reinforced concrete. The floor is reinforced concrete 12 to 17 in. thick. Walls in Building 782 are 6-in thick-, precast, reinforced concrete panels joined in place by 8-in thick concrete columns that vary from 14 to 24 in. wide. There are no interior walls.

The roof consists of precast, reinforced concrete twin tees with a minimum of 2 in. of composite cast- in-place, stone aggregate topping. It is supported by 8-in. thick reinforced concrete roof beams resting on the reinforced concrete columns.

Automatic sprinklers throughout the building, and heat detectors with automatic alarms connected to the Central Alarm Station, provide fire protection for the building.

Zone Concept for Confinement

To ensure that radioactivity is contained and controlled within the building, Building 779 is divided into several ventilation zones separated by physical barriers. Contamination control is accomplished through a series of pressure-control zones, each of which is connected to dampers that control the amount of air leaving a zone. Ventilation pressure is increasingly negative from zone to zone toward areas of potentially higher radioactivity. The ventilation atmosphere flows from areas having the least potential for radioactivity toward areas having progressively higher potentials.

The air-pressure balance between zones is maintained by differential-pressure sensing instruments and is controlled by inlet and outlet zone dampers.

Pressure differentials maintain airflow toward the zone having highest radioactivity potential to final filtration, prior to being exhausted to the outside atmosphere.

The outer shell of Building 779 provides the final containment barrier for radioactive materials before the outside environment. Conventional double-door airlocks provide passage to areas that do not contain radioactive materials, such as offices or maintenance shops.

Glovebox Design

The primary confinement of radioactive materials in plutonium process areas is achieved by the use of gloveboxes. In general, process gloveboxes are of welded construction, using formed stainless steel sheet. Some boxes are lined with Teflon®. Gloveboxes are covered with 1/8-in. lead sheet where greater radiation shielding is required.

Glovebox windows are attached by means of floating gaskets or external studs and clamping bars that seal suitable gaskets. Windows are constructed of laminated safety glass, wire glass, or plastic, depending upon the use of the box. If shielding was required, leaded glass was laminated with safety glass. Gloveports are stainless steel rings welded to glovebox walls. Thick rubber gloves are attached to gloveports with steel rings. Before they were used, gloveboxes were leak tested to ensure their integrity.

Where possible, gloveboxes were designed with a single-level floor to prevent fissile material from accumulating in low areas or pockets. Large openings in a glovebox, such as a ventilation duct, were positioned above the floor of the glovebox to prevent the entry of liquid. Some gloveboxes that potentially could contain a critical quantity of fissile material had a gravity flow drainage system capable of removing liquid to maintain a critically safe depth. Criticality drains terminated on the laboratory floor that was designed to hold the liquid in a critically safe configuration. Liquid was then be sucked into special Raschig ring-filled vacuum tanks for subsequent analyses and processing.

Heating, Ventilating, and Air Conditioning Systems

The purpose of the HVAC system is to control the temperature, humidity, and quality of the zone atmospheres within Building 779. The 779 Cluster contains several HVAC systems. They are described below for the following areas: (1) original Building 779, (2) Room 127, (3) Room 122, (4) Building 779-2, (5) Building 779-3, (6) Building 729, and (7) Building 782.

The air supply systems within Building 779 are capable of conditioning 100% of the outside air; however, the systems usually operate in a recirculating mode to conserve energy. Control rooms and instrumentation operating under normal power, emergency power, or uninterruptible power, ensure safe dependable surveillance and control of the HVAC systems.

Original Building 779 HVAC

This portion of the Building 779 HVAC has two air supply systems, two air recirculating systems, and two air exhaust systems (Figure A-7). Outside supply air for offices, lavatories, locker rooms, and the electron beam laboratory within the original Building 779 structure is drawn into the building through fixed louvers and a bird screen, through back-draft dampers, then drawn through a fiberglass filter in air conditioner, AC-2, by fan B-201. Brine is circulated through the air conditioning coils to reduce the temperature of the air entering the HVAC system.

The fan delivers the air through temperature-control heating coils to office-area distribution systems. Figure A-8 illustrates a typical two-stage plenum of HEPA filters.

Most of the air from the office areas is recirculated through AC-2; a small amount is exhausted to the atmosphere through a filter plenum (FP-403) by building exhaust fan F-403A or B in Building 782.

Outside air for hoods and gloveboxes, excluding inert gloveboxes, passes through a distribution system similar to that for the office areas, except that there are two supply fans (B-IOIA and B). A recirculation system for the production side room air also has two fans, F-404A and B, one of which recirculates 90% of the air from the production side of the building through a filter plenum, FP-404, back through its own air conditioner, AC-I. (With the AC-I system, there is the option to use 100% fresh air.)

Air exhausted from the production side gloveboxes and hoods is drawn by fans through four-stage filter plenums in Building 782 before it is exhausted to the atmosphere. Fan F-401A or B pulls the glovebox exhaust through filter plenum FP-401 while fan F-402A or B pulls hood exhaust through FP-402.

Room 127 HVAC

Room 127 is a mechanical equipment room located within the original Building 779 that has its own air supply and supply fan HV-I. One hundred percent of the air from Room 127 is exhausted through the building exhaust plenum, FP-403, in Building 782.

Room 122 HVAC

Room 122 is the control room for original Building 779, Building 779-2, and Building 782 HVAC systems. It also monitors the HVAC system in Building 729. It has its own supply filter plenum, FP-407, and supply fan, F-407, with chiller and heater; its air is exhausted directly to the atmosphere.

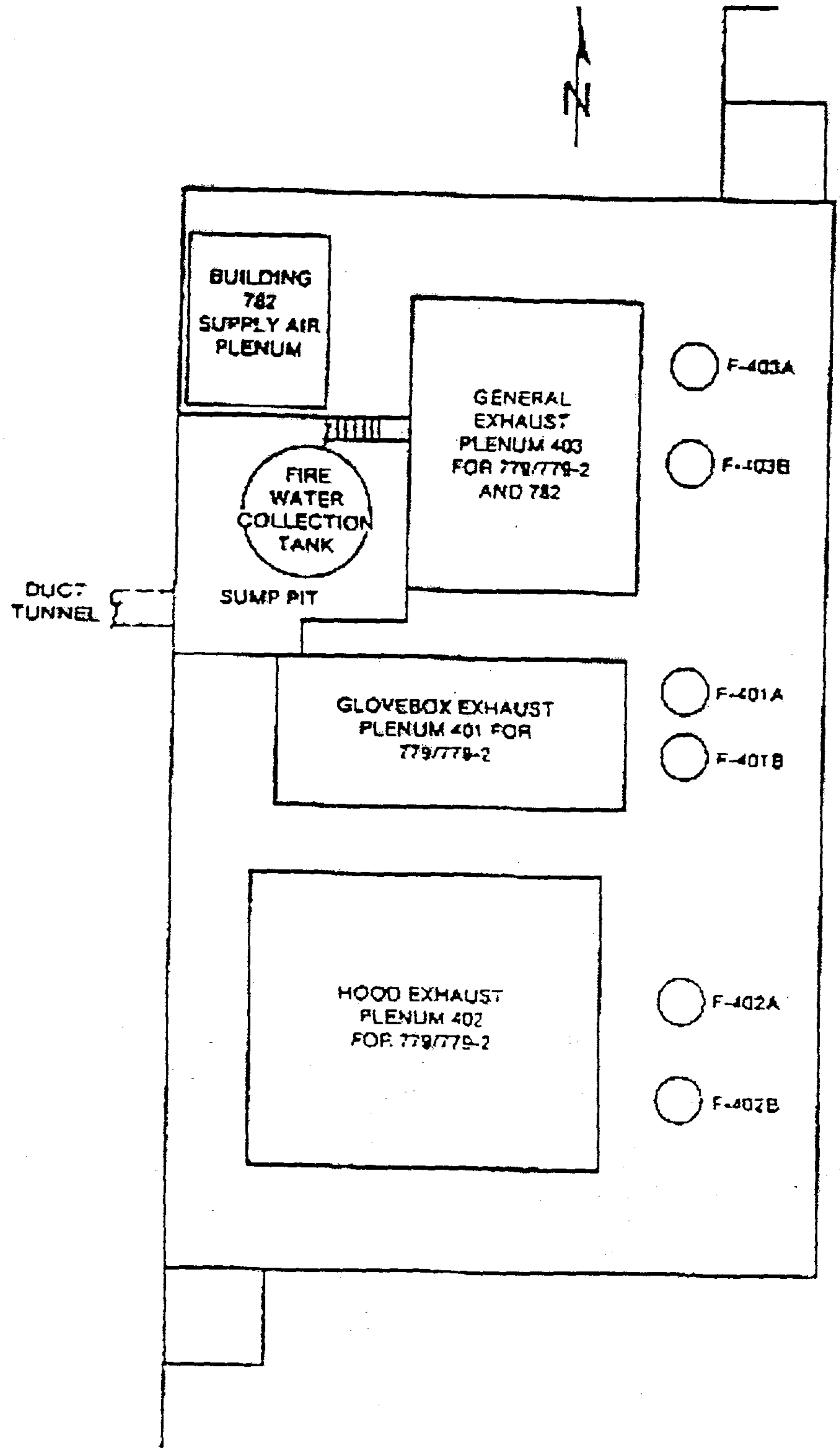


Figure A-6 *Floor Plan, Building 782*

Building 779-2 HVAC

The HVAC system for this part of the building is completely separate from the systems in the original Building 779 and Building 779-3 addition(Figure A-9). Supply fans F-101A and F-101B draw fresh air through a plenum into the laboratory areas for electroplating, joining, and machining. Hoods in the laboratories draw air from the room in which they are situated and the hood air is exhausted through the hood exhaust plenum (FP-402) in Building 782 to the atmosphere.

Room air in Building 779-2 is recirculated through a filter plenum,FP-405, by one of two fans, F-405A or F-405B, to enter the system again through the supply air plenum.

Air supplied to the gloveboxes, excluding inert gloveboxes, in Building 779-2 is drawn by fan F-201A or F-202A and then through a supply air filter plenum. Before the exhaust is released to the atmosphere, it is filtered by four stages of HEPA filters in FP-401 in Building 782. One of two fans, F-401A or F-401B, exhausts the air to the outside (Figure A-7).

Building 779-3 HVAC

Supply air for Building 779-3 is supplied from the south side of Building 779. It is heated, if required, then filtered by a roll or drum filter and a bag filter, after which it passes through a cooling -coil, through a fan (F-1) through zone heaters, and into the building (Figure A-10).

Air required by the gloveboxes in Building 779-3 is drawn from the room air using the flow created by the exhaust fan, F-4 or F-5, in Building 729. Air supply and exhaust for Building 779-3 is a one pass system. Room exhaust is filtered through a two-stage exhaust HEPA filter plenum in Building 729. Glovebox exhaust from Building 779-3 goes through a spray filter and then a four stage HEPA filter in Building 729, after which it joins room exhaust and goes out the stack at the east side of the building. Room exhaust is pulled from Building 779-3 by one of two fans in Building 729, F-2 or F-3. Glovebox exhaust is also removed by one of two fans, F-4 or F-5.

Building 729 HVAC

A small supply-air fan located at the west end of the building draws air into Building 729. Room air is exhausted to the atmosphere through the same plenum that filters room exhaust from Building 779-3.

Building 782 HVAC

This building also has its own supply fan, F-406, to provide air for the building. Air is exhausted through plenum FP-403, in combination with exhaust from the original Building 779.

Piping

Piping located in for Building 779 was designed and fabricated in accordance with current standards at the time. The following pipe lines enter or exit Building 779: steam condensate, domestic cold water, fire protection water, natural gas, hydrogen, nitrogen, argon, compressed air, process waste, sanitary sewer, steam, fuel oil, tower water supply, and tower water return.

Building 779-2 HVAC

The HVAC system for this part of the building is completely separate from the systems in the original Building 779 and Building 779-3 addition(Figure A-9). Supply fans F-101A and F-101B draw fresh air through a plenum into the laboratory areas for electroplating, joining, and machining. Hoods in the laboratories draw air from the room in which they are situated and the hood air is exhausted through the hood exhaust plenum (FP-402) in Building 782 to the atmosphere.

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Air supplied to the gloveboxes, excluding inert gloveboxes, in Building 779-2 is drawn by fan F-201A or F-202A and then through a supply air filter plenum. Before the exhaust is released to the atmosphere, it is filtered by four stages of HEPA filters in FP-401 in Building 782. One of two fans, F-401A or F-401B, exhausts the air to the outside (Figure A-7).

Building 779-3 HVAC

Supply air for Building 779-3 is supplied from the south side of Building 779. It is heated, if required, then filtered by a roll or drum filter and a bag filter, after which it passes through a cooling -coil, through a fan (F-1) through zone heaters, and into the building (Figure A-10).

Air required by the gloveboxes in Building 779-3 is drawn from the room air using the flow created by the exhaust fan, F-4 or F-5, in Building 729. Air supply and exhaust for Building 779-3 is a one pass system. Room exhaust is filtered through a two-stage exhaust HEPA filter plenum in Building 729. Glovebox exhaust from Building 779-3 goes through a spray filter and then a four stage HEPA filter in Building 729, after which it joins room exhaust and goes out the stack at the east side of the building. Room exhaust is pulled from Building 779-3 by one of two fans in Building 729, F-2 or F-3. Glovebox exhaust is also removed by one of two fans, F-4 or F-5.

Building 729 HVAC

A small supply-air fan located at the west end of the building draws air into Building 729. Room air is exhausted to the atmosphere through the same plenum that filters room exhaust from Building 779-3.

Building 782 HVAC

This building also has its own supply fan, F-406, to provide air for the building. Air is exhausted through plenum FP-403, in combination with exhaust from the original Building 779.

Piping

Piping located in for Building 779 was designed and fabricated in accordance with current standards at the time. The following pipe lines enter or exit Building 779: steam condensate, domestic cold water, fire protection water, natural gas, hydrogen, nitrogen, argon, compressed air, process waste, sanitary sewer, steam, fuel oil, tower water supply, and tower water return.

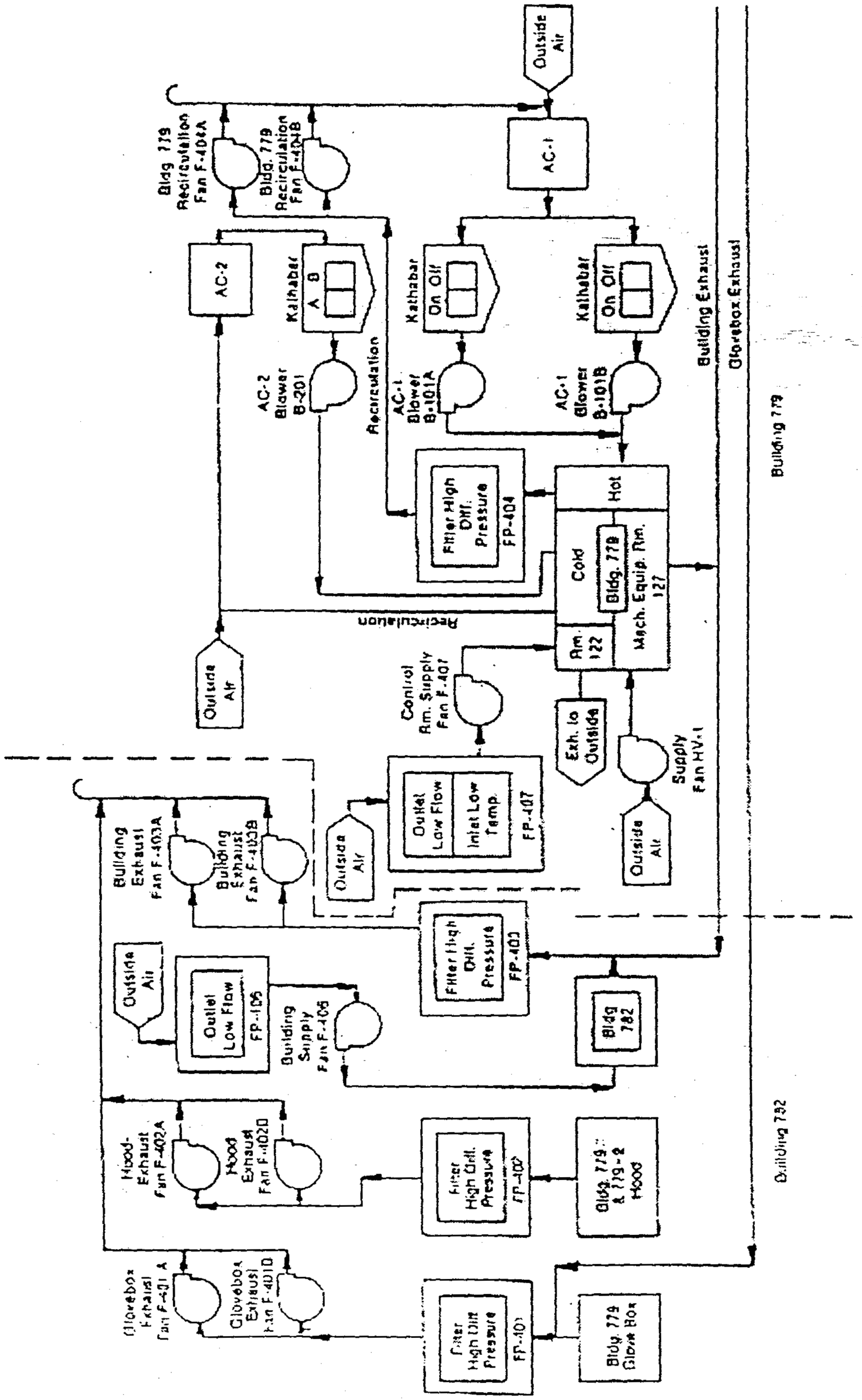

Figure A-7 Building 779 Airflow

Figure A-7

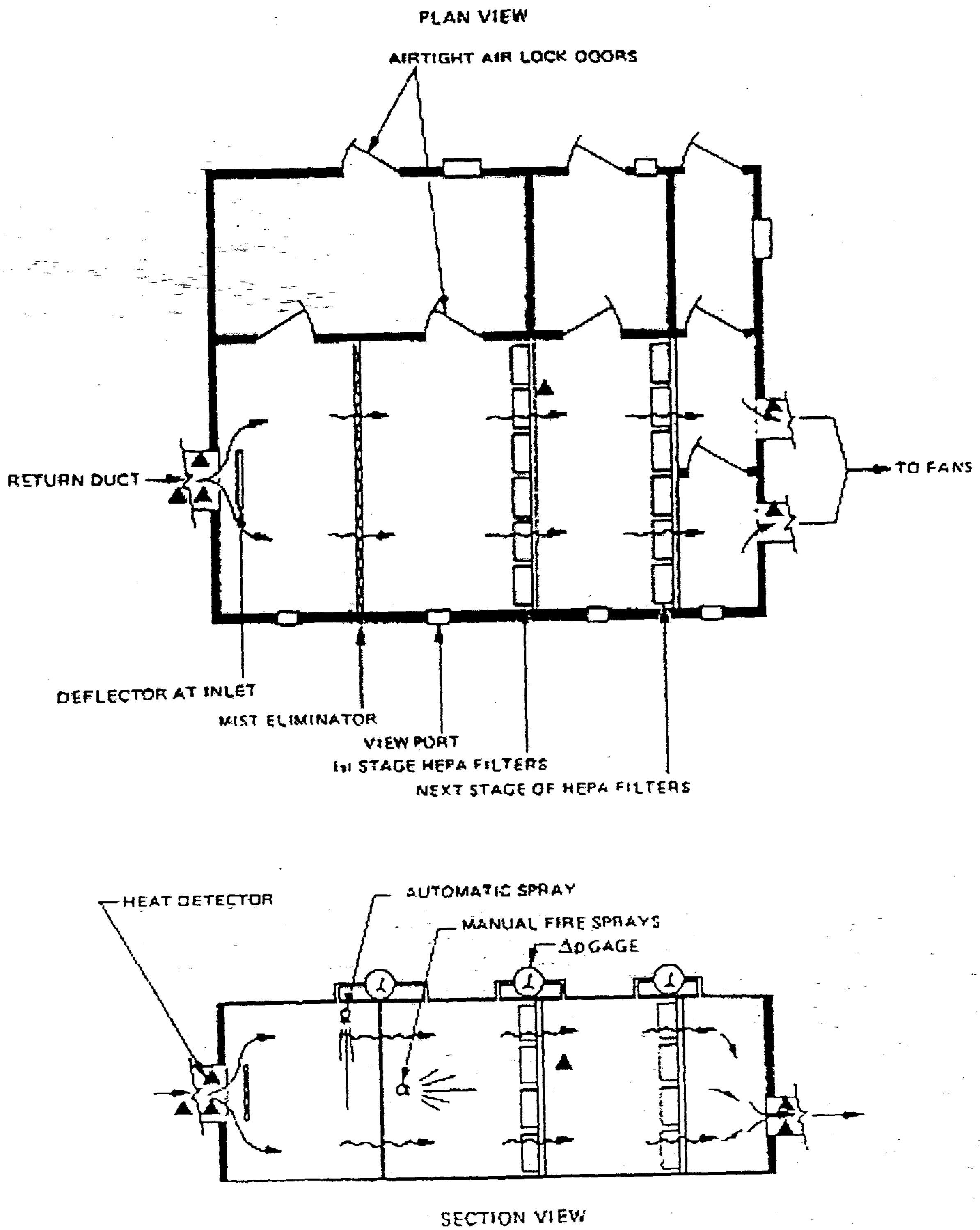

Figure A-8 *Typical Two-Stage Filter Plenum for Exhaust Air*

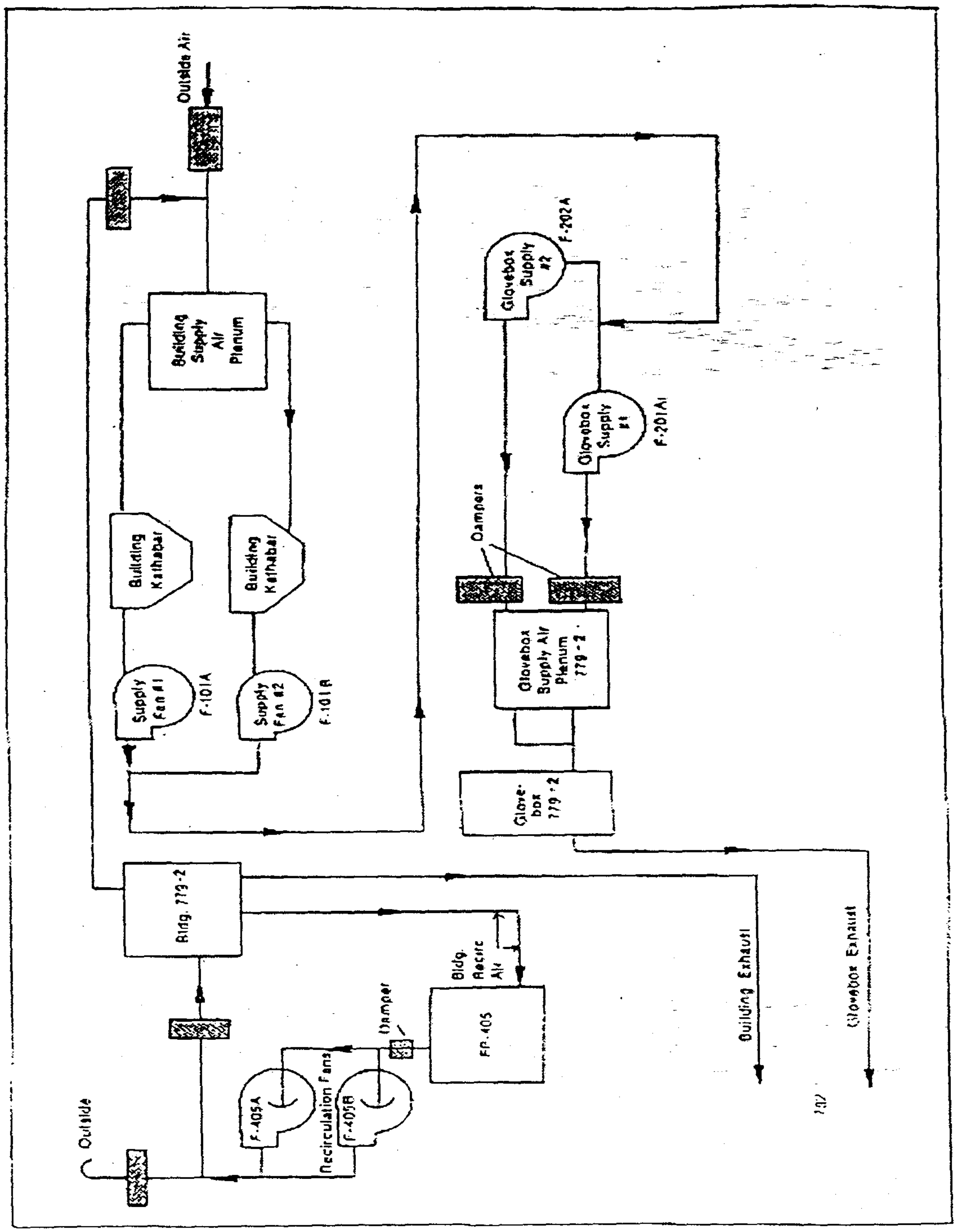

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Figure A-9 *Building 779-2 Airflow*

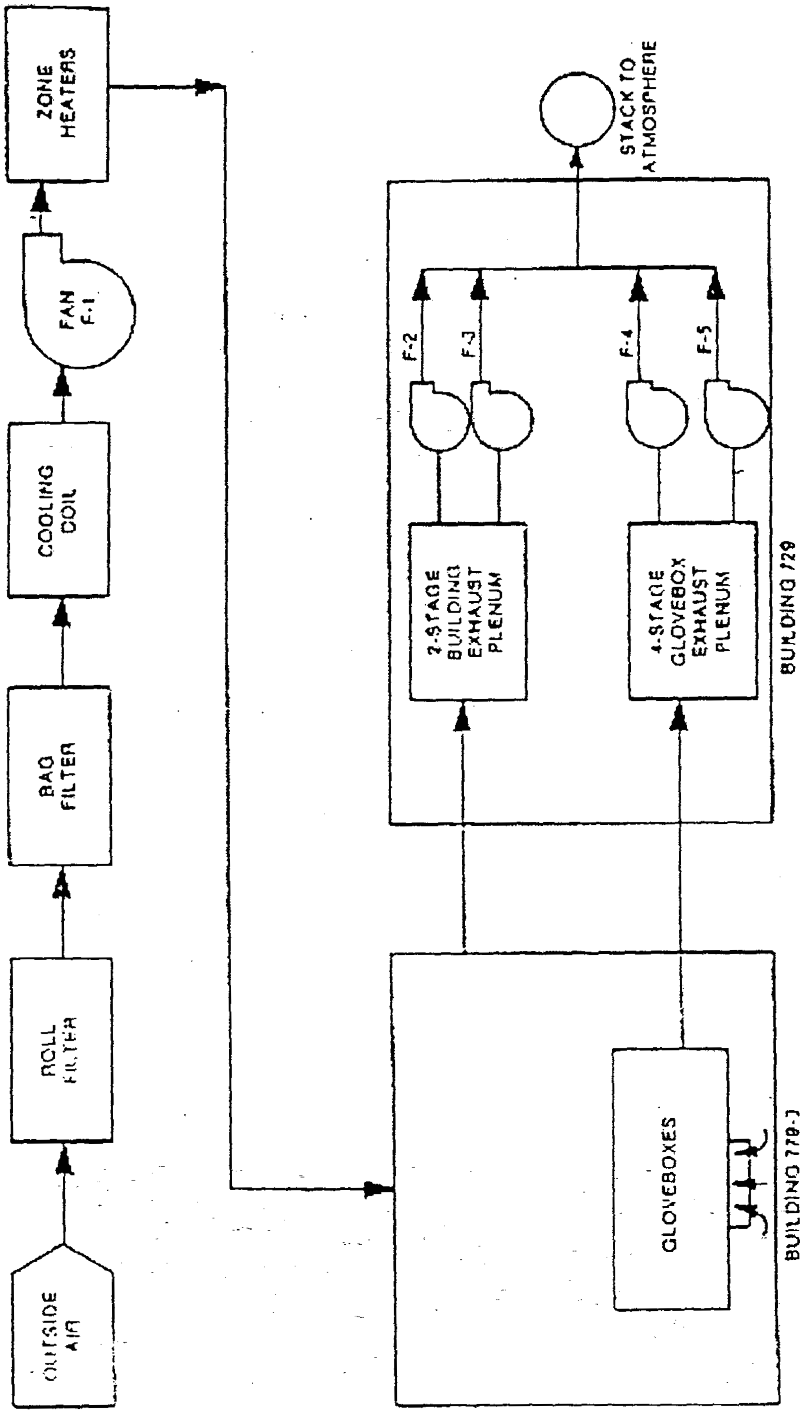

Figure A-10 *Building 779-3 Airflow*

Electrical Systems

RFETS is served by the Public Service Company of Colorado with two 115-kV lines, the Valmont and Boulder lines. Each line is intended to handle loads imposed by plant facilities. Primary power distribution within the plant is at 13.8 kV. Buildings 727, 729, 779, 783, and 782 are served from two 13.8-kV feeders. Each feeder is designed to carry the entire load assigned to both. If power in one feeder is lost, the alternate automatically picks up and continuously carries the entire load. In addition to the backup feature, the dual feeder system provides a means of load balancing and isolation for maintenance purposes. Figure A-11 illustrates the basic electrical distribution system for Buildings 727, 729, 779, and 782.

Substations 515-2 and 516-2 supply normal power to the feeders. Building substations (transformers) 729-1, 779-1, 779-2, 782-1, and 782-2 convert the 13.8 kV from the feeders to 480 V for distribution within the buildings.

There are four basic electrical systems for Buildings 727, 729, 779, 783, and 782:

- Normal Electrical Power
- Emergency Power Systems
- Uninterruptible Power Supply (UPS)
- Grounding and Lightning Protection

Normal Electrical Power

Switch gear, motor control centers (MCCs), and emergency motor control centers (EMCCs) distribute building substation power to power panels, bus ways, and directly to some larger electrical loads. Welding receptacles, lighting panels, and standard receptacles receive power from lighting or power panels, or bus ways.

When normal power is lost from an incoming feeder to an EMCC, MCC, switch gear, or building substation, normal power can be restored via the transfer switches on the dual feeder arrangement. This transfers the source of power from the inoperable feeder to its alternate.

Building 729 has this dual feeder arrangement only at the 13.8-kV level incoming to the 729-1 sub station. If either of the 115-kV power lines lose normal power, the plant power can be obtained from the other line. If both the primary and alternate sources of power to a particular item in service are lost, the power to that item is lost. Exceptions to this are the EMCCs that have their power re-stored via emergency generators. The function and operation of the EMCCs are discussed in the following section.

Emergency Power Systems

Emergency power systems provide alternate sources of 480-volt, 3-phase power to the EMCCs during failure of normal power. EMCCs receive and distribute normal power during normal operation. When normal power is lost, emergency loads are automatically transferred to the emergency power systems. The emergency power is then distributed to critical loads whose operations are necessary at all times for security, safety, or radiation confinement.

Emergency power systems for Buildings 729, 779, and 782 consist of three diesel engines that drive three electric generators. Each generator unit services a separate function, (i. e., three different areas are covered with no redundancy between them). A 150-kW emergency generator is located on the first floor in Building 729, Room 105, and consumes fuel at a rate of 22 gal/hr. There is a 250-kW emergency generator in Room 117 of Building 779 which has a consumption rate of 21 gal/hr. Building 727 houses a 500-kW emergency generator system for Building 782 and this uses fuel at a rate of 55 gal/hr.

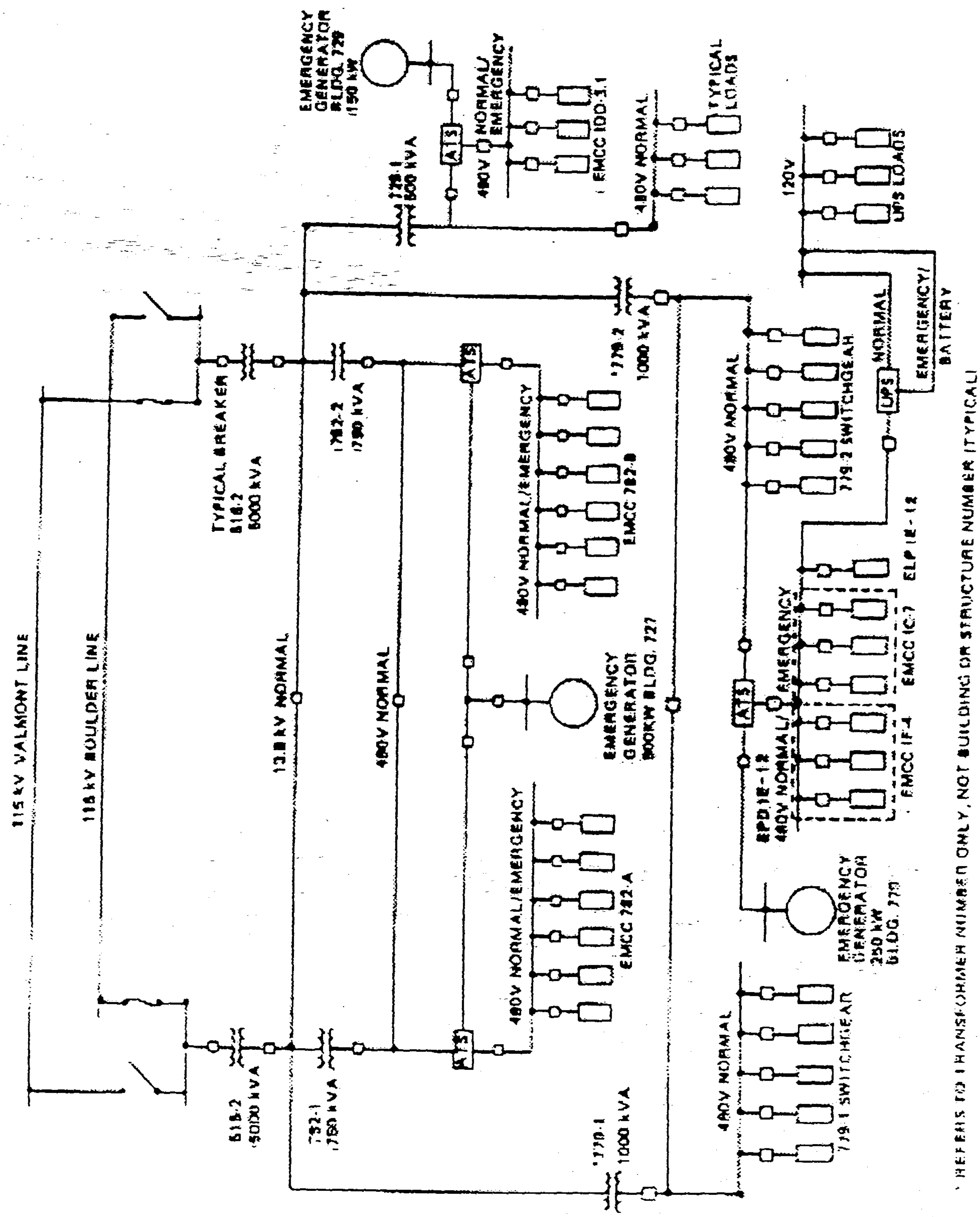

Figure A-11 Basic Electrical Distribution System for Buildings 727, 729, 779, and 782

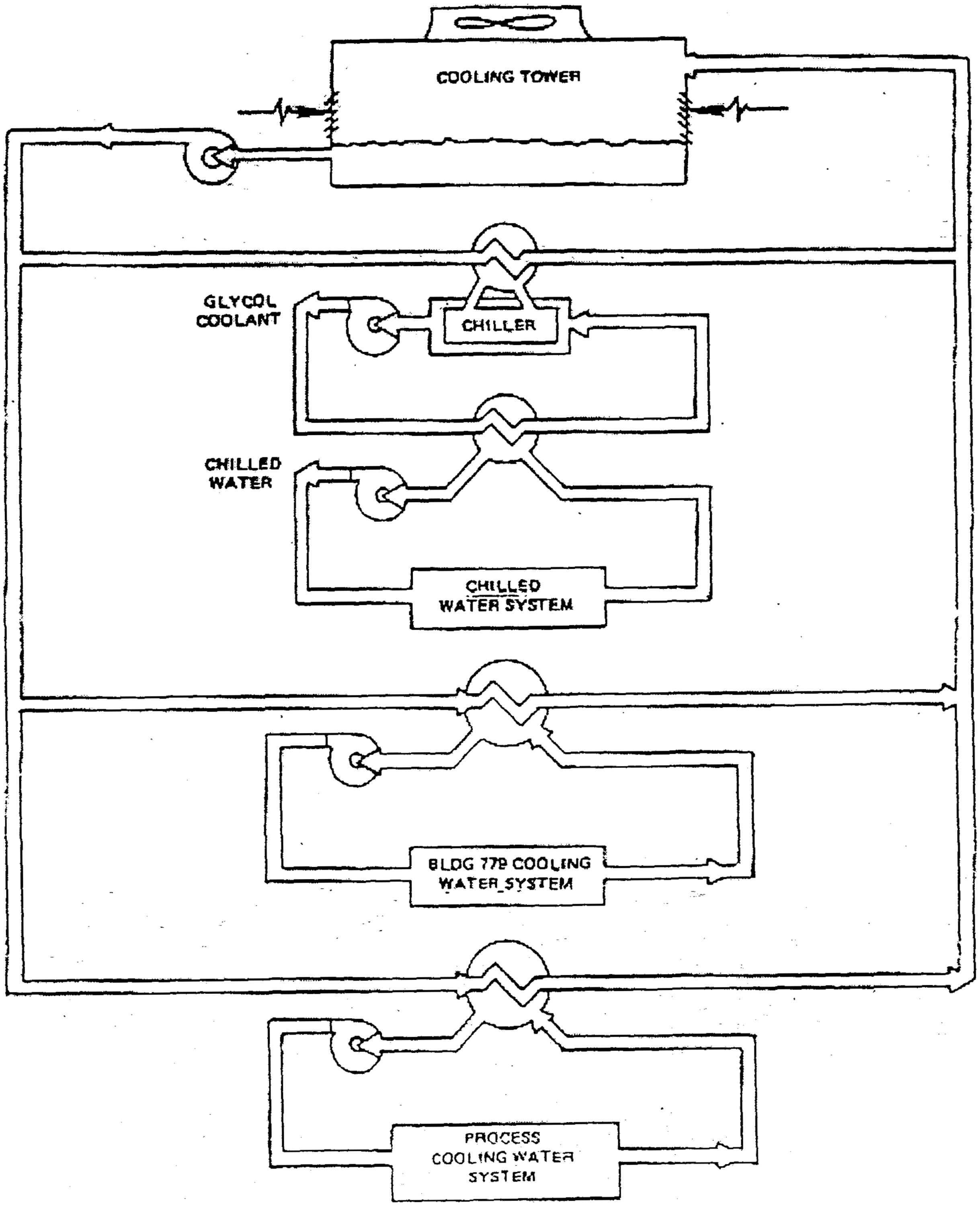

Figure A-12 *Cooling System*

TRANSFER FROM NORMAL TO EMERGENCY POWER

The three electric generators have control circuitry that senses a loss of normal power and will automatically initiate the start of the diesel engine that drives a generator. After the start of an emergency generator, the engine and generator must stabilize at the proper operating speed before the automatic transfer switch (ATS) will connect the emergency power to the EMCC bus.

When the ATS has switched to the emergency position, the emergency generator will remain on line and provide power until the building utilities operator manually transfers the system back to normal operation. Approximately 5 to 15 seconds elapse from the time normal power is lost until the ATS connects the emergency generator to the EMCC bus.

Transfer From Emergency Power to Normal Power

Building 727

Each of the three emergency generators has a different sequence of transfer from emergency power back to normal power. The return of EMCC 782-A and EMCC 782-B to normal power and the shutdown of the 500-kW generator in Building 727 is controlled from the utilities control board in Building 779. A utility operator activates the remote switch that moves the ATS from the emergency to the normal position. The ATS then delays the transfer until the three phases of normal power are synchronized with the three phases of emergency power, which completes the transfer to normal power. The generator will automatically shut down after a 9-minute cool-down time. The shut-down can also be remotely activated by the utilities operator in an emergency.

Building 729

The return of EMCC IDD-3.1 to normal power and the shutdown of the emergency generator in Building 729 is controlled in that building. A utilities operator activates the controls to start the transfer; when the three phases of normal and emergency power are synchronized, the ATS completes the transfer. The operator shuts the emergency generator down at the local generator control panel.

Building 779

Operator controls for returning EMCC IC-7 and EMCC IF-4 to normal power and shutting down the emergency generator in Building 779 are located at the generator. To return the above EMCCs to normal power, the operator resets the breaker between the emergency generator and the ATS, causing the ATS to transfer to its normal position. The generator will continue to run for 9 minutes, then shuts down automatically. Equipment on emergency power is listed by EMCC in Appendix A, Table A-1 for the generators in Buildings 727, 729, and 779.

The emergency unit in Building 727 consists of a diesel engine driving a housing 625-kVA (500-kw), 480-V generator. The engine has electric starters that operate using nearby storage batteries. Batteries are kept fully charged by a permanently connected battery charger. The charger is run from normal power except when the emergency generator is in operation, during which time the charger receives its power from the power panel, PP-I.

Two electric heaters maintain the generator and generator building at temperatures required for rapid starting of the system. Electric heaters also maintain Building 727 at a comfortable level for personnel and for proper operation of instruments and equipment. Electric heaters for water and oil are provided to ensure rapid starting of the diesel engine.

The 150-kW emergency generator in Building 729 is also powered by a diesel engine. It has an electric starting and battery charging system that is identical in operation to the system for the generator in Building 727. The diesel engine has electric heaters for water and oil. Heat for the emergency generator room is provided by plant steam.

Table A-1 Equipment on Emergency Power

EMCC 782-A -- Fed from 500-kW Emergency Generator, Building 727

Pit Sump Pump P-401, 3 hp
Control Transformer and Breaker
Plenum Exhaust Fan F-402A, 200 hp
Plenum Exhaust Fan F-402B, 200 hp

EMCC 782-B -- Fed from 500-kW Emergency Generator, Building 727

Emergency Lighting Transformer, 45 kVA
Power Panel PP-l, Building 727
Welding Receptacle, 60A
Condensate Pumps P-405A and P-405B, 2 hp each
Plenum Exhaust Fan F-403A, 150 hp
Plenum Exhaust Fan F-403B, 150 hp
Control Transformer, 1 kVA
Plenum Exhaust Fan F-401A, 50 hp
Plenum Exhaust Fan F-401B, 50 hp
Transfer Pump P-402, 1-1/2 hp
Manhole Sump Pump P-404, 1/3-hp
Supply Fan F-406, 20 hp

EMCC IDD-3.1 -- Fed from 150-kW Emergency Generator, Building 729

Glovebox Exhaust Fan F-4, 5 hp
Glovebox Exhaust Fan F-5, 5 hp
Building Exhaust Fan F-2, 25 hp
Building Exhaust Fan F-3, Z5 hp
Supply Fan F-l, 15 hp
Instrument Air Dryer, 1 hp
Instrument Air Compressor, 5 hp
Radiator Fan, 3 hp
Vacuum Pump, 3 hp
Condensate Pump Unit CPR-l, 2 each, 1-1/2 hp
Condensate Pump Unit CPR-2, 2 each, 1-1/2 hp
Emergency Lighting Panel, Building 729
Emergency Lighting Panel, Building 779
Condensing Unit AC-l

EPD IE-12

Emergency Lighting Panel ELP-IE-12 (Criticality Alarms, Disaster Warning PA)
EMCC IG-7
EMCC IF-4

EMCC IC-7 -- Fed from 250-kW Emergency Generator, Building 779

Condensate Return Pump CPR-IA, 1-1/2 hp
Condensate Return Pump CPR-IB, 1:1/2 hp
Instrument Air Compressor C-2, 2 hp
Selective Alpha Air Monitor (SAAM) System
Cooling Water Pump-Hot Side P-3A, 10 hp
Cooling Water Pump-Hot Side P-3B, 10 hp
Cooling Water Pump-Cold Side P-4A, 5 hp

Cooling Water Pump-Cold Side P-4B, 5 hp
Three-Pole Receptacle, 30A, and Dri-Train
Invertor Power (UPS)
Dock Roof Fan F-407, 2 hp
Joy Air Compressor C-l, 20 hp
Building Recirculation Fan F-404A, 30 hp
Control Transformer Feeder, •5 kVA
Building Recirculation Fan F-404B, 30 hp
Health Physics Vacuum
Room 160

EMCC IF-4 -- Fed from 250-kW Emergency Generator, Building 779

Hot Water Normal Pump HP-IOIA, 7-1/2 hp
Hot Water Standby Pump HP-102A, 7-1/2 hp
Beryllium Exhaust Fan 06-11, 10 hp
Condensate Pump 1 CPR-LA, 5 hp
Condensate Pump 2 CPR-LA, 5 hp
Building Recirculation Fan F-405A, 30 hp
Emergency Lighting Panel ELP-IF-4, 15 kVA
Emergency Lighting Panel ELP-IJ-4, 10 kVA
Building Recirculation Fan F-405B, 30 hp
Recirculation Fan and Pump, Room 160
Health Physics Vacuum
Fire Water Pump - FP-405

The 250-kW diesel-driven emergency generator in Building 779 has an electric starting system identical to the system for the emergency generator in Building 727. Electric heaters for water and oil keep the generator warm for rapid and dependable starting. Heat to the generator room is provided from the Building 779 heating system.

A safety system for Building 779 is the Process Air Programmer (PAP). PAP is used to start (in sequence) the ventilation fans on emergency power and to ensure proper differential- pressures for radioactivity confinement. On normal power, the PAP monitors the ventilation fans. During startup, the PAP takes corrective action if a fan fails to start. On emergency power, the PAP ensures that the ventilation fans start in the proper sequence. This prevents all fan motors and other emergency equipment from starting simultaneously. Fan-starting current, or "inrush" current, is about six times fan-operating current. To start these motors simultaneously would require an excessive current demand from the emergency generator, whose speed would then be reduced, resulting in unacceptable power frequency and a severe drop in voltage. The PAP starts only one fan motor at a time, and waits at least 4 seconds before starting each succeeding motor.

Uninterruptible Power Supply System (non-functional)

A 10-kVA Static Products™ UPS system, located in Building 779, provides power to certain loads that cannot withstand even a momentary interruption transfer from normal to emergency power. These loads include critical equipment such as ventilation controls and the process air programmer.

The UPS system consists of an invertor, storage batteries, and a battery charger. It is basically an array of storage batteries that is connected to the normal and emergency power systems. The array of storage batteries are kept charged at all times. Direct current from the batteries is converted to alternating current by an invertor to provide compatible power for distribution to the loads. When normal power is lost and before the emergency generator can provide power, the loads draw the required power from the invertor which can remain connected and operational for up to 8 hours. Since the invertor and batteries are always connected to the UPS loads, the UPS loads draw power without interruption. When the emergency generator starts, it charges the batteries as required.

Grounding and Lightning Protection

The grounding system for Building 779 functions as both lightning protection grounding and building electrical grounding. As a lightning protection grounding system, it offers a path to ground high currents that may occur during a storm, thus protecting the building structure and electrical equipment within the building. As a building electrical grounding system, it offers a path to ground for electrical fault currents (short circuits), and supplements the protection offered by fuses and circuit breakers to the electrical equipment in the building. The grounding system also dissipates (from equipment) static electrical charges that could cause shock or fire. Metal electrical equipment enclosures are grounded to prevent possible shock to personnel if a short circuit should occur in the equipment enclosure.

The grounding and lightning protection system for Building 779 was installed in accordance with applicable codes of the National Fire Protection Association (NFPA) and Underwriters' Laboratories (UL) lists in effect at the time of construction.

Grounding System

Grounding consists of a series of 45 ground wells spaced around the outside of the building. Each ground well has a 3/4-in. by 10-ft. ground rod driven into the ground so that the top of the rod is below grade. These ground wells are interconnected by a grid of bare copper wire forming a square array below the first floor of the building. All conductors outside the building are buried below grade. Buried conductors along the outside walls of the building connect the lightning protection system to the grid. Down conductors within the building connect electrical equipment on the first and second floors to the grid. A similar grounding system has been installed for each of the support buildings for Building 779 (Buildings 727, 729, 783, and 782).

Lightning Protection System

The 779 Cluster is equipped with a lightning protection system that will carry lightning discharges safely to the ground without injury to personnel or damage to structures or equipment. The system consists of air terminals (lightning rods) uniformly spaced around the roof periphery and across open roof areas. Air terminals are also placed on exhaust stacks, ventilators, and any other structure or item of equipment that is especially susceptible to receiving a lightning strike. Air terminals are interconnected by cables to the grounding system described above. The lightning protection system was designed in accordance with the applicable building codes at the time of construction.

Electrical Safety Evaluation

Effects of Normal Power Failure

Normal electrical power for Building 779 comes from main substations 515/516 and has a double feeder configuration. Any load may receive power from either of two feeders by automatic or manual switching. (The main substation has disconnects and tie breakers to tasks may switch automatically when one power source is lost). Protective relays monitor the normal power and actuate breakers in the 13.8-kV substations to resolve problems such as excessive current, low voltage, and frequency deviations.

Personnel monitor the major substations 24 hours a day. Operation of a circuit breaker or tie breaker activates an audible alarm and indicator light on the plant power system board. This alerts personnel to problems in the system so that immediate corrective action may be taken. The power system board indicates the status of breakers and feeders in the system.

As alarms are activated at the plant power office due to a breaker malfunction, an alarm activates at the Central Alarm Station. This alarm indicates which substation has a problem, but does not identify the status of the breakers.

Upon loss of normal power from the 515 or 516 substation, the tie breaker between the 13.8-kV feeders closes in approximately 3.7 second, restoring normal power (through the tie breaker) from the operational substation to the inoperative side of the system. (Interlocking circuitry associated with the tie breaker prevents the latter from closing when an electrical fault exists, if the closing would add to the fault current).

The building switch gear (779-1/2) also has disconnects and tie breakers to switch automatically in the event one power source is lost. If the automatic tie breaker fails to close at the 515/516 substation, or if switching rearrangement is required to restore power, plant power personnel perform the required tasks manually. These take approximately 30 to 60 min.

If the automatic tie breakers at 779-1/2 or 782-1/2 fail to close, Utilities personnel restore power manually in about 10 min. If there is a loss of both power sources to the building, the emergency generators start automatically, after a 5-sec delay. Emergency generators reach full speed on approximately 5 to 15 seconds and connect with the emergency switch gear (480-V normal/emergency). UPS loads are unaffected by any outages.

Effects of Emergency Power Failure

The emergency generator in Building 727 has a diesel fuel tank which contains approximately a 2-hr supply of fuel. The other emergency generators have diesel fuel tanks with approximate 1-hr fuel supplies. Chapter 7 of the Operational Safety Requirements (OSR), defines the minimum duration that the emergency generator main fuel oil supply shall provide.

If an emergency generator fails to start, utility operators must take action to start it manually. If a major failure of the emergency generators and both sides of the normal power supply occur simultaneously, the UPS system can remain in operation for the loads (i.e., HVAC instrumentation) connected to it to effect a safe shutdown of critical systems. All loads on emergency power, (i.e., HVAC fans and normal power loads) will not operate.

Effects of a UPS Failure

There are two modes in which a UPS could fail: (1) an electrical or electronic failure within the UPS, and (2) exhaustion of UPS batteries when no other power source is available. If normal or emergency AC power is available during an electrical or electronic failure of a UPS, the ATS actuates to supply UPS power through the alternate feed. In the second mode of UPS failure, if normal or emergency AC power is not available, a loss of power to UPS loads will occur. In that case, it is not possible to monitor building conditions or operate any HVAC controls until AC power is restored.

Worst-Case Failure

The worst-case failure of the electrical systems could occur if both normal power sources were lost, the emergency generator would not start, and the UPS systems failed. If all sources of power are lost, including the UPS system, the building supply air dampers will be closed manually and the building exhaust air dampers will fail closed. This failure mode allows the building to go to a static air condition.

Under static air conditions, some release of radioactivity within the building may be possible, since internal confinement barriers depend on negative air pressures within the gloveboxes. The amount of airborne radioactivity is not expected to cause any serious problems in restarting decommissioning operations once power is restored. If the exhaust dampers fail closed, minor releases to the environment may be possible due to evacuation of the building.

Upon loss of power, all operations are suspended until power is restored. Operating personnel are evacuated from the building, if the building superintendent or radiation monitoring personnel determine it is necessary.

Gas and Compressed Air

Inert gas for the 779 Cluster is supplied from various sources outside the Cluster. Com-pressed air is piped to the Cluster for use in pneumatic equipment. Inert gas will not be used during decommissioning.

Inert Gas Systems

Nitrogen is used for inverting certain gloveboxes and for supplanting compressed air within the glovebox system. Nitrogen is supplied from an outside supply tank located on the east side of the building. These gloveboxes are flooded with dry nitrogen during operations and the glovebox ventilation system exhausts the gas. Argon was also used in Building 779 to inert certain operations. It is stored in an outside supply tank located on the east side of the building.

Natural Gas System

Natural gas enters Building 779 on the west side of the building at the top of the first floor. The natural gas system will not be used during decommissioning.

Compressed Air System

Compressed air equipment located in the Building 776 area supplies air to Buildings 779 and 782. Building 779 has two compressors that can service the building in an emergency. Building 729 maintains its own compressor. Compressors are on the emergency power grid and can supply pressure up to 90 pounds per square inch (psi).

Breathing Air System

The breathing air system provides quality air for supplied air work in the building. Breathing air is used by workers in areas with high airborne radioactivity. It is supplied to suits that isolate workers from this environment.

The compressor station and air quality control equipment associated with the breathing air system are located in Buildings 707 and 708. Distribution piping brings the air into Building 779 at 90 psi., already filtered, dried, and monitored. The monitoring system in Building 707 checks moisture content, excess flow, pressure, temperature and carbon monoxide and condensate oxygen levels. This station continuously monitors the quality of the breathing air. Should the air become unacceptable, the supply automatically stops and an alarm sounds in the utility control room.

Steam Supply and System

Steam for the 779 Cluster is supplied by the main heating plant in Building 443 via valve station C which is located north of the Building 776 maintenance shop. In valve station C, the steam is reduced to 125 psi before continuing on to Building 779. Condensate is piped from Building 779 to Building 771 then to a large holding tank near Building 443.

Water Systems

Treated water is supplied by gravity pressure (from an elevated storage tank) from Building 124 through a 10-in. loop on the plant Site. The loop system allows water supply to flow from the area of least resistance, and permits isolation of piping sections for maintenance purposes. The water is used in the fire suppression system, as makeup for the domestic process and cooling tower water systems. Domestic water is provided by a 4 in. line from the 10-in. plant loop and is used for the lavatories and as supply to the process water systems. Domestic and process systems have backflow preventers to keep process water that could be contaminated, from contaminating treated water. Fire protection water is discussed in Appendix A, Fire Protection. Nine cooling towers are open cooling water systems using untreated water as the primary make-up source and -domestic water is used as an alternate source. Cooling towers are the final heat sink of the cooling system. Cooling water is circulated by electric pumps.

The process cooling water system is a closed-loop system. Pumps circulate water through shell and tube heat exchangers. Rejected heat is absorbed by tower cooling water passed through the exchanger tubes.

Process Waste System

The areas in which radioactive operations are performed drain into one holding tank in the basement (Room 001) of Building 779.

Sanitary Sewer System

The sanitary sewer system services showers, restrooms, and janitors' closets outside the airlock system. Some sanitary sewer inlets are located in controlled areas. The system handles blown down from the cooling towers, as well as overflow and relief valve effluent. Waste water is delivered to the waste treatment plant (Building 995) through a vitrified clay sewer main.

Fuel Oil System

Fuel oil for the emergency generators is stored in separate, underground and above ground tanks. There is one tank for each generator. Pumps bring the oil from the storage tanks to the diesel fuel tanks that supply the generators. The Cluster has a 3,000-gal underground storage tank west of the building feeding a 90-gal diesel fuel tank at the 500-kW generator inside the building.

Off the southeast corner of Building 729, there is a 630-gal underground oil storage tank to supply the 15-gal diesel fuel tank at the 150-kW generator. The Building 779 250-kW generator in Room 117 has a 20-gal diesel fuel tank plus an underground 500-gal storage tank, the latter is located near the truck ramp on the east side of the building. A project to replace the underground fuel oil storage tanks with above ground tanks is currently being completed. The above ground tanks are expected to be in place before the start of the decommissioning effort. Final disposition of the underground tanks is part of the tank replacement project.

Fire Protection

The exterior walls and roof of Buildings 779 have a 2-hour fire rating. Within the building, laboratory areas are separated from office and service areas by 2-hr rated walls. Wall interior are finished throughout with fire resistant and noncombustible materials. Major structural components of gloveboxes and process equipment consist of noncombustible materials.

Door openings in fire-resistant walls are equipped with automatic fire doors of a comparable rating. Ducts that penetrate fire-resistant walls have fire dampers to prevent the spread of fire.

Windows located on the top of gloveboxes are made of fire-resistant, wire-reinforced glass, while most others are constructed of safety plate. When required, fire resistant doors separate connected gloveboxes. Fire-resistant doors that must remain open have fusible links for automatic closure in the event of fire.

All areas in Buildings 779, 782, and 729 are equipped with overhead sprinklers. These are installed according to code, with alarms reporting to the Central Alarms Station and the Fire Department. Each riser is equipped with an external flow alarm which sounds an audible alarm when a sprinkler system is being discharged. Wet standpipe hose reels and portable fire extinguishers throughout the facility supplement the automatic sprinkler system.

The water-supply system is connected through the plant with at least two independent paths such that water can feed two separate fire water mains. There is a single riser for the sprinklers in Building 779. This water supply system can also feed one riser in Buildings 729 and 782. Fire protection water is drawn from the connection by two 6-in. lines outside Building 779, one from the east and one from the west. The two 6-in. lines are joined together at a tee connection inside the building, at which point a single 4-in. line is used to supply water to Building 779 sprinkler system. The site water supply system and redundant building supply allow water to come from the area of least resistance, and permit isolation of the piping sections for maintenance.

Fire protection water for Building 782 comes from the 10-in. domestic-water supply. It enters the building through a 6-in. pipe and after being drawn from this main supply, provides water to the building sprinklers, deluge systems, and inside hose reels. Domestic water for this building comes from a separate 6-in. line -off the 10-in. supply. Building 729 has one 6-in. line off the 10-in. supply for both fire protection and domestic water use. The recirculating filter plenum in Building 779 has redundant feeds from the two 6-in. lines, but exhaust filter plenums in Buildings 729 and 782 do not have redundant feeds. However, the Building 782 plenums can be manually connected to the 6-in. domestic water line. The building sprinkler systems are not cross-connected to other risers. Building 727 has an automatic sprinkler system with an antifreeze solution.

For each major laboratory and equipment area, manual fire-phone alarm stations for each major laboratory and equipment area are installed in corridors and along exit routes. These activate local and plant wide alarm systems. Emergency telephone lines permit instant communication with the Site Fire Department. Incoming air temperatures to all exhaust plenums are monitored by a Temperature Indicating, Recording and Enunciating (TIRA) system. If the temperature of air to a plenum goes above 120-F, the TIRA activates audible and visual alarms and a strip chart recorder in the utilities control room in 779, and a local alarm at the affected plenum.

In addition to the TIRA system, an automatic fire alarm system activates if air coming to the plenums reaches 190°F. This system sends alarms to the fire department, the utilities control room main panel, and the plant protection dispatch center. The heat detector will also start water spray upstream of the mist eliminator section of the affected plenum. These plenums have an automatic water spray prior to the mist eliminators, and a manual water deluge system prior the first stage of HEPA filters, as shown in Figure A-8.

Radiation, Contamination, and Criticality Safeguards

Radiation Control

Gamma and neutron radiation surveys are performed as required to support decommissioning activities. All employees working in a radiation control area wear dosimetry badges containing thermoluminescent elements to measure exposure to these radiations. Badges are interpreted according to job and potential for exposure.

Physical radiation protection in the form of plexiglas, Benelex®, water walls for neutron shielding, and lead for gamma shielding, has been successful in keeping radiation exposure to employees at ALARA.

As required, the metal sides of the standard gloveboxes are covered with a l/8-in. layer of lead. Glovebox windows typically have a 1/4-in. thickness of leaded glass outside a layer of safety glass. Removable or hinged lead covers at all glove ports provide shielding when the gloves are not in use. In areas where radiation calculations indicate, additional internal or external shielding is provided for gloveboxes.

Contamination Control

Personnel safety is enhanced through administrative and engineering contamination controls. Selective Alpha Air Monitors (SAAMs) are located in work areas to detect any airborne contamination. Hand monitors (alpha mets) for the detection of alpha particulate contamination are positioned at gloveboxes and conveyor lines near glove ports. Hand and foot monitors (alpha combos) are placed at work areas and corridor exits. For work with greater exposure potential, additional respiratory equipment, such as full-face masks or supplied air suits may be required. Additional shielding (lead aprons) may also be required.

The level of airborne contamination is continuously sampled by fixed air sampling heads. These heads are located at each room exhaust port, on the outside of gloveboxes near the glove ports and bagout stations, and near down draft tables throughout the work areas. Collection media are counted daily to determine average alpha contamination levels.

Self-monitoring for the presence of radioactive material on the body or clothing is required of process workers and visitors. Complete monitoring is required before leaving the building's controlled area.

Any potential Contamination releases are contained within controlled areas through good housekeeping practices and engineering controls. Equipment or materials are not permitted to leave the process areas without a complete survey for radioactive material contamination.

Penetrations through the walls and the ceiling in Building 779 are sealed to prevent the spread of contamination. Contaminated fire water is controlled by critically safe low weirs at exits and at corridor exits to the outside.

In the event of a radioactive material release within the building, the HVAC systems contain airborne radioactive contamination, permitting no harmful release of particulate radioactive pollutants to the surrounding environs. Before being exhausted to the atmosphere outside the building, gases from the process gloveboxes pass through four stages of HEPA filters in the final exhaust plenum. Room air from the laboratories is filtered through two stages of HEPA filters.

Air emissions discharged through stacks are monitored and samples are measured for long-lived alpha activity. SAAMs constantly monitor the exhaust from each stack for plutonium. An alarm system exists and is activated if out of balance limits are exceeded which results in cessation of discharge activities.

Criticality Control

Nuclear criticality safety is achieved by both administrative and physical controls. Nuclear material safety limits, double-contingency criteria (where at least two independent conditions must exist simultaneously before a criticality accident is possible), and strict handling and storage procedures for fissile materials are examples of administrative controls that are enforced to prevent a criticality accident. Physical safeguards are designed to control parameters that influence criticality such as: geometry, reflection, and interaction. Examples of these physical safeguards are fixed spacing, safe geometry tanks, and neutron absorbers (neutron poisons). The following conditions apply in the operation of Building 779:

- The equipment is made dimensionally safe or contains nuclear poisons to eliminate the potential for nuclear criticality.
- Most glovebox floors are level to prevent accumulation of liquids and materials in low areas. Where this is not practical, dams and criticality drains are installed as a precaution.
- Dams are installed at stair-wells, elevator shafts, corridor entrances, and doorways to modules to safely control the spread and depth of liquid.
- Interaction in storage arrays is controlled by permanently positioned racks; interaction during transfer of material is controlled by carrier and cart design.
- Safeguards such as carrier design, criticality drains, and dams provide criticality protection from water used to extinguish a fire; filter plenums have a drainage system to handle the spray water.

Alarm and Communications Systems

A comprehensive system of both audible and visual alarms warns personnel of malfunctions and hazards. Among these systems are fire, radiation, security, oxygen level, overflow, criticality and pressure alarms. These alarm systems are connected to the utilities control room and as alarms are received corrective actions can be implemented.

Fire Alarms

The fire alarm system in Building 779 consists of 20 manually operated telephone stations and 9 automatic stations. Manual stations are activated by lifting the- telephone (inside the alarm box) to send a signal directly to the Plant- Protection Dispatch Center (Building 121) and the Fire Department (Building 331). The system in turn identifies the location and type of transmitting station. The alarm also sounds the building fire bells.

Automatic fire alarm stations are activated through storage area contact heat detectors, filter plenum heat detectors, and sprinkler water flow. When the automatic fire alarm stations are activated, signals are sent to the Central Alarms Station and Fire Department. In some instances, alarms also sound locally.

Selective Alpha Air Monitors

SAAMs (37 units) are located throughout the facility, supplying continuous monitoring. When airborne radiation counts reach a predetermined level, these monitors activate audible alarms and warning lights in the affected area and in the radiation monitoring office. Alarms can also be manually activated.

Security Alarms

Security alarms in Buildings 779 include door alarms on all outside entrances. These alarms are also transmitted to the Central Alarms Station.

Communications

Various methods of communications are used internal and external to Building 779. The primary method is the telephone. A public address system, connected to the Central Alarms Station, provides both internal and external communications to building personnel. Two-way radios provide communications between the guard posts at the Building 700 Complex, the dispatch center, and the Fire Department. Walkie-talkie radios permit additional communications between personnel and the dispatch center. Emergency fire telephones permit communications directly with the plant Fire Department. In addition, radiation, criticality, security, and fire alarms offer a passive form of internal and external communications.

Appendix B

Decontamination Options

1.0 DECONTAMINATION OPTIONS

The following sections have been extracted from DOE Decommissioning Handbook, (DOE/EM - 0142P). These sections provide descriptions of the most probable methods to be used in this project. The decontamination sections were written to provide guidance on technology which could be used in different situations. The implementation of a specific technology will be through the use of an IWCP. Cautionary statements in this appendix are provided to aid in development of the implementing procedure or work package. The Building 779 Decommissioning Project may use new technologies. Some of the sections which are included discuss new decontamination technologies. Although certain decontamination methods which may be used are described below, additional methods may be required/used.

Decontamination is a predominant decommissioning activity that may be used to accomplish several goals, such as reducing radiological occupational exposure, reducing the potential for the release and uptake of radioactive material, permitting the reuse of a component, and facilitating waste management. The decision to decontaminate will be weighed against the total dose and cost. This section presents both proven and emerging techniques which can be used to accomplish the goals stated above.

1.1 INTRODUCTION

Decontamination is defined as the removal of contamination from surfaces of facilities or equipment by washing, heating, chemical or electrochemical action, mechanical cleaning, or other techniques. In decommissioning programs, the objectives of decontamination are to:

- Reduce radiation exposure;
- Salvage equipment and materials;
- Reduce the volume of equipment and materials requiring disposal in licensed burial facilities;
- Restore the Site and facility, or parts thereof, to an unrestricted-use condition;
- Remove loose radioactive contaminants and fix the remaining contamination in place in preparation for protective storage or permanent disposal work activities; and
- Reduce the magnitude of the residual radioactive source in a protective storage mode for public health and safety reasons or reduce the protective storage period.

Some form of decontamination is required in any decommissioning program, regardless of the form of the end product. At a minimum, the floor, walls, and external structural surfaces within work areas should be cleaned of loose contamination.

It is not envisioned at this point that chemical decontamination methods that concentrate the contaminant in a fluid medium will be used in this project, however, this may become an option. Presently, the additional cost for the disposal of materials is expected to outweigh the potential for a decrease in:

- Occupational exposure rates,
- The potential for a release, and

- The uptake of radioactive material and could result in even higher doses than those received from removing, packaging, and shipping the contaminated system without extensive decontamination. There are two primary categories for decontamination equipment or techniques: mechanical and chemical.

Primary Choice:

Mechanical and manual decontamination are physical techniques. Most recently, mechanical decontamination has included washing, swabbing, foaming agents, and latex-peelable coatings. Mechanical techniques may also include wet or dry abrasive blasting, grinding of surfaces, and removal of concrete by scabbling. These techniques are most applicable for the decontamination of structural surfaces.

Secondary Choice:

Chemical decontamination uses concentrated or dilute solvents in contact with the contaminated item to dissolve either the base metal or the contamination film covering the base metal. Dissolution of the film is intended to be nondestructive to the base metal and is generally used for operating facilities. Dissolution of the base metal should only be considered in a decommissioning program where reuse of the item will never occur. Chemical flushing is recommended for remote decontamination of intact piping systems. Chemical decontamination has also proven to be effective in reducing the radioactivity of large surface areas such as floors and walls as an alternative to removal.

In recent years, many innovative decontamination techniques have been proposed. For the most part, these emerging technologies are hybrid technologies comprised of one or more of the following methods: chemical, electrochemical, biological, mechanical, or sonic methodology. These innovative techniques are described in a separate section (Section 1.4) and are subdivided into categories based on similar characteristics.

1.2 CHEMICAL DECONTAMINATION

1.2.1 Introduction

Only an overview of chemical decontamination methods is provided for reference as no chemical methods are expected to be used in this project due to the large amount of secondary waste which would be produced. Chemical reagents are very widely used in the commercial nuclear power industry as decontaminates. The objective of chemical decontamination in the commercial nuclear power industry is to remove fixed contamination on surfaces of piping, components, equipment, and facilities.

The advantages of chemical decontamination are that it can be used for inaccessible surfaces, it requires fewer work hours, it can decontaminate process equipment and piping in place, and it can usually be performed remotely. Chemical decontamination also produces few airborne hazards, uses chemical agents that are readily available, produces wastes that can be handled remotely, and generally allows the recycling of the wash liquors after further processing. The disadvantages of chemical decontamination are that it is not usually effective on porous surfaces, it can produce large volumes of waste (although volume may be reduced by a radioactive waste treatment system), it may generate mixed wastes, and it can result in corrosion and safety problems when misapplied. In addition, it requires different reagents for different surfaces; it requires drainage control; for large jobs, it generally requires the construction of chemical storage and collecting equipment; and it requires addressing criticality concerns, where applicable.

Chemical decontamination involves the use of either concentrated or dilute reagents. In general, both the concentrate and dilute processes fall into one of six chemical classifications:

- high - pH oxidation and dissolution,
- high - pH oxidation followed by low-pH dissolution,
- low - pH oxidation and dissolution,
- low - pH oxidation followed by low-pH dissolution;
- low - pH dissolution, and
- low - pH reduction and dissolution (Munson, Divine and Martin 1983).

An example of the high-pH oxidation and dissolution chemistry is the use of alkaline permanganate (AP), which dissolves chromium oxide and attacks various hard-surface alloys, organics, and copper. The use of AP followed by citric acid or any other acid is an example of high-pH oxidation followed by a low - pH dissolution. In this case, there is some dissolution in the first step, but the major purpose of the AP is to condition the corrosion product film; most of the decontamination occurs with the dilute acid step. These techniques are generally applied to nuclear reactor systems, which operate under reducing conditions. It should be noted that a strong acid can be substituted for a weak acid, if necessary in a decommissioning program where the equipment will not be reused.

A similar use is made of low - pH oxidation and dissolution. For example, nitric acid can be used as both oxidant and acid, particularly in the removal of uranium oxide fuel debris. A procedure that is similar to the high - pH oxidant followed by Citrox or another acid for a low - pH dissolution step. this process is suitable for the removal of fuel and fission product debris and can be used for corrosion product removal if little or no chromium is present.

Several solutions are available for low - pH dissolution. The best known of these are phosphoric acid and CAN-Decontamination. Inhibited phosphoric acid was used successfully for many years in the Hanford N-reactor, a primarily carbon steel system. CAN-Decontamination, a dilute solution used on reactor-scale operations in Canada, has also been successful on nuclear reactor components and with an oxidizing pretreatment. Phosphoric acid vaporized with steam has been used for vapor-phase cleaning of isolated components.

Low - pH solutions that are strongly reducing are not common because reactions with water tend to make them unstable. One process developed for high-temperature stainless steel is a reducing decontamination solution that uses hydrazine (Peach and Skeleton 1988).

1.2.2 Decontamination Chemistry

Chemical solutions are generally most effective on nonporous surfaces. Possible decontamination agents are chosen based upon the chemistry of the contaminant, the chemistry of the substrate, and disposal of the waste that will be generated by its use. Because a wide variety of possible decontaminating agents is usually available for each case, other factors such as cost, material corrosion, safety, waste, and support services must also be considered.

Decontamination factors (DFs) are used to determine the effectiveness of the decontaminating agent (i.e., chemical treatment). DFs are usually increased with contact time, concentration, temperature, and agitation. Contact time between the reagent and the surface can range from a few minutes to many hours and even days. Removal of metal oxide layers usually requires several hours of contact. Increasing temperature accelerates the reaction rates; however, some chemical constituents break sown at elevated temperatures. At times, several applications of the same reagents are needed, and the surface may need to be flushed upon completion. Consideration should also be given to how long the reagent can be recycled before a fresh solution is used, because metal hazardous waste ions have a tendency to resettle out of the solution. Chemical decontamination is more effective under turbulent conditions produced by some form of mechanical agitation such as cavitation, hydraulic flow, or scrubbing.

Numerous chemical formulations are possible. Without specific physical and chemical information pertaining to the hazardous species present on a particular type of surface, it is not possible to describe chemical reactions. Furthermore, the complete reporting of chemical formulations used most frequently is difficult because some of these are proprietary and sold under a sales descriptor without complete technical information about the ingredients.

Water/Steam

Water is a universal decontamination agent that acts by dissolving the chemical species or by eroding and flushing loose debris from the surface. It can be used on all nonporous surfaces, and its effectiveness can be enhanced by increasing its temperature, adding a wetting agent and detergent, or using a water jet. Steam is effective partially because of its gas velocity impinging on the surface, and it can be made even more effective with detergents. Steam can be used on any nonporous surface that can withstand the temperature, but it is most useful on accessible surfaces. Steam generally provides better DFs than water for flat-coated or polished surfaces. Dry Steam has some application for uncoated concrete.

Most ionic compounds are soluble in water; therefore, water/steam is the first choice for sluicing bulk salts and solids from tanks. For surfaces with grease or oil, it is not effective unless detergents are added. Water is most effective when the contaminant has been in contact with the surface for only a short time.

Water itself has little effect in removing long-standing contaminants and those that are chemically bonded to the substrate. It has almost no effect on hard metal oxide and carbonate or silicate scales, and it reacts violently with metallic sodium or potassium. Most transition metal compounds have limited solubility in water unless the pH is lowered. The advantages of using water as a decontaminate are that it is cheap, available, nontoxic, noncorrosive, and compatible with most radioactive waste and RCRA waste systems. In addition water/steam requires few support services that are not already available. Because of its safe nature, it can be used in large facility and environmental flushing operations. Remote operations can be accomplished with fire hoses, jets, or steam lances. Most cleaning operations use a water flush before other agent are used. The advantage of using steam is that the volume of water is reduced.

The disadvantages of water is a decontamination are that large volumes are usually required and contaminants can resettle onto other surfaces. In particular, the use of water has the tendency to spread radioactive contamination, which complicates the control of clean up. If fissile materials are present, criticality concerns become paramount.

1.3 MECHANICAL DECONTAMINATION

Mechanical Decontamination methods can be classified as either surface cleaning (e.g., sweeping, wiping, scrubbing) or surface removal (e.g., grit blasting, scarifying, drill and scabbling). Mechanical decontamination can be used as an alternative to chemical decontamination, can be used simultaneously with chemical decontamination, or can be used in sequence with chemical decontamination.

In general, mechanical decontamination methods can be used on any surface and achieve superior decontamination. When these methods are used in conjunction with chemical methods, an even better result may be realized. Moreover, when dealing with porous surfaces, mechanical methods may be the only choice. There are two general disadvantages to the mechanical methods. First, the methods require the surface of the work place to be accessible (i.e, the work piece should generally be free of crevices and corners that the process equipment cannot easily or effectively access.) Second, many methods produce airborne dusts. If contamination is a concern, containment must be provided to maintain worker health and safety and to prevent the spread of contamination.

As with chemical decontamination, the selection of the most effective technique depends on many variables, such as the contaminants of interest, surface material, and cost. For example, the selected treatment may have to be applied several times to respond to Site-specific conditions (i.e., to meet the established clean up criteria). Because each of these techniques can be modified to Site-specific conditions, the actual effectiveness and implementability of each technique under those conditions will be explored before being implemented. Surface-cleaning techniques are used when contamination is limited to near-surface material. Some techniques may remove thin layers of the surface (less than 1/4 in.) to remove the contamination. However, these techniques differ from surface-removal techniques in that the removal of the contaminant from the surface is the goal rather than the removal of the surface itself. Certain surface-cleaning techniques can be used as a secondary treatment following surface removal. Because these techniques are so versatile, it may be advantageous to locate a centralized decontamination facility on Site in which one or more of these techniques may be used. Such a facility could then be used to decontaminate dismantled or segmented components.

Surface-removal techniques are used when future land-use scenarios include reuse or when it is impractical to demolish the building (i.e., a laboratory within a building). The techniques described in this chapter remove various depths of surface contamination (i.e., floors versus walls) and may be used to reduce the amount of contaminant to be disposed of. For example, if a contaminated building is demolished, all the debris is considered contaminated and requires special handling. However, by first using a surface-removal technique, the volume of contaminant is limited to the removed surface material. The eventual demolition can then be handled in a more conventional manner. In this instance, a cost-benefit analysis should be prepared that considers such potential concerns as packaging, shipping, and burial costs for a surface-removal technique versus conventional demolition and disposal.

Before any surface-cleaning or removal activity, surface preparation and safety precautions are required. All surfaces to be treated must be free of obstructions (i.e., piping and supports should be dismantled or segmented), and surfaces should be washed down to minimize the release of airborne contamination during the surface-removal technique. The wash liquor must be processed as contaminated waste because it contains materials from the contaminated surface being washed. In this instance, all combustibles should be neutralized, stabilized, or removed. Finally, the contaminated debris (i.e., the removed portion of surface) must be collected, treated, and/or disposed of, and any liquids used during the removal process, either as part of the process or as a dust control, must be processed/recycled. In cases in which a contaminant has penetrated the material beyond the surface layer, another treatment may be required. Most of the surface-removal techniques usually leave an undesirable surface finish.

1.3.1 Flushing Water

Description of Technique

The technique involves flooding a surface with hot water. The hot water dissolves the contaminants, and the resulting wastewater is pushed to a central collection area. This technique is usually performed after scrubbing, especially on floors. Squeegees can be used to force the waste water to the collection area. This technique may be used with detergents or other chemicals that enhance the effectiveness of the technique.

The volume of the waste water can be reduced by simply wetting the surface and flushing before drying occurs. The volume of waste water can also be reduced by using a water treatment system to recycle the flush water (Wood, Irving, and Allen 1992; IAEA 1988; MMES 1993).

Applications

This process can be used for areas that are too large for wiping or scrubbing. It is effective on loosely Deposited particles (e.g., resins) and readily soluble contaminants, and it can be used as a first step to prepare a surface for a more aggressive decontamination. It is not recommended for

fixed, nonsoluble contamination. In addition, nuclear criticality considerations must be addressed when using water containing SNM.

1.3.2 Dusting/Vacuuming/Wiping/Scrubbing

Description of Technique

These techniques refer to physical removal of dust and particles from building and equipment surfaces by common cleaning techniques. If the dust and particles are contaminated, PPE may be required for workers as a health and safety control.

Vacuuming is performed using a commercial or industrial vacuum equipped with a HEPA filter. If a wet vacuum is used to pick up liquids, however, a replacement filter system will have to be used because HEPA filters do not function properly with liquids (i.e., they clog).

Surfaces that cannot be reached with a vacuum can be wiped with a damp cloth or wipe (soaked with water and solvent) to remove dust. If required, the cloth or wipe is disposed of as contaminated waste.

Scrubbing is similar to dusting/wiping except that pressure is applied to assist in removing of loosely adhering contamination.

Applications

The dusting and vacuuming techniques are applicable to various types of contamination, including lead-based paint chips, PCBs, and asbestos. The techniques are applicable to facility surfaces, although scrubbing should not be used on porous or absorbent materials because loosely Deposited materials may be pushed deeper into the surface and should not be used when contaminants are not soluble in water. Wastes are contained in vacuum cleaner bags, wipe cloths, scrub brushes, or mops and, depending on the nature of contamination, may need to be containerized or otherwise treated before disposal. All of these techniques are best suited for smooth surfaces.

Several considerations must be addressed before these techniques are applied. The wiping technique can be used to remove dust generated from other operations. Fugitive dusts may be created by the dusting and vacuuming action and spread contamination. It is important to remember that if the source of the contaminated particles is exterior to the work area interior vacuuming or dust efforts may be ineffective until the external source is controlled. Thermal effects need to be considered when collecting fissile materials (i.e, Pu-238) while using these techniques. (Esposito et al. 1985. Wood, Irving, and Allen 1992; IAEA 1988.)

1.3.3 Fixative/Stabilizer Coatings

Various agents can be used as coatings on contaminated residues to fix or stabilize the contaminant in place and decrease or eliminate exposure hazards. No removal of contaminants is achieved. Potentially useful stabilizing agents include molten and solid waxes, carbon waxes (polyoxyethylene glycol), organic dyes, epoxy paint films, and polyester resins. The stabilized contaminants can be left in place or removed by a secondary treatment. In some cases, the stabilizer/fixative coating is applied in place to desensitize a contaminant (e.g., an explosive residue) and prevent reaction or ignition during some other phase of dismantling or demolition.

In general, coatings can be applied in one of two ways: in a water-based solution or a solvent-based solution. Either solution contains a wetting agent that serves to break the surface tension between the fine particles (<20 microns) and the water or solvent. The ensuing chemical reactions allow the coating to dry and harden. Several applications of solution may be required depending on Site-specific conditions.

In practice, hazards posed by solvent flammability and toxicity should be considered. Proper PPE is required during application of the coating and will vary with the type of solvent used and the contaminant(s) of interest.

Applications

Coatings as fixatives or stabilizers may be used on PCB, explosive, and radioactive contamination. Stabilizers are used to reduce the potential spread of contamination an ingestion of radioactive contamination at nuclear facilities. In practice, stabilization is achieved using an agent that is complementary to the contaminant(s) of interest and the Site-specific work conditions. For example, if the contamination needs to be stabilized and then removed, a wax can be used in conjunction with a solvent or a reactant to dissolve or decompose the contamination. The wax-bearing treatment is allowed to first work and then harden, creating a contaminant-laden wax that can be physically removed in a stripping technique. The maximum DF achieved by this technique, as measured by ambient air level, is 2-3, depending on the fixative or stabilizer used. In general, experiments to ensure the effectiveness of the stabilizer or fixative need to be performed before one is selected because the degree of immobilization or desensitization required can vary on a Site-specific basis.

1.3.4 Metal Based Paint Removal

Description of Technique

Metals such as lead, cadmium, chromium, and mercury have been used as ingredients in paints used to coat the interior surfaces of buildings. In some instances these paints, especially lead, may still have been to coat piping and other metallic structures or components. With age, these paints can crack and peel, creating a potential health hazard to building occupants or to workers involved in demolition activities. If decontamination of any such surface is required, use of paint removal techniques may be necessary.

Prior to paint removal, a controlled area is initially established that surrounds the areas to be decontaminated, and a plastic ground cover is place beneath the working area. Peeling paint is then removed from surfaces through a combination of commercial paint removers, and scraping, water washing, and detergent scrubbing. This combination of removal methods should allow all surface areas of a building to be reached and affected. Any paint chips accumulate on the plastic ground covering. When paint removal is complete, the plastic is rolled up, securely sealed, labeled, placed into storage containers, and disposed of properly. Contaminated paint containing metal may be considered a mixed waste and require special handling.

Following decontamination, building surfaces may be repainted in a conventional manner, although repainting does not always take place immediately after removal of the old paint. Action following paint removal depends on the projected future use of the area and the degree of contamination. Resurfacing or further decontamination efforts may be necessary.

Because there is the possibility that workers might be exposed to airborne particulates and/or chemical vapors during the technique application, a training program should be conducted and safety equipment used. For example, respirators may be necessary to protect workers from organic solvent vapors. In another instance, biological monitoring methods that are available for lead, cadmium, chromium, and mercury contamination may be used.

Applications

This technique can be used to remove paints from any surface. It is most effective when the contaminated paint layer is the uppermost layer or when the contaminated paint layer is sandwiched between layers of paint. Paint removal and replacement have been used as cleanup techniques in many commercial, industrial, or residential buildings containing high lead-based or other metal-based paints, as well as in buildings contaminated with radioactive residues. For example, paint containing lead in excess of 0.06% by weight can be removed from building surfaces using commercially available paint removers and/or physical means (e.g., scraping, scrubbing, water washing). The removed paint waste is placed in sealed containers and disposed of properly. Surfaces may then be repainted with new paint having a lead content of no more than 0.06% by weight. During application, federal, state, and/or local regulations regarding health and safety concerns and controls of the waste streams must also be considered.

1.3.5 Strippable Coatings

Description of Technique

The use of a strippable coating involves the application of a polymer mixture to a contaminated surface. As the polymer reacts, the contaminants are stabilized, becoming entrained in the polymer.

In general, the contaminated layer is pulled off, containerized, and disposed of, although a polymer can be applied as a fixative or stabilizer or even as a protective coating for a clean surface. A self-stripping coating that is a nontoxic, water-based copolymer is also available. As the formula polymerizes, it cracks, flakes, and falls off, taking loose surface material with it. The resultant waste requires no additional processing before disposal. The necessary health and safety requirements are determined by the hazards associated with the contaminant(s) of interest as well as with the polymer. To avoid contact with the polymer, protective clothing, gloves, and eye protection should be used by workers. If the monomer is hazardous (e.g., vinyl chloride), additional protection such as respirators must be used. When removing materials that generate heat (e.g., Pu-238) care must be taken to prevent excessive heat generation (i.e., separate material into smaller portions).

Applications

Strippable coatings should be applicable to all contaminants and materials. Different polymer formulations may be required for various building materials. This technique is best suited for coated and uncoated floors and walls because these structural components have large surface areas that are easily accessible. Coatings may also be applied as a protective layer for clean surfaces before those surfaces become contaminated and may be used as fixatives or stabilizers.

Ideally, a strippable coating should remove all the contaminants it contacts, especially on smooth surfaces (e.g., metallic surfaces). There is a potential for the coating not to reach all the contamination on rough surfaces, however, especially if the surface to be treated has a high surface tension or if the polymer molecules are too large to fit in the surface pores. Moreover, secondary treatment may be needed, depending on how effective the polymer is in removing the contaminant and how deeply the contaminant has penetrated the material.

The polymer may bind not only to the contaminant but also to the surface of the wall or item on which it is applied (strippability depends on its properties and those of the surface). In this instance, large volumes of wastes may result, and the building or structural surface may be damaged.

Applications of self-stripping copolymer, which is limited to nonporous surfaces since porous surfaces will simply absorb the polymer, can be used to remove rust or oxide layers from base materials. Because oxide layers are quite porous, they tend to absorb contaminants. By removing the oxidized layers, a copolymer can remove a substantial amount of surface contamination. For rust removal and surface preparation, data have shown that two applications of the copolymer can clean rusted carbon steel surfaces to levels comparable to surfaces cleaned by thorough commercial blast cleaning. When used on oxidized or weathered lead, copper, aluminum, or galvanized steel, one application has been shown to be sufficient to render a metallic surface clean and bright. It is recommended that this material be tested on a small area for each substrate application to ensure its performance.

The polymer-coating technology has been extensively studied and has been widely used in decommissioning nuclear facilities. In practice, a chemical that reacts with the contaminant can be added to the polymer, detoxifying or eliminating its hazardous properties and thereby circumventing the need for secondary decontamination (Esposito et al. 1985; EPRI 1985; Wood, Irving and Allen 1992).

1.3.6 Steam Cleaning

Description of Technique

Steam cleaning physically extracts contaminants from building and equipment surfaces. The steam is applied using hand-held wands or automated systems, and condensate is collected for treatment. This technique combines the solvent action of water with the kinetic-energy effect of blasting. As a result of the higher relative temperature, the solvent action is increased and the water volume requirements reduced compared to hydroblasting.

Applications

Steam cleaning is applicable to a wide variety of contaminants and structural materials. This technique is recommended for use on complex shapes and large surfaces to remove surface contamination or to remove contaminated soil particles from earth-moving and drilling equipment. It can be used in conjunction with scrubbing, either as a preliminary step or as part of the scrubbing process.

Although a lesser volume of waste is generated using this technique than by hydroblasting, the installation of sumps and the use of waste water storage containers may be necessary. As in hydroblasting, existing sumps or water collection systems may be used but must be checked for leaks to ensure that contamination does not inadvertently migrate to another medium.

1.3.7 Sponge Blasting

Description of Technique

Sponge blasting, originally developed for the painting industry as a surface preparation activity, is now being used as a decontamination technique. This technique cleans by blasting surfaces with various grades of foam-cleaning media (e.g., sponges). The sponges are made of a water-based urethane. During surface contact, the sponges expand and contact, creating a scrubbing effect. Most of the energy of the sponges is transferred onto the surface being cleaned. A typical system consists of four major components: feed unit, sifter unit, wash unit, and evaporator unit. The feed unit is pneumatically powered and propels the sponges against the surface being cleaned at approximately 100 psi. Standard blasting equipment (e.g., hoses and nozzles) is used to transfer the sponge and air mixture. The sifter unit consists of a series of progressively finer screens used to remove debris from the sponges. Residue from the sifter unit must be properly disposed of. The wash unit is a portable closed-cycle centrifugal unit that launders the sponges, usually in three to five cycles. The evaporator unit reduces the volume of contaminated waste water from the wash unit before disposal. Because the system cleaning heads are similar to those of other blasting techniques, this technique is readily adaptable to a robotics system.

Applications

Two types of sponges are used: a nonaggressive grade that is used for surface cleaning on sensitive or otherwise critical surfaces and an aggressive grade that is impregnated with abrasives which can be used to remove tough material such as paints, protective coatings, and rust. The aggressive grade can also be used to roughen concrete and metallic surfaces. The sponges are absorptive and can be used either dry or wetted with a variety of cleaning agents and surfactants to capture, absorb, and remove surface contaminants such as corrosion, rust, oils, greases, lead compounds, paint, chemicals, and low-level radionuclides. Using wetted sponges decreases the amount of dust that may be generated and also provides for dust control without excess dampening of the surface being cleaned. The sponges are nonconductive and can be used to clean electrical motors and transformers and hydraulic and fuel-oil lines. This system does not use or produce noxious, hazardous, and/or difficult-to-contain substances.

The media typically can be recycled eight to ten times. During the first cycle, the sponge-blasting unit uses approximately 6-8 ft^3 of media per hour at a surface-cleaning rate of about 1 ft^2/min. The waste stream produced (the spent sponges and the absorbed contaminants) is approximately 0.01 ft^3 per square foot of surface cleaned. The sponges can be collected by vacuum for proper disposal. The wash water sponges are collected, filtered, and reused within the unit. As with any blasting technique, a potential for cross contamination exists because sponge particles may be sprayed or otherwise transported into the surrounding areas. Static electricity may be generated during the blasting process; therefore, the component being cleaned should be grounded.

1.3.8 CO_2 Blasting

Description of Technique

This technique is a variation of grit blasting in which CO_2 pellets are used as the cleaning medium. Small dry-ice pellets are accelerated through a nozzle using compressed air at 50-250 psi. The pellets shatter when they impact the surface, and the resulting kinetic energy causes them to penetrate the base material and shatter it, blasting fragments laterally and releasing the contaminant from the base material. The dry-ice fragments instantly sublimate, which adds a lifting force that speeds the removal of the contaminant. Removed debris falls to the ground, and the CO_2 (now gas) returns to the atmosphere. Because the pellets vaporize, they do not pose a collection, treatment, or disposal problem; however, collection of the removed debris is required. Use of CO_2 is advantageous to remove radioactive contamination because it does not become radioactive and because no secondary waste is produced. The airborne contamination potential is typical of that of other blasting actions.

A typical system consists of two major components: a pelletizer that converts liquid CO_2 into dry-ice snow and a cleaning station from which the pellets are stored and blasted. The cleaning station is portable and may be used to clean equipment in place, but it may also be used to clean dismantled equipment that has been transported to a centralized cleaning area where the pelletizer is located.

Applications

Blasting with CO_2 has proven effective with plastics, ceramics, compoSites, and stainless steel. Wood and some soft plastics could be damaged, and brittle materials may shatter. Hard coatings that bond very firmly to the base material may be removed effectively by this technique. Additionally, soft contaminants such as grease and oil tend to splatter and may require specialized application procedures and collection systems. If the object being cleaned is porous, soft contaminants may be pushed into the base material. However, this technique is very effective for hardened, baked-on grease.

Some cooling takes place in the base material, but the amount of cooling seldom exceeds 40°F. In some applications, cooling makes a small contribution to the cleaning, principally with those contaminants that break up more easily as a result of thermal shock (i.e., those with high moisture content or a high freezing point.) The likelihood of damage resulting from cooling is remote, but material analysis should be performed before using this technique on components that may potentially be reused.

In general, CO_2 blasting is best applied in a room or booth that is dedicated to that purpose to contain the loosened debris and to isolate the noise of blasting, which can range from 75 dB to 125 dB. In a normal work space, ventilation is usually sufficient to prevent undue CO_2 buildup; in a confined space, however, ventilation needs to be actively monitored. Because CO_2 is heavier than air, placement of exhaust vents is best at or near ground level. Static electricity may be generated during the blasting process, therefore the component being cleaned should be grounded (Alpheus).

1.3.9 Hydroblasting

Description of Technique

In the hydroblasting technique, a high-pressure (several thousand pounds per square inch) water jet is used to remove contaminated debris from surfaces. The debris and water are then collected, treated, and disposed of properly. Configurations range from a jet tip, which produces a narrow stream, to a flat fan shape, which produces flow similar to a paint scraper in form. Use of the correct lance tip is critical to producing desired results. The treated surface may require painting or other refinishing methods if the surface is to be reused. Many manufacturers produce a wide range of hydroblasting systems and high-pressure pumps.

Applications

This technique is recommended for surfaces that are inaccessible to scrubbing or that are too large for scrubbing. Hydroblasting can be used on contaminated concrete, brick, metal, and other materials. It is not applicable to wooden or fiberboard materials. In general, the technique is very effective, completely removing surface contamination. On the average, hydroblasting removes 3/16-3/8 in. of concrete surface at the rate of 40 yd^2/hr. Hydroblasting may not effectively remove contaminants that have penetrated the surface layer (Esposito et al. 1985). However, variations such as hot or cold water, abrasives, solvents, surfactants, and various pressures that may increase the effectiveness of decontamination can easily be incorporated into the technique.

Water lances have been successfully used to decontaminate pump internals, valves, cavity walls, spent-fuel pool racks, reactor vessel walls and heads, fuel-handling equipment, feed water spargers, floor drains, sumps, interior surfaces of pipes, and storage tanks. DF's of up to several hundred have been obtained. Experience at one Site indicated that DF's of 2-50 could be achieved using water only and that DFs of 40-50 could be achieved if a cleaning agent, (e.g., Radiac-Wash) was added. Personnel at the Site recommend an initial treatment at lower pressures (500 psi) because the lower pressures perform just as well as higher pressures (3,000-5,000 psi).

To decontaminate pipe runs, a variation of the water lance -- the pipe mole -- is used. In this method, a high pressure nozzle head is attached to a high-pressure flexible hose and inserted into pipe runs. The nozzle orifices are angled to provide forward thrust of the nozzle so that the hose can be dragged through the pipe.

Hydroblasting has been used to decontaminate nuclear facilities, remove explosives from projectiles, and decontaminate military vehicles. Hydroblasting also has been employed commercially to clean bridges, buildings, heavy machinery, highways, ships, metal coatings, railroad cards, heat exchanger tubes, reactors, piping, etc. Given the volume of water generated, installation of sumps and external waste water storage tanks may be necessary. Existing sumps or water collection systems may be used, although they must be checked for leaks to ensure that contamination does not inadvertently migrate to another medium.

1.3.10 Ultra-High-Pressure Water

Description of Technique

In this technique, water is pressurized up to 55,000 psi by an ultra high-pressure intensifier pump. The water is then forced through a small-diameter nozzle that generates a high-velocity water jet at speeds of up to 3,000 ft/s. This is the same technique used in abrasive water-jet cutting except that for cleaning purposes the nozzle is mounted in a cleaning head. With the cleaning head attached to a lance, it can be manually moved about the surface being decontaminated. Surface contaminants are first eroded and then removed by the water jet. Deeper penetration of the surface is possible by adding abrasives to the water jet; however, care should be taken to not damage or cut through the material. The contaminant and waste water require a processing system in which the contaminant is separated, containerized, and disposed of and the waste water treated and recycled.

Applications

Concrete, metallic components, structural steel, and ceramic tile are just a few of the materials that can be decontaminated with ultra high-pressure water. Water jets can remove paint, coatings, and hard-to-remove deposits without damaging the underlying surface. They can also remove galvanized layers from sheet metal. The decontamination efficiency of the technique is dependent on a number of parameters: water pressure and flow rate, nozzle/cleaning head configuration, distance of the cleaning head to the surface, and translation speed. These parameters must be evaluated, along with the geometric complexities of the substrate, to achieve optimum results.

Because water jets are omni- directional and have very little thrust, they are readily adapted to robotics or remote operation. Moreover, the power unit is basically the same as that used for water-jet cutting. Therefore, with minor modifications, the unit can be used for either technique as long as the appropriate nozzle is used (e.g., a cleaning head or a cutting head) (MMES 1993, Flow International, K&S Engineering).

1.3.11 Shot Blasting

Description of Technique

Although the shot blasting technique was originally developed and marketed as a surface preparation technique to enhance coating adhesion, it can be used to remove contaminants from floors and walls. Shot blasting is an airless method that strips, cleans, and etches the surface simultaneously. The technique is virtually dust free, so the potential for airborne contamination is very low. The surface is left dry and free from chemicals, so additional waste treatment is not required.

Portable shot blasting units move along the surface that is being treated as the abrasive is fed into the center of a completely enclosed centrifugal blast wheel. As the wheel spins, the abrasives are hurled from the blades, blasting the surface. The abrasive and removed debris are bounced back to a separation system that recycles the abrasive and sends the contaminants to a dust collector. Larger shot removes more concrete, and the etch depth can be controlled by

varying the speed of the unit. Units are available that can remove an up to 1/4-in.-thick surface in a single pass. Units are also available for vertical surfaces.

The contaminated debris and contaminated shot must be treated and disposed of properly. The mobile unit must also be decontaminated.

Applications

Shot blasting is generally used for concrete surfaces, but it can be applied to metallic components such as storage tanks. Shot blasting effectively cleans surfaces that have been exposed to acids, caustics, solvents, grease, and oil. It can also remove paint, coatings, and rust.

1.3.12 Wet Abrasive Cleaning

Description of Technique

A wet abrasive cleaning system is a closed-loop, liquid abrasive (wet grit blasting) decontamination technique. The system uses a combination of water, abrasive media, and compressed air and is applied in a self-contained, leak tight, stainless steel enclosure. There is no danger of airborne contamination because a self-contained HEPA ventilation system maintains negative pressure inside the cabinet. The radioactive waste is mechanically separated from the cleaning media, resulting in a very low waste volume. The water can be recycled and filtered, eliminating any access to waste water drainage.

The system is designed based on field experience and is governed by ALARA concerns. The system uses no soluble or hazardous chemicals, only the abrasive media (e.g., glass beads, aluminum oxide, silicon carbide, ceramics) and water.

Applications

Wet abrasive cleaning is being used by many nuclear facilities to remove smearable and fixed contamination from metal surfaces such as structural steel, scaffolds, components, hand tools, and machine parts. The equipment can be used on close-tolerance parts such as turbine blades or valves where the removal of metal is not desired, or it can be adjusted to remove heavy-duty corrosion and paint by varying the amount of air pressure and media.

A basic 4-ft .x 4-ft. x 5-ft. or a larger 4-ft. x 8-ft. x 7-ft. system provides enough space in which to decontaminate small tools or heavy, large-scale parts. If a material cannot be cut down to a smaller size (e.g., long I-beams), it can be fed through small cabinets. Most booths are custom designed to specific configurations and sizes.

1.3.13 Grit Blasting

Description of Technique

The grit blasting technique, commonly called sand blasting and abrasive setting, has been used since the late 1800s. This technique, which uses abrasive materials suspended in a medium that is projected onto the surface being treated, results in a uniform removal of surface contamination. Compressed air or water or some combination of both can be used to carry the abrasive. Removed surface material and abrasive are collected and placed in appropriate containers for treatment and/or disposal.

Applications

Grit blasting is applicable to most surface materials except those that might be shattered by the abrasive, such as glass, transite, or plexiglass. It is most effective on flat surfaces, and because the abrasive is sprayed it is also applicable on hard-to-reach areas such as ceilings or areas behind equipment. Nonetheless, obstructions close to or bolted to walls must be removed before application, and precautions should be taken to stabilize, neutralize, or remove combustible contaminants because some abrasives can cause some materials to detonate. Static electricity may be generated during the blasting process; therefore, the component being cleaned should be grounded. Remotely operated units are available.

Abrasives may be applied under either wet or dry conditions. Under dry conditions, dust-control measures may be needed to control dusts and/or airborne contamination. This problem can be reduced by using filtered vacuum systems in the work area. When water is used to apply the abrasive, large volumes of waste are produced that include the waste water, the abrasive, and the removed debris. These wastes must be properly treated and/or disposed of. If the waste water can be recycled, it may or may not need to be treated before it is reused. Depending on the application, the following variety of materials can be used as the abrasive media:

- minerals (e.g., magnetite or sand),
- steel pellets,
- glass beads/glass frit,
- plastic pellets, and
- natural products (e.g., rice hulls or ground nut shells).

Silica has also been used as an abrasive; however, its use is not recommended because silica is moderately toxic, is a highly irritating dust, and is the chief cause of pulmonary disease. Prolonged inhalation of dusts containing free silica may result in the development of a disabling pulmonary fibrosis known as silicosis.

A grit-blasting system consists of a blast gun, pressure lines, abrasives, and an air compressor. Several grit-blasting equipment manufacturers and contractors are available. Labor cost could be high because it is a relatively slow and labor-intensive technique. Large amounts of abrasive are required, so costs are necessarily dependent on the type of abrasive used (Esposito et al. 1985; Wood, Irving, and Allen 1992).

1.3.14 Grinding

Description of Technique

The grinding technique removes thin layers of surface contamination from concrete. In many cases, the contamination is limited to the paint coating or concrete sealer finish. The technique involves abrading the surface that is being treated using coarse-grained abrasives in the form of water-cooled diamond grinding wheels or multiple tungsten-carbide surfacing discs. Machines to power these abrasives are floor-type grinders who grinding heads rotate in a circular fashion parallel to the floor. Water required for cooling is injected into the center of the grinding head, reducing the amount of dust. Supplementary contamination control can be accomplished using HEPA-filtered vacuum systems and wet vacuums attached to or held near the machine. The surface may be moistened before and during grinding to hold down dust levels.

Applications

In general, grinding is recommended for use where thin layers of contamination need to be removed. If the contamination is deep, the grind wheels or discs are quickly worn down, which decreases the overall effectiveness of the technique.

A typical diamond grinding wheel (used on a floor grinder) is capable of removing several thousand square feet of surface per day to an approximate depth of 1/2 in. In smaller areas, the wheel can remove up to 1 inch of surface per day. The machine can be operated by one operator. Floor and hand-held grinding machines have been successfully used at the San Onofre Unit 1 Nuclear Plant to remove surface contamination.

1.3.15 Scarifiers

Description of Technique

Scarifiers physically abrade both coated and uncoated concrete and steel surfaces. The scarification process removes the top layers of contaminated surfaces down to the depth of sound, uncontaminated surfaces. A decade ago, concrete scarification was considered a radical approach to decontamination owing to poor performance of the tools and inability to provide a uniform surface profile upon removal of the contaminants. Today's refined scarifiers are not only very reliable tools, but also provide the desired profile for new coating systems in the event the facility is to be released for unrestricted use. For steel surfaces, scarifiers can completely remove contaminated coating systems, including mill scale, leaving a surface profile to bare metal. To achieve the desired profile and results for contaminated concrete removal, a scabbling scarification process is implemented; for steel decontamination, a needle scaling scarification process is used.

Scabbling

Scabbling is a scarification process used to remove concrete surfaces. Manufacturers of scabblers typically incorporate several pneumatically operated piston heads to simultaneously strike (i.e., chip) a concrete surface. Today's scabblers range from hand-held scabblers to remotely operated scabblers, with the most common versions incorporating three to five scabbling pistons mounted on a wheeled chassis. Because scabbling can cause a cross-contamination hazard, vacuum attachments and shrouding configurations have been incorporated by a few scabbling equipment manufacturers. According to one manufacturer's claim, users can scabble with no detectable increase in airborne exposures above background levels (Pentek).

One of three types of scabbling bits, which are mounted on the piston heads, can be used: a 6-point anvil bit for surface scabbling, a cross anvil bit for aggressive surface reduction, or a 9-point bit for aggressive removal, leaving a smooth, finished surface profile. All bits have tungsten-carbide cutters and range from 1 3/4 to 2 1/2 in. in diameter, depending on the manufacturer's configuration. The bits have an operating life of approximately 80s hr under normal use. Before scabbling, combustibles must be stabilized, neutralized, and/or removed. In practice, floor scabblers can only be moved to within 1/2 in. of a wall. Other hand-held scabbling tools are manufactured to remove the last 1/2 in. of concrete flooring next to a wall, as well as remove surface concrete on walls and ceilings. This technique is a dry decontamination method -- no water, chemicals, or abrasives are required. The waste stream produced is only the removed debris.

The approximate removal rates for a scabbler vary depending on the type of bit that is used. In general, the removal rate for a 6-point anvil bit is 30-40 ft^2/hr based on the removal of a 1/6 inch deep layer. The removal rate for a cross anvil bit varies inversely to the thickness removed: 14-24 ft^2/hr for a 1/4 inch deep layer, 7-12 ft^2/hr for a 1/2 inch deep layer, and 3-6 ft^2/hr for a 1 inch deep layer.

Needle Scaling

Needle scaling is a scarification process used in both concrete and steel surface removal. These tools are usually pneumatically driven and use uniform sets of 2mm, 3mm, or 4mm needles to obtain the desired profile and performance. The needle sets use a reciprocating action to chip the contamination from the surface. Some manufacturers have added specialized shrouding and vacuum attachments to collect the removed dust and debris during needle scaling with the result of no detectable concentrations above background levels.

For removing surface contamination from steel surfaces where combustibles were once stored, copper beryllium needle sets can be used to reduce the risk of needle sparking. Needle scalers are an exceptional tool in tight, hard-to-access areas, as well as for wall and ceiling surface decontamination. This technique is a dry decontamination process and does not introduce water, chemicals, or abrasives into the waste stream. Only the removed debris is collected for treatment and disposal.

Production rates vary depending on the desired surface profile to be achieved. Nominal production rates range from 20 to 30 ft^2/hr.

Applications

Scabblers are best suited for removing of thin layers (up to 1 in. thick) of contaminated concrete (including concrete block) and cement. It is recommended for instances where (1) no airborne contamination can occur, (2) the concrete surface is to be reused after decontamination, or (3) for instances in which the demolished material is to be cleaned before disposal. The scabbled surface is generally level, although coarsely finished, depending on the bit used. If necessary, after release, the surface can be finished with a concrete cap and an epoxy, polymer, or similar finish. This technique is suitable for both large open areas and small areas.

Needle scaling is best suited for removing of surface contamination and coatings from steel surfaces, piping, and conduit. Needle scalers with vacuum attachments and shrouding are ideal for clean room surface removal operations, dustless decontamination operations, and in the reduction of containment structures and ventilation schemes. They an also remove surface contamination from concrete surfaces (up to 1/2 inch thick). Needle scaling is generally more versatile than scabbling and is highly effective on concrete walls and ceilings. (Esposito et al. 1985; Pentek; MacDonald Air Tool).

A proprietary system integrates scabblers and scarifiers into a family of remotely and manually operated scarification equipment for dustless decontamination of concrete and steel. The system incorporates a high-performance vacuum/waste packaging unit in conjunction with pneumatically operated scabblers and needle scalers to safety remove contaminated material. Dust and debris are captured at the cutting-tool surface, which minimizes cross contamination. The HEPA filtration design incorporates a patented fill-seal drum changeout method that allows the operator to fill, seal, remove, and replace the waste under controlled vacuum conditions. The unit can accommodate 55- and 23-gal drums. It can also simultaneously support several drum sizes, including up to three scabbler/needle scalers from a 100-ft distance. The remotely operated floor scabbler has an on-board vacuum packaging unit. The smaller scabbler and needle scaler have vacuum ports that can be attached to the vacuum waste packaging unit. Although the equipment is designed to work as an integrated system, the individual components can also be operated as stand-alone units that can be used with conventional air supplies and vacuum systems.

1.3.16 Milling

Description of Technique

There are two milling techniques, one used for shaving metals and one for shaving concrete. Metal milling is the technique by which a machine shaves off a layer of material (up to 1/8 in.) from a surface using rotating cutters. The most commonly used method involves feeding the work piece past stationary cutters that are perpendicular to the cutter's axis. Other types of milling machines (i.e., where the work piece is stationary and the cutter or cutters move) are available. Waste consists of the machined-off chips and any cooling/lubricating fluids (which can be recycled if necessary).

Concrete milling is similar to concrete scabbling or scarifying, except that it may be applied to a much larger surface area. Large, paving-type equipment is generally used to shave the concrete surface. Approximately 2 1/2-10 in. can be removed in this manner.

Applications

Because of the setup time for configuration (1/2-3/4 hr), metal milling is most effective when there is a large number of similarly shaped items to be decontaminated. After the equipment is set up and loaded, about 2 1/2 ft^2/hr can be milled. Concrete milling is most effective when used on large, open, horizontal surfaces. No documentation on its use as a decontamination technique has been found; however, metal milling has been used at the Oak Ridge K-25 Site to decontaminate individual metal items (MMES 1993).

1.3.17 Drill and Spall

Description of Technique

The drill-and-spall technique was developed to remove contaminated concrete surfaces without demolishing the entire structure. All potential obstructions to the drill or spall rig should be removed and combustible sources stabilized, neutralized, or removed. The technique involves drilling 1-1 1/2 -in.-diameter holes approximately 3 in. deep into which a hydraulically operated spalling tool is inserted. The spalling tool bit is an expandable tube of the same diameter as the hole. A tapered mandrel is hydraulically forced into the hole to spread the fingers and spall off the concrete. The holes are drilled on approximately 12-in. centers so that the spalled area from each hole overlaps the next. The removed concrete is collected, treated, and/or disposed of. If the contamination is deeper than that which can be removed in one pass, a second pass may need to be performed.

Applications

The drill-and-spall technique is applicable to concrete only (not concrete block) and is recommended for removing surface contamination that penetrates 1-2 in. into the surface. Removal of the near-surface contamination in this manner decreases the amount of contaminated material that needs to be disposed of prior to demolition. This technique is effective for large-scale, obstruction-free applications, the only limit being the interior building configuration. The treated surface may require a concrete cap if a smooth surface is desired because any rebar is exposed and the surface is generally left in an overall rough condition.

A concrete spaller was used at Pacific Northwest Laboratories (PNL) to remove 1 in. of contaminated concrete from the surface of air lock cover blocks. The concrete spaller was first set up and tested on nonradioactive concrete to allow hands-on training of personnel. During these equipment tests, it was found that if the surface was first painted with a latex paint, it acted to keep the spalled aggregates together, somewhat in the same manner as a fixative. A nominal 8-in. spacing between drilled holes was found to be satisfactory. The interface between the push rod and bit was lubricated between each spalling operation rather than every four operations as recommended. This lubrication sequence may have helped prevent wear or galling-type failures. One spalling bit was replaced when the wedge portion broke away from one of the expanding prongs. During operation, workers were required to wear respirators.

1.3.18 Paving Breaker And Chipping Hammer

Although paving breakers and chipping hammers are primarily used in demolition activities, they can be used to remove surface contamination up to 6 in. thick. The surface is left very rough and resurfacing is required.

1.3.19 Expansive Grout

Although expansive grout is primarily used as a demolition technique, it can also be used as a decontamination method to remove a thick layer of contaminated concrete.

1.4 EMERGING TECHNOLOGIES

In the last decade, many decontamination development activities have been initiated in anticipation of the extensive program activities scheduled to begin in the next 10 year. Most of these technologies have not yet been field tested. Regardless, a fraction of these development activities appears to be more effective in special situations than the established chemical and mechanical methodology currently being used.

A literature review indicates some of these technologies may be more well developed than others. Because these technologies have not been field tested, there is no way to determine their effectiveness at this time. DOE has provided funding in this project to demonstrate such technologies. The purpose of this section is to develop an awareness of these ongoing activities.

1.4.1 Light Ablation

Description of Technique

Light ablation uses the absorption of light energy and its conversion to heat (photopyrolysis) to selectively remove surface coating or contaminants. For a given frequency of light, some surfaces reflect the beam, some (such as glass) transmit the beam, and others absorb the light energy and convert it to heat. There are three candidate light sources for use in light ablation applications; laser, xenon flash, and pinch plasma lamps. The first two of these are currently commercially available, and the third is under development.

If the properties of a specific contaminant/substrate combination are known, a proper light frequency can be selected for use. If the light intensity is high enough, the surface film can be heated to 1,000-2,000°C in microseconds or less, while the substrate is virtually unaffected. With each light pulse, some of the surface contaminant is transformed from a solid into a plasma, which erupts from the surface. The high-temperature gas or plasma produces a brilliant flash of light and a loud audible report (up to 90 dB) from the plasma's supersonic shockwave. Photochemical and thermochemical reactions, such as organic destruction occur within the plasma, but there is no flame because the shock wave pushes ambient oxygen away from the gas plasma.

This technique has the ability to operate at a distance by transporting the light through periscopes or fiber optics up to 450 ft. long. The small laser heads, fiber optic cables, or compact flash blast heads can easily be adapted for manipulator use. These small components can be designed into a robotics viewing, aiming, and handling system to gain access to and decontaminate otherwise inaccessible areas (Flesher, 1992).

Applications

Surface coatings that have been removed by the high-energy light technique range from epoxy paints, adhesives, and corrosion products to centuries of accumulated airborne pollutants and 1/4-in. layers of concrete. Surfaces contaminated with several different compounds or particles may require multiple passes, changing the frequency and/or intensity to match a particular contaminant and remove it with each pass. Research in this area of decommissioning purposes is being performed by Westinghouse Hanford Company and Ames Laboratory at Iowa State University.

Because no chemicals or abrasives are used; there is no increase in secondary waste volume. In some cases, a light water spray may be used; however, no liquid runoff or dissolution is required. In most applications, the volume of waste should be equal to or less than the actual volume of the coating removed. The high-energy light and plasma generated are frequently accompanied by photoreaction, which reduces organic molecules to their basic gaseous constituents, to reduce the overall solid waste volume.

This technique minimizes the potential for exposures that result from contact with contaminated surfaces because the end effectors for both the xenon flash (at 1/2-1 in.) and the laser (at 50 ft or more) are at a distance from the contaminated surface. These end effectors are small (under 10 lb) and are attached to their power supplies and controls by cables or fiber optics up to 450 ft long. Therefore, operators are not required to make contact with the surface, and the equipment is easily adaptable to remote operations.

1.4.2 Microwave Scabbling

A new method for surface removal of concrete has been developed at the Oak Ridge Y-12 plant. This technique directs microwave energy at contaminated concrete surfaces and heats the moisture present in the concrete matrix. Continued heating produces steam-pressure-induced internal mechanical stresses and thermal stresses. When combined, these two stresses burst the surface layer of concrete into small chips. The chips are small enough to be collected by a HEPA-filtered vacuum system that is connected at the tailing end of the mobile unit. Less than 1% of the debris is small enough to pose an airborne contamination hazard. Larger debris can be manually vacuumed. The concrete removed can be controlled by choosing the frequency and power of the microwave system. Higher frequencies concentrate more of their energy near the surface and remove a thinner layer of material. A thicker layer can be removed by using lower frequencies, which are absorbed deeper in the concrete.

This technique is applicable to concrete surfaces only because metallic surfaces negatively impact the performance of the technique. Steam was observed escaping from the outer edges of a support bolt during laboratory-scale tests. The effect of steel-reinforcing bars, however, does not seem to pose any problems because they are usually far below the surface. A layer of paint had negligible impact on performance during testing. Cracks in the surface allow steam to escape and have a negative effect on performance. This technique generates little dust and does not require the concrete surface to be wet, which eliminates the cost of disposal/treatment (with the exception of the removed debris). The mobile test unit collected approximately 95% of the removed debris. It is expected that a larger vacuum system can collect 98% or more of the debris. Currently, the test unit is applicable only to floors; however, future phases of development are expected for wall and ceiling applications. No information has been given on the amount of microwave energy that may be transferred (i.e., leaks) from the surface being treated and the applicator. If the amount of leakage is above the American National Standards Institute (ANSI) standard of 5 mW/cm^2, then appropriate measures must be taken to eliminate this leakage for safety purposes. (White, 1992; DiDonato, 1993)

Appendix C

Characterization Survey And Hazard Summary Matrix

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
001	Basement sumps	728	Class 1	None	- Moderate levels of loose and fixed surface contamination; Radioactive contaminated process waste water with hazardous chromium and lead.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	Possibly present on sump surfaces and sludge	- Standard Work Steps (Section 3.2.3) will be used. - Confirmed Space Entry may be required. - Aggressive decontaminational techniques are expected to be used.
	Room 001 Total Grams			**0**				
100	Main Entry Vestibule	48	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 100 Total Grams			**0**				
101	Hallway & Stairs	510	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 101 Total Grams			**0**				
101A	Room In Hall	70	Class 1	None				
	Room 101A Total Grams			**0**				
103	Men's Locker Room	660	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 103 Total Grams			**0**				
103A	Men's Locker Room	120	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 103A Total Grams			**0**				
103B	Men's Locker Room	190	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 103B Total Grams			**0**				
104	Elevator	100	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 104 Total Grams			**0**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
105	Janitors Closet	45	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 105 Total Grams			**0**				
106	Office	182	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 106 Total Grams			**0**				
107	Office	182	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 107 Total Grams			**0**				
108	Office	1170	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 108 Total Grams			**0**				
109	Office	192	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 109 Total Grams			**0**				
110	Office	145	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 110 Total Grams			**0**				
110A	Office	148	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 110A Total Grams			**0**				
111	Office	156	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 111 Total Grams			**0**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
113	Machine Shop	400	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used. - Possibly present in equipment oil - to be sampled.
Room 113 Total Grams				0				
114	Storage	1070	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present - Additional characterization to be performed	- Standard Work Practice (Section 3.2.3) will be used. - Satellite Accumulation Area.
Room 114 Total Grams				0				
115	Office/Storage	925	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 115 Total Grams				0				
115A	Electronics Labs	240	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 115A Total Grams				0				
116	Hallway	487	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 116 Total Grams				0				
116A	Office	108	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 116A Total Grams				0				
116B	Office		Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 116B Total Grams				0				
117	Emergency Generator	600	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section3.2.3) will be used. -Possibly present in electrical equipment to be sampled.
Room 117 Total Grams				0				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
118	Hallway	147	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 118 Total Grams				**0**				
119	E & W Hallway	1826	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 119 Total Grams				**0**				
121	Machine Shop	1100	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Possible present in equipment - Additional characterization to be performed	- Standard Work Practice (Section 3.2.3) will be used.
Room 121 Total Grams				**0**				
121A	Electrician Office	150	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 121A Total Grams				**0**				
121B	Security Access	418	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 121B Total Grams				**0**				
122	Control Room	462	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 122 Total Grams				**0**				
123	Store Room	60	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 123 Total Grams				**0**				
124	Office	173	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 124 Total Grams				**0**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
125	Office	236	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 125 Total Grams				**0**				
126	Utilities Room	1730	Class 1	Lg. Duct **17.9** GB-126 LLD Sm Duct 4.2 All Others < LLD	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used. - Possibly present in electrical equipment to be sampled
Room 126 Total Grams				**22.1**				
127	Utilities Room	6915	Class 1	Plenum 404	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present - Additional characterization to be performed	- Standard Work Practice (Section 3.2.3) will be used.
Room 127 Total Grams				**404**				
128	Instrument Repair Facility	96	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 128 Total Grams				**0**				
130	Chemical Storage	50	Class 1	None	- Little or no loose surface contamination on room surfaces. - Known areas of fixed contamination on floors. - High contamination levels inside gloveboxes.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 130 Total Grams				**0**				
131	Aqueous Lab	548	Class 1	Lg. Duct **11.5** GB-961 **54** Sm Duct **2.7** All others < LLD.	- High contamination levels, insides gloveboxes. - Little or no loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination on floor/wall surfaces. - Internally contaminated pumps.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used. - Known materials used in room: Plutonium oils contaminated, solvents, hydrochloric Acid and Calcium Chloride. - RCRA Permitted Area GB-131A,B,D,E.
Room 131 Total Grams				**68.2**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
Room 131 Total Grams				**68.2**				
132	Office	234	Class 1	None	-No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 132 Total Grams				**0**				
133	R & D Pyrochemical Lab	820	Class 1	Lg. Duct **30.6** GB-954 **104** GB-954 equip GB-956 **31** GB-957 **29** GB-959 **50** GB-955 **21** All others < LLD GB-954 equip **4** GB-956 equip **24** GB-957 **12** GB-959 equip **38** Sm Duct **7.2**	- Little or no loose surface contamination on room surfaces on majority of room surfaces. - High contamination levels under GB-957. - Known areas of fixed contamination on floors. - High contamination levels inside gloveboxes.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.		- Standard Work Practice (Section 3.2.3) will be used. - Known materials used in room: Plutonium, Americium, Tantalum, Oils, Solvents, Calcium, Calcium Chloride, Magnesium, Gallium, Zinc, Tin, Aluminum, Dicesium Hexachloro-plutonate.
Room 133 Total Grams				**350.8**				
134	Flammable Liquid Storage	130	Class 1	None	-No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present - Additional characterization to be performed	- Standard Work Practice (Section 3.2.3) will be used. - Satellite Accumulation Area.
Room 134 Total Grams				**0**				
135	RCT Storage Area	130	Class 1	None	-No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 135 Total Grams				**0**				
136	Chem Tech Office	120	Class 1	None	-No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 136 Total Grams				**0**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
137	Aqueous R &D Lab	533	Class 1	Lg. Duct **3.1** GB-106-6 **56** GB-106-2 **17** GB-106-1 **22** GB-106-5 **8** GB-106-3 **17** GB-106-4 **9** Sm Duct **.7** All Others LLD.	- Little or no loose surface contamination on room surfaces. - Known Areas of fixed contamination on floors. - High contamination levels inside gloveboxes.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present due to research/machining operations. - Additional characterization to be performed.	- Standard Work Practice (Section 3.2.3) will be used. - RCRA Permitted GB-106-3,4,5. - Known materials used in Room: Pu, Americium, Tantalum, Oils, Solvents, Aluminum, Zinc, Potassium, Cadmium, Hydrochloric Acid, Nitric Acid, Phosphoric Acid, Calcium Chloride Acid, Ammonium Hydroxide.
Room 137 Total Grams				**132.8**				
138	Excess Chemical Storage	72	Class 1	None	-No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 138 Total Grams				**0**				
139	Soil Analysis Lab	413	Class 1	- Small quantity present in C95 duct. Sm Duct .9 Lg. Duct **3.9** All others < LLD.	-Little or no contamination present on room surfaces. - Possible isolated locations of fixed contamination. - Hoods &B-Boxes have moderate levels of contamination. - Room contains a shielded Americium source.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present due to chemical research activities. -Additional characterization to be performed.	- Standard Work Practice (Section 3.2.3) will be used. - Known Materials Used in Room: Plutonium, Americium, Uranium, Sodium Hydroxide
Room 139 Total Grams				**4.8**				
140	Metal Preparation Lab	323	Class 1	None	- Little or no loose contamination present on room surfaces. - Possible isolated locations of fixed contamination. - B-Boxes contaminated with Uranium and Beryllium.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used. - Known materials used in room: Depleted Uranium, Beryllium.
Room 140 Total Grams				**0**				
140A	Scanning Electron Support Room	86	Class 1	None	-No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 140A Total Grams				**0**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
140B	Scanning Electron Microscope (SEM)	85	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination. - SEM likely non-contaminated.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 140B Total Grams			**0**				
141	Electron Spectroscopy for Chemical Analysis	209	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination. - ESCA likely non-contaminated.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 141 Total Grams			**0**				
141A	Microprobe	130	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination. - Microprobe is internally contaminated.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 141A Total Grams			**0**				
141B	Scanning Electron Microscope (SEM)	130	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination. - SEM likely non-contaminated.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 141B Total Grams			**0**				
141C	Metallography & Optical Reduction Equipment	90	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	-Potentially present - Additional characterization to be performed	- Standard Work Practice (Section 3.2.3) will be used.
	Room 141C Total Grams			**0**				
142	Utilities Room	4579	Class 1	None	-No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	-Potentially present - Additional characterization to be performed	- Standard Work Practice (Section 3.2.3) will be used. - Satellite Accumulation Area.
	Room 142 Total Grams			**0**				
145	Office Under Stariwell		Class 1	None				
	Room 145 Total Grams			**0**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
146	Office	196	Class 1	None	-No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 146 Total Grams			0				
147	Office/Storage	176	Class 1	None	-No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 147 Total Grams			0				
149	Hallway	1286	Class 1	None	-No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 149 Total Grams			0				
150	Metal Joining Facility	1720	Class 1	Sm Duct **1.7** Lg. Duct **7.4** GB-W. HOOD **6** All Others < LLD	- No loose surface contamination on room surfaces. - Possible isolated spots of low-level fixed contamination. - Possible internal contamination in welding equipment.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized. - Additional sampling to be performed.	- Potentially present in electron beam welding equipment. - Additional characterization to be performed.	- Standard Work Practice (Section 3.2.3) will be used. - Known materials used in room: Pu, Hydrochloric Acid, Nitric Acid, Hydrofluoric Acid, Oxalic Acid, Sulfuric Acids, Acetone, Ethanol, Copper Sulfate, and Alcohol. Possible - Electrical transformers; to be sampled.
	Room 150 Total Grams			15.1				
151	Office	112	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 151 Total Grams			0				
152	Experimental Casting Lab	644	Class 1	Sm Duct 1.2 Lg. Duct **5.2** GB-208 **25** GB-211 **67**	- Little or no loose contamination on room surfaces. - Fixed contamination on floors/walls. - High contamination levels in gloveboxes.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None suspected	- Standard Work Practice (Section 3.2.3) will be used. - Possiblly present in electrical equipment - to be sampled. - Vault on north end of room requires further radiological characterization. Room pasted as Airborne Radiation Area. - 90 Day Area.
	Room 152 Total Grams			98.4				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
153	Drum Staging Room	168	Class 1	None	- Little or no loose contamination. - Fixed contamination on floors.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None suspected	- Standard Work Practice (Section 3.2.3) will be used. - The Satellite Accumulation Area will be deleted during decommissioning.
Room 153 Total Grams				**0**				
153A	Compact Room	78	Class 1	None	- Little or no loose contamination on room surfaces. - Isolated locations of fixed contamination possible. - High contamination levels in gloveboxes.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Possibly present. - Additional sampling to be performed.	- Standard Work Practice (Section 3.2.3) will be used. - Room previously handled tritium contaminated waste.
Room 153A Total Grams				**0**				
153B	Downdraft Room	49	Class 1	Lg. Duct **0.6** Sm Duct **.1**	- Loose contamination present on room surfaces. - Respiratory protection required for entry. - Fixed contamination on floors.	*Floor/Wall/Ceiling materials* and piping insulation, possible ACM*. To be characterized.	- Possibly present. - Additional sampling to be performed.	- Standard Work Practice *(Section 3.2.3)* will be used.
Room 153B Total Grams				**.7**				
154	Plutonium Hydriding Lab	594	Class 1	GB-7248 equip148 GB-4933 equip40 GB-1363 equip97 GB-1364 equip92 Sm Duct .7 Lg. Duct **2.8** GB-1363 **209** GB-1364 **196** GB-1365 **106** GB-7248 **148** GB-4933 **40** All Others < LLD	- Loose contamination likely present in overhead. - Fixed contamination on floors/walls. - High contamination present under GB 1364 - 300,000 dpm/100cm sq. - High contamination levels in glovebox. - Contaminated oil in two vacuum pumps.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present due to be processing activities. - Additional characterization to be performed.	- Standard Work Practice (Section 3.2.3) ... - Known materials used in process - Plutonium, sulfamic acid, hydraulic oil, nitric acid, Tantalum, and other heavy metals.
Room 154 Total Grams				**1079.5**				
155	Plutonium Sample - Mounting Lab	460	Class 1	Sm Duct .1 Lg. Duct **0.4** GB-218 **15** GB-219 **7** GB-222 **42** All Others < LLD	- Loose contamination likely in overhead areas. - Fixed contamination on floors/walls. - High contamination levels in glovebox.	- Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized. - Transite Line Hood.	None	- Standard Work Practice (Section 3.2.3) will be used. - Acids residue inside hoods and gloveboxes. - The satellite accumulation area will be deleted during deactivation.
Room 155 Total Grams				**64.5**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
156	Calorimeter Room	176	Class 1	None	- Little or no loose contamination on room surfaces. - Fixed contamination possible on floors.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 156 Total Grams				**0**				
157	Tensile Testing Lab	690	Class 1	Sm Duct .9 Lg.Duct **3.7** All others < LLD	- Little or no loose contamination on floors/walls. - Fixed contamination on floors. - contamination present inside gloveboxes.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 157 Total Grams				**4.6**				
159	Waste Packaging	399	Class 1	Sm Duct 8.1 Lg. Duct **34.6**	- No loose surface contamination on room surfaces. - Isolated locations of fixed contamination on floors/walls.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used. - Satellite Accumulation Area.
Room 159 Total Grams				**42.7**				
160	Pyrochemical Development Facility	1650	Class 1	Lg. Duct **172.2** GB-857 **79** GB-865 **48** GB-859 **55** All Others < LLD GB-862/863 **23** Furnaces GB-862/863 **73** GB-857 **31**	- Widespread fixed contamination. - All electrical boxes posted internal contamination. - High Contamination levels inside gloveboxes. - Areas of loose surface contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used. '- Known materials used: Calcium oxide, magnesium oxide, magnesium chloride, sodium chloride and calcium chloride - RCRA Permitted Area GB-860. - Possibly present in electrical transformer equipment - to be sampled.
Room 160 Total Grams				**481.2**				
160A	Material Storage (Vault)	176	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 160A Total Grams				**0**				
161	Janitor Closet	145	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 161 Total Grams				**0**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
162	Machining Lab	984	Class 1	None	- No history of radioactive contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	Possibly present - Additional sampling required	- Standard Work Practice (Section 3.2.3) will be used. - Possibly present in electrical transformers, requires additional sampling.
Room 162 Total Grams				**0**				
163	Empty Drum Storage	88	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 163 Total Grams				**0**				
163A	Office		Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 163A Total Grams				**0**				
164	Hallway (Airlock)	56	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 164 Total Grams				**0**				
166	Entry Way	120	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 166 Total Grams				**0**				
167	Women's Locker Room	585	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 167 Total Grams				**0**				
167A	Women's Locker Room	100	ClaSs 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 167A Total Grams				**0**				
170	Dumb Waiter	16	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used. - Possibly present in electrical transforms, requires additional sampling.
Room 170 Total Grams				**0**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
171	Material Storage (Vault)	1102	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present due to storage of Beryllium parts. - Additional characterization to be performed.	- Standard Work Practice (Section 3.2.3) will be used.
Room 171 Total Grams				**0**				
172	Material Storage No Access		Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 172 Total Grams				**0**				
173	Utility Area	380	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 173 Total Grams				**0**				
201	Office	273	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 201 Total Grams				**0**				
201A	Office	294	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 201A Total Grams				**0**				
202	Office	130	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present - Additional characterization to be performed	- Standard Work Practice (Section 3.2.3) will be used.
Room 202 Total Grams				**0**				
202A	Office	260	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present - Additional characterization to be performed	- Standard Work Practice (Section 3.2.3) will be used.
Rom 202A Total Grams				**0**				
203	Office	143	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present - Additional characterization to be performed	- Standard Work Practice (Section 3.2.3) will be used.
Room 203 Total Grams				**0**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
204	Office	143	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present - Additional characterization to be performed	- Standard Work Practice (Section 3.2.3) will be used.
	Room 204 Total Grams			**0**				
204A	Office	104	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 204A Total Grams			**0**				
204B	Office	260	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 204 Total Grams			**0**				
205	Conf. Room	840	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 205 Total Grams			**0**				
206	Office	400	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 206 Total Grams			**0**				
207	Office	130	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 207 Total Grams			**0**				
207A	Office	120	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 207A Total Grams			**0**				
207B	Office	132	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 207B Total Grams			**0**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
207C	Office	143	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 207C Total Grams			**0**				
208	Office	740	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present - Additional characterization to be performed	- Standard Work Practice (Section 3.2.3) will be used.
	Room 208 Total Grams			**0**				
209	Office	400	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 209 Total Grams			**0**				
210	Vestibule To Restroom	16	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 210 Total Grams			**0**				
210A	Restroom	120	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 210A Total Grams			**0**				
211	Janitors Closet	40	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 211 Total Grams			**40**	**0**				
212	Office	88	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 212 Total Grams			**0**				
212A	Office	72	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 212A Total Grams			**0**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
213	Office	400	Class 3	None	- No loose surface contamination on room surfaces. - Fixed contaminations possible at isolated locations. - Vacuum pump oil - radioactively contaminated.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used. - Known materials used in room - Trichloroethane, Freon, Ethanol and Methanol
Room 213 Total Grams				0				
214	Office	400	Class 3	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 214 Total Grams				0				
215	Hallway (Airlock)	56	Class 1	None	- No loose surface contamination on room surfaces. - Fixed contaminations possible at isolated locations.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 215 Total Grams				0				
216	E & W Hallway	1971	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 216 Total Grams				0				
217	Gas - solid kinetic studies	627	Class 1	Sm Duct **.8** Lg. Duct **3.6** GB-330-371 **4** GB-963 **8** GB-964 **17** All others<LLD	- Vacuum pump, oil - radioactively contaminated. - Little or no loose contamination on floors/walls. - High contamination levels inside gloveboxes and surface analysis. - Fixed contamination present on floors.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used. - Deleted Uranium Storage Area. - Known materials used in room - trichloroethane, freon, ethanol and methanol.
Room 217 Total Grams				33.4				
218	Gas - solid kinetic studies	779	Class 1	Lg. Duct **2.4** GB-970 **11** GB-971 **25** All others<LLD	- Little or no loose contamination on floors/walls. - High contamination levels inside gloveboxes. - Fixed contaminations present on floors/walls.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used. - Room contains C0-60 shielded source. Known materials used in room - oils, solvents, trichloroethane, methanol, freon and ethanol. - CO 60 source (21,632 Curies) housed in the Gamma cell
Room 218 Total Grams				38.4				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
219	Gas - solid kinetic studies	124	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 219 Total Grams				**0**				
220	Gas - solid kinetic studies	820	Class 1	Sm Duct **2.6** Lg. Duct **10.9** GB-463 **60** GB-462 **70** GB-974 **68** All Others < LLD.	- Little or no loose surface contamination on room surfaces. - Fixed contamination at isolated spots up to 5000 dpm/cm sq. - High contamination levels inside glovebox.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 220 Total Grams				**211.5**				
221	Office/storage	285	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 221 Total Grams				**0**				
221A	Storage	88	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 221A Total Grams				**0**				
221B	Office/Storage	110	Class 1	None	- No loose surface contamination on room surfaces. - Know locations of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 221B Total Grams				**0**				
221C	Office/Storage	49	Class 1	None	- No loose surface contamination room surfaces. - Know locations of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 221C Total Grams				**0**				
222	Gas - solid kinetic studies	2040	Class 1	Sm Duct **8.7** GB-989 **14** GB-992 **21** Lg. Duct **37.3** GB-105 **35** GB-975 **62** All Others <	- Little or no surface contamination on surfaces. - Spots of fixed contamination labeled on floor up to 2000 dpb/100cm sq. - High contamination level inside gloveboxes.	Floor/Wall/Ceiling materials and piping insulation, possible ACM* - Transite inside hood	None	- Standard Work Practice (Section 3.2.3) will be used. - Known materials used in room - Plutonium, Uranium, Oils, Solvent, Inks, Trichloroethane, Methanol, Freon and Ethanol.
Room 222 Total Grams				**178**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
222A	Storage room	54	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 222A Total Grams			0				
223	Coating studies	348	Class 1	- Present in gloveboxes and ventilation duct.	- Little or no surface contamination on room surfaces. - Isolated locations of fixed surface contaminations. - Contamination present in hoods and vacuum systems.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present due to vapor deposition studies. - Additional characterization to be performed.	- Standard Work Practice (Section 3.2.3) will be used. - Known materials used in room - Plutonium, Uranium, Oils, Solvent, Inks, Trichloroethane, Methanol, Freon and Ethanol.
	Room 223 Total Grams			0				
224	Decon Room	80	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 224 Total Grams			0				
225	Coatings Lab	192	Class 1	None	-Fixed contaminations on floors. - Little or no loose surface contamination on room surfaces. - Uranium contamination present in welding and vacuum equipment.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	-Potentially present due to past operations. - Additional characterization to be performed.	- Standard Work Practice (Section 3.2.3) will be used. - Known materials used in room: Uranium, beryllium, nitric acid, and ethyl alcohol
	Room 225 Total Grams			0				
226	Stairway	190	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed contaminations.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 226 Total Grams			0				
228	Metallurgy Lab	1840	Class 1	Sm Duct **8.8** Lg. Duct **37.5** GB-199 **50** GB-202 **11** GB-192 **16** GB-203 **31** GB-468 **11** All Others < LLD.	-Little or no loose surface contamination on room surfaces. - Isolated spots of fixed surface contamination marked on the floor. - High contamination levels in gloveboxes and ventilated system.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present. - Additional characterization to be performed.	- Standard Work Practice (Section 3.2.3) will be used. - Known materials used in room: Plutonium, Uranium, Oils, Organic Solvents, Isopropanol, Diamond Paste and Freon.
	Room 228 Total Grams			165.3				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
229	Office	120	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated locations of low-level fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 229 Total Grams			**0**				
230	Office	128	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated locations of low-level fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 230 Total Grams			**0**				
231	Office	120	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated locations of low-level fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 231 Total Grams			**0**				
232	Office	108	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated locations of low-level fixed contamination	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 232 Total Grams			**0**				
233	Office	120	Class 1	None	- No loose surface contamination on room surfaces. - Possible isolated locations of low-level fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
	Room 233 Total Grams			**0**				
234	Metallurgy Lab	341	Class 1	Sm Duct .8 Lg. Duct- **3.5** B-Box-**6** GB-205 -**14** GB-205A -**35** GB-205B -**16** GB-205C- **34** All Others -< LLD.	- Little or no loose surface contamination on room surfaces. - Isolated spots of fixed surface contamination on floor. - Contamination present in metallography and gloveboxes.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present. - Additional characterization to be performed.	- Standard Work Practice (Section 3.2.3) will be used. - Known materials used in room: Plutonium, Oils, Organic Solvent, Isopropanol, Nitric Acid, Hydrofluoric Acid, Carbon Tetrachloride, and Freon. - Satellite Accumulation Area.
	Room 234 Total Grams			**109.3**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
234A	Met Lab	100	Class 1	None	- Little or no loose surface contamination on room surfaces. - Known spots of fixed contamination on floor. - Internal surfaces of gloveboxes contaminated.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present. - Additional characterization to be performed.	- Standard Work Practice (Section 3.2.3) will be used.
Room 234A Total Grams				**0**				
234B	Dark Room	210	Class 1	None	- Little or no loose surface contamination on room surfaces. - No known locations of fixed contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used. - Photo processing chemicals
Room 234B Total Gram				**0**				
235	Electron Microscope	120	Class 1	None	- Little or no loose surface contamination on room surfaces. - No known locations of fixed contamination. - Internal surfaces of electron microscope contaminated.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present inside EM and storage cabinets. - Additional characterization to be performed.	- Standard Work Practice (Section 3.2.3) will be used.
Room 235 Total Grams				**0**				
270	Poly Solid Studies	982	Class 1	Lg. Duct **8.0** GB-972 **9** All Others < LLD.	- Little or no loose surface contamination on room surfaces. - No know locations of fixed contamination on floors. - Contaminated glovebox internals.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present. - Additional characterization to be performed.	- Standard Work Practice (Section 3.2.3) will be used. Known Materials used in the room: Plutonium, Uranium, Oils, Solvents, Inks, Trichloroethane, Methanol, Freon, TF and Ethanol.
Room 270 Total Grams				**17**				
271	Vestibule Entry	367	Class 1	None	- Little or no loose surface contamination on room surfaces. - Isolated locations of fixed contamination possible.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	- Potentially present - Additional characterization to be performed	- Standard Work Practice (Section 3.2.3) will be used.
Room 271 Total Grams				**0**				
272	Gas Testing Electron Microscope	342	Class 1	None	- Little or no loose surface contamination on room surfaces. - No know locations of fixed contamination possible. - Contaminated glovebox internals.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 272 Total Grams				**0**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
273	Office/Storage	110	Class 1	None	- Little or no loose surface contamination on room surfaces. - No known locations of fixed contamination possible. - fixed contamination on box of electrical connections.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 273 Total Grams				**0**				
274	Office Storage	110	Class 1	None	- Little or no loose surface contamination on room surfaces. - Isolated locations of fixed contamination possible.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 274 Total Grams				**0**				
275	Office Storage	104	Class 1	None	- Little or no loose surface contamination on room surfaces. - Isolated locations of fixed contamination possible.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 275 Total Grams				**0**				
277	Office Storage/Hall	158	Class 1	None	- Little or no loose surface contamination on room surfaces. - Isolated locations of fixed contamination possible.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Room 277 Total Grams				**0**				
Building 729	Filter Plenum	2376	Class 1	All Others < LLD	- Possible high levels inside filter. - Plenum.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	Possibility present inside plenum to be confirmed.	- Temporary Ventilation will be required. - Standard Work Practice (section) will be used. - The filter plenum will remain in operation until all areas served have been cleaned up.
Bldg. 729 Total Grams				**0**				
Building 727	Emergency Diesel Generator	384	Class 3 (Class 1 exterior)	None	- No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (section 3.2.3) will be used. - Possibly present in electrical transformer equipment. To be confirmed.
Bldg. 727 Total Grams				**0**				
780	Storage Facility	128	Class 3 (Class 1 exterior)	None	- No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Bldg. 780 Total Grams				**0**				

* ACM = Asbestos Containing Material.

Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
780A	Metal Storage Facility	96	Class 3 (Class 1 exterior)	None	- No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Bldg. 780A Total Grams				**0**				
780B	Gas Bottle Storage Facility		Class 3 (Class 1 exterior)	None	- No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Bldg. 780B Total Grams				**0**				
782	Filter plenum	6600	Class 1	PL401-13 PL402-27	- No loose surface contamination on room surfaces. - Possible isolated locations of low level fixed contamination. - Possible high levels inside filter bank.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	Possibility present inside filter bank. To be confirmed.	- Standard Work Practice (Section 3.2.3) will be used. - The filter plenum will remain in operation until all areas served have been cleaned up.
Bldg. 782 Total Grams				**40**				
783	Cooling Tower Pump House	480	Class 3 (Class 1 exterior)	None	- No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Bldg. 783 Total Grams				**0**				
784	Cooling Tower Pump House		Class 3 (Class 1 exterior)	None	- No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Bldg. 784 Total Grams				**0**				
785	Cooling Tower Pump House		Class 3 (Class 1 exterior)	None	- No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Bldg. 785 Total Grams				**0**				

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Room/ Area	Description	Square Feet	Initial Survey Classification	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
786	Cooling Tower and West Chiller		Class 3 (Class 1 exterior)	None	- No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Bldg. 786 Total Grams				**0**				
787	Cooling Tower and East Chiller		Class 3 (Class 1 exterior)	None	- No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2.3) will be used.
Bldg. 787 Total Grams				**0**				
East Dock	Dock		Class 3	None	- No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (section 3.2.3) will be used.
Room East Dock Total Grams		**1965**		**0**				

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