NOTICE

All drawings located at the end of the document.

DRAFT

DECOMMISSIONING OPERATIONS PLAN

(DOP)

FOR THE BUILDING 779 COMPLEX

January 6, 1997

1/1/97

(DOP)
TABLE OF CONTENTS

4

1.0 INTRODUCTION AND SUMMARY

1.1 INTRODUCTION

On July 19, 1996 the Rocky Flats Clean-up Agreement (RFCA) was signed by DOE, Colorado Department of Public Health and Environment (CDPHE) and the Environmental Protection Agency (EPA). RFCA is the document which will govern the clean-up and decommissioning of the RFETS facilities through the CERCLA interim status removal process. The RFCA requirements for decommissioning at RFETS are being implemented by Kaiser Hill in their Decommissioning Program Management Plan and Department of Energy's (DOE) Decommissioning Program Plan (DPP). This Decommissioning Operations Plan (DOP) for the Building 779 Complex (see Figure 1.1 for cluster location) is the project plan which is used to describe how the RFCA and DPP requirements will be implemented to complete the Building 779 Cluster Decommissioning Project. The Building 779 Cluster Decommissioning Project will be completed over a three year time frame and a cost of approximately 8 million (unburdened) dollars.

1.2 779 CLUSTER DECOMMISSIONING SUMMARY

1.2.1 DOP Summary

The mission of Building 779 was primarily as a research and development (R&D) center, and an analytical lab in support of Pu operations. The Building did perform a limited amount of production activities. The major thrust of the R&D effort was metallography and welding, with the lab concentrating on metal analysis (see Appendix 1, Figure 1.2.3 & 1.2.4).

R &D Operations within Building 779 were curtailed in 1989. Since 1989 the 779 Complex has been maintained in a standby condition. With the change in mission of RFETS Building 779 was selected as the first building, which conducted plutonium operations, to be deactivated and decommissioned. This document (DOP) provides the administrative structure within which the decommissioning activities will be conducted.

The following provides a brief discussion of the DOP contents.

Section 1 provides an introduction to the governing documents for decommissioning at RFETS and a summary of Building 779 history facility layout and operations. Detailed information on the various room/areas associated with the 779 Cluster are presented in Appendix1.

Section 2 identifies the organizational structure, responsibilities and lines of communication which will be used to complete the 779 Cluster decommissioning activities.

Section 3 presents a description of the areas to be decommissioned and planned decontamination/decommissioning activities. First it provides a description of the R&D process and associated equipment which are in Building 779 and some of the major hazards which will be considered during the work planning process. Second, 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 2), and the control mechanisms built into the process which will ensure protection of the workers, public and environment.

Section 4, briefly describes the facility characterization process and the identified hazards within the 779 Cluster. The characterization information is required to properly plan the decommissioning activities. The specific characterization information is provided in a summary format in Appendix 3. Appendix 3, in a summary fashion, demonstrates how characterization information will be used to assess a specific room/work area hazard during work package preparation.

Section 5 establishes the criteria which will be used to demonstrate the criteria which will be used to demonstrate the 779 Cluster buildings have been adequately decontaminated and they are ready to be dismantled.

Section 6 is a discussion of how the nuclear safety operational controls will be reduced during the decommissioning process as the hazards within the 779 Cluster are reduced.

Section 7 identifies the documents and controls which will be used, 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 the assigned tasks and while being properly protected from potential hazards in the work area.

Section 8 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 9, describes the CERCLA process which governs the project controls and execution. This section states the specific regulations and statutes which are applicable or appropriate and relevant to the project.

Section 10, establishes the quality controls and management attributes which will be implemented during the decommissioning process.

Section 11 provides an overview of the security requirements for the 779 cluster.

Appendix 1 established a baseline knowledge of the 779 Cluster facilities and systems.

Appendix 2 is an overview of decontamination techniques which may be used during the e779 Cluster decommissioning.

Appendix 3 cross references the characterization information to the type of work which will be completed in each area.

1.2.2 Building 779

Building 779 was originally constructed in 1965, with additions in 1968 and 1973.

The additions are referred to as Building 779-A, and Building 779-B. Since all three buildings are physically connected, and share resources and mission, any reference to Building 779 should be understood to include all three buildings.

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 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.

A more detailed description of Building 779 is contained in Appendix 1.

1.2.3.1 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 as 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 72ft. x 38ft. 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):

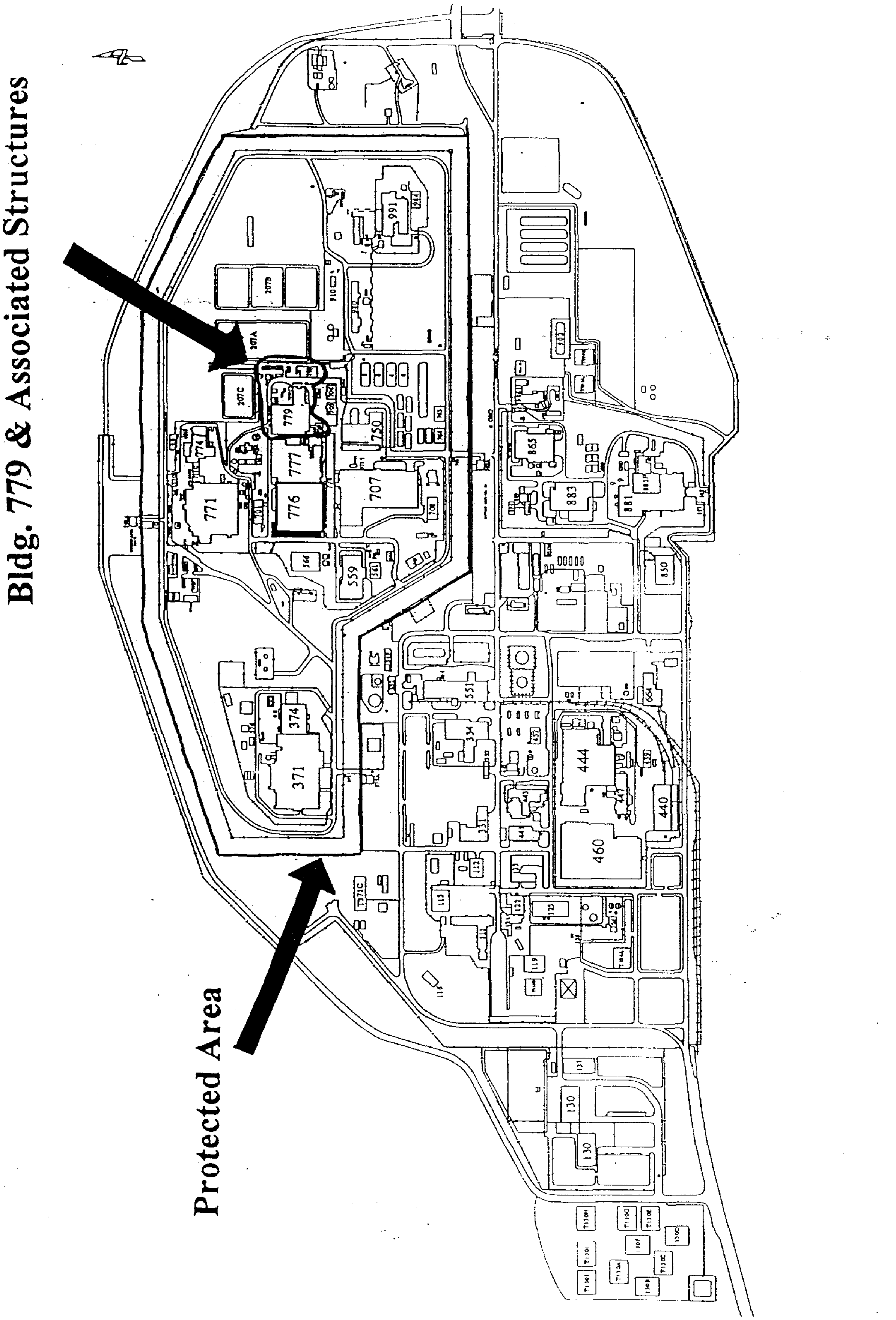
Building 783 - Cooling Tower Pump House
Building 784 - Cooling Tower
Building 785 - Cooling Tower
Building 786 - Cooling Tower West Chiller
Building 787 - Cooling Tower East Chiller
Building 780 - Paint/Storage Facility
Building 780-A - Metal Storage Facility
Building 780-B - Gas Bottle Storage Facility

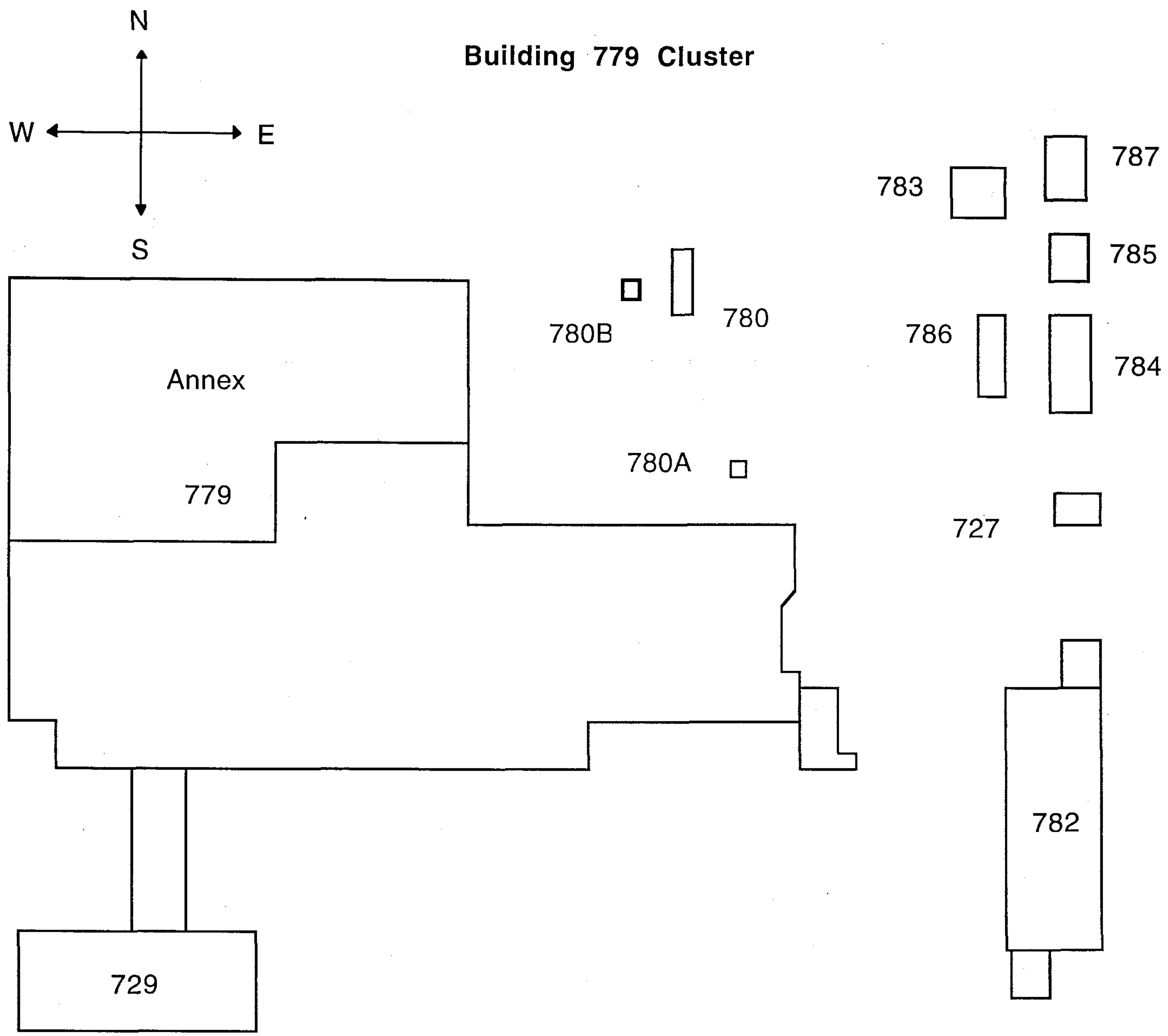
1.2.4 Facilities Descriptions

A through description of the 779 Cluster work areas is provided in Section 3.0 and Appendix1.

BUILDING 779 CLUSTER D & D AREA

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

2.0 779 DECOMMISSIONING ORGANIZATION AND RESPONSIBILITIES.

2.1 ORGANIZATION

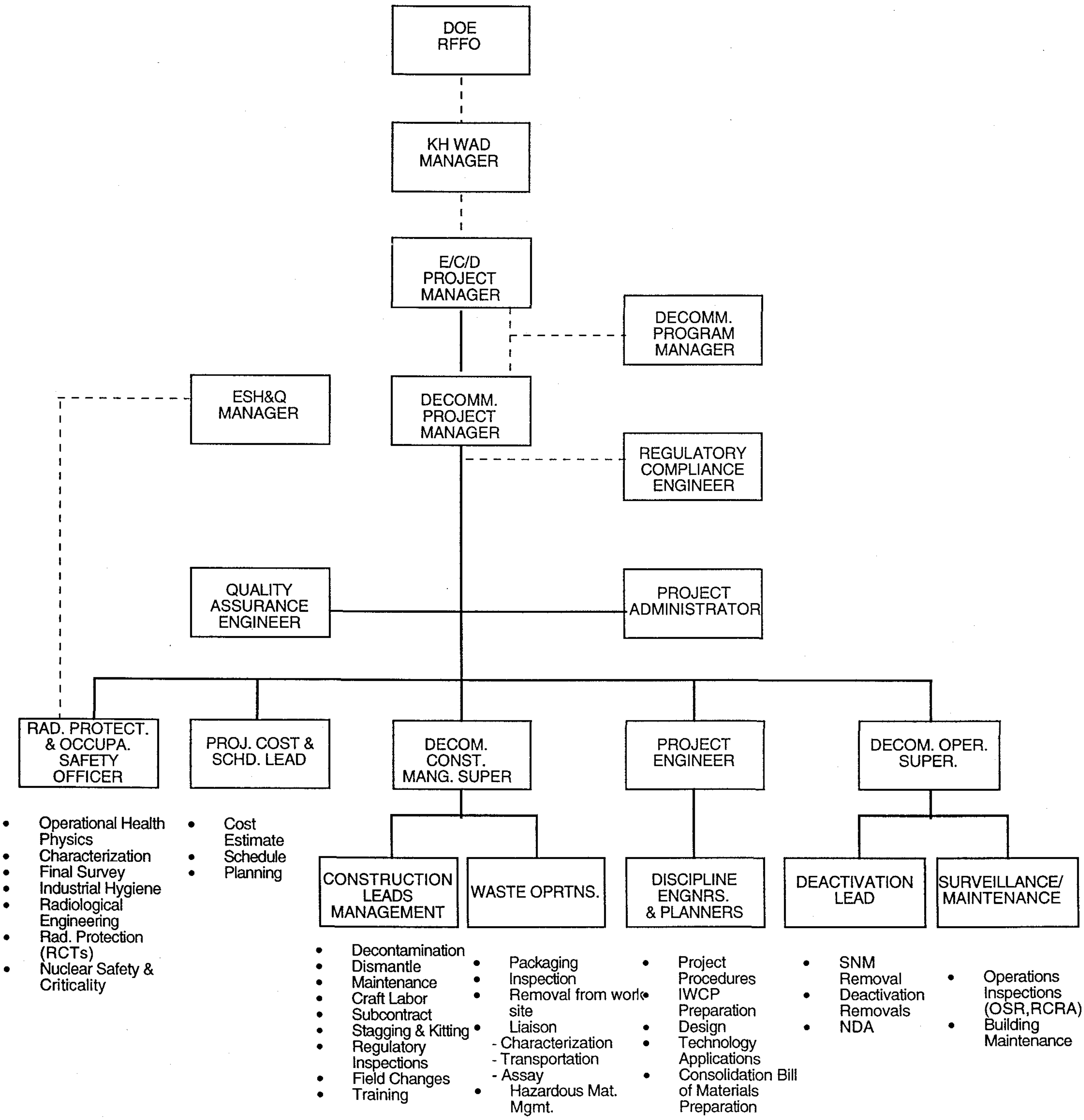
The 779 Cluster Decommissioning activities will be controlled within a Rocky Mountain Remediation Service (RMRS) project organization with Kaiser Hill integration and DOE oversight. The planned RMRS organization structure, which is subject to change, is illustrated in Figure 2.1. The personnel assigned to the various positions discussed in this section are matrixed from their respective support organization to work within the project organization. The matrixed individuals maybe assigned part time or full time depending on the requirements of the project. The project personnel report to the Project Manager for all project related matters. If technical issues can not be resolved within the project organization, additional assistance will be requested from support organization(s).

2.1.1 Project Manager (PM)

The Building 779 Cluster Decommissioning Project Manager reports to the Engineering/Construction/Decommissioning (E/C/D) Manager and is responsible for overall management of the project. To carry out this function the Project Manager is responsible for and has the authority for the development, execution, supervision, coordination and integration of all aspects of the decommissioning project's planning, staffing, management and operations activities. All project aspects will be completed under his direction or designated individual.

Typical decommissioning activities which will be managed within the project include the following:

- Establishing a decommissioning training requirements matrix and identifying responsibilities to ensure project personnel are properly trained.
- Establishing/verifying industrial and radiological safety plans and controls are in place to support the projects activities.
- Verify project support is available to ensure project activities are completed in accordance with applicable quality assurance requirements.
- Establish a mechanism to have periodic quality assessments of the projects records and activities.
- Establishing a cost control program which will adequately collect project costs to ensure proper fiscal management of the project.
- Verify/establish interface with Radioactive Waste Management organization to ensure the project is supported, so that, the projects' waste is properly inspected, packaged, assayed, stored and available for off site shipment.
- Direct the project team to implement the execution of project planning and field activities.
- Delegate responsibilities for achieving specific technical criteria, completing required reviews, and other related activities to project personnel.
- With the assistance of project team members, establish the detailed scope and sequence of work.


DOE RFFO
KH WAD MANAGER
E/C/D PROJECT MANAGER
DECOMM. PROGRAM MANAGER
ESH&Q MANAGER
DECOMM. PROJECT MANAGER
REGULATORY COMPLIANCE ENGINEER
QUALITY ASSURANCE ENGINEER
PROJECT ADMINISTRATOR
RAD. PROTECT. & OCCUPA. SAFETY OFFICER
PROJ. COST & SCHD. LEAD
DECOM. CONST. MANG. SUPER
PROJECT ENGINEER
DECOM. OPER. SUPER.
• Operational Health Physics
• Characterization
• Final Survey
• Industrial Hygiene
• Radiological Engineering
• Rad. Protection (RCTs)
• Nuclear Safety & Criticality
• Cost Estimate
• Schedule
• Planning
CONSTRUCTION LEADS MANAGEMENT
WASTE OPRTNS.
DISCIPLINE ENGNRS. & PLANNERS
DEACTIVATION LEAD
SURVEILLANCE/ MAINTENANCE
• Decontamination
• Dismantle
• Maintenance
• Craft Labor
• Subcontract
• Stagging & Kitting
• Regulatory Inspections
• Field Changes
• Training
• Packaging
• Inspection
• Removal from work site
• Liaison
- Characterization
- Transportation
- Assay
• Hazardous Mat. Mgmt.
• Project Procedures
• IWCP Preparation
• Design
• Technology Applications
• Consolidation Bill of Materials Preparation
• SNM Removal
• Deactivation Removals
• NDA
• Operations Inspections (OSR,RCRA)
• Building Maintenance

- With the assistance of applicable project team members, develop the project budget and schedule.
- Establish/verify mechanism to obtain reports for analyzing project costs and schedule. Take appropriate action to minimize cost and schedule variances.
- Maintain chronological record of the project's history.
- The Project Manager is also the Facilities/Building Manager as assigned responsibilities in the RFETS Conduct of Operations Manual (COOP).
- Work with the Regulatory Compliance Engineer to ensure all project activities are completed within the requirements of applicable regulations.

2.1.2 Radiation Protection and Occupational Safety Officer (RPOSO)

The RPOSO reports to the Building 779 Cluster Decommissioning Project Manager for priorities of day to day project related activities. The RPOSO has responsibility for facility characterization, implementation of the RFETS Radiological Control Manual and final survey development and implementation. The RPOSO will maintain a direct reporting relationship to the RMRS Health and Safety Manager and the Kaiser Hill Radiation Protection Manager for ensuring Project activities are compliant with applicable health and safety regulations and requirements. This duel reporting relationship will allow independence of perceived project pressures due to schedule and funding demands.

The RPOSO (Radiation Protection and Occupational Safety Officer) responsibilities include:

- Monitoring/Review of building and project safety criteria to ensure activities are being completed within the correct authorization basis.
- Ensure an effective radiation protection program is implemented as required by the RFETS Radiological Control Manual and associated implementing procedures.
- Complete ALARA reviews with assistance of project Radiological Engineers.
- Ensure OSHA requirements are factored into project work packages.
- Coordinate activities and priorities of Radiological Engineers (RE) and Radiation Control Technicians (RCT).
- Ensure adequate preparation and review of radiation work permits.
- Coordinate the completion of routine building radiation surveys and project related surveys and characterizations.
- Assist in developing project completion survey requirements to ensure compliance with established project endpoint criteria.
- Maintain/Manage & verify quality of all radiological data.
- Coordinate completion of project completion surveys.
- Work with the Regulatory Compliance Engineer to ensure all project activities are completed within the requirements of applicable regulations.

2.1.3 Decommissioning Construction Management Superintendent

The Decommissioning Construction Management Superintendent reports to the PM and is responsible for managing the decommissioning team, (labor and supervision) in completing the decommissioning activities which include the decontamination of surfaces, structures, materials, and equipment, the decommissioning activities of any sub-contract work, the movement, packaging and storage of wastes on-site; the monitoring of performed work against plan and for maintaining time records of the operating staff. The Decommissioning Construction Management Superintendent is also responsible for ensuring that activities are performed in accordance with applicable IWCP procedures, including tasks plans, radiation work permits, and safety requirements.

Specific responsibilities of the Decommissioning Construction Management Superintendent are:

- Review of project scoping and engineering design documents, (i.e. EOs, HASP, IWCPs, Characterization Records);
- Review and approval of pre-evolution requirements including job safety analysis, RWPs training documentation, sub-contractor planned activities.
- Compliance with Conduct of Operations during field operations.
- Acquire and manage craft labor for decommissioning, decontamination, and waste handling activities.
- Manage the day-to-day activities of subcontract personnel.
- Maintaining daily log book.
- Reviewing out of tolerance documentation.
- Ensuring personnel maintain required training certification
- Conducting daily/weekly project status and training meetings.
- Completing occurrence notifications.
- Providing support for development of compliance documentation and project close-out.
- Work with the Regulatory Compliance Engineer to ensure all project activities are completed within the requirements of applicable regulations.

2.1.4 Project Administrator

The Project Administrator reports to the Project Manager. The Project Administrator is responsible for establishing and maintaining the project files which will include all documentation relating to the project. The Project Administrator will also provide clerical and secretarial help to the project manager. The Project Administrator will provide a copy of all project documents to the Administrative Record for distribution.

2.1.5 Project Cost and Schedule

The Project Cost and Schedule Lead reports to the Project Manager and is responsible for establishing, maintaining, and reporting project cost and performance utilizing the computerized Primavera system. The project cost and schedule Lead is responsible for generating status reports and schedules as requested by the Project Manager.

2.1.6 Quality Assurance Engineer

The QA Engineer is responsible for performing assessments and surveillance of project activities; inspections of selected activities; assists in training project personnel on quality control requirements, concurrence of the disposition of non-conformance reports and reviews of project procedures for quality requirement by providing quality related input. The QA Engineer is also responsible for initiating discrepancy reports, non-conformance reports, corrective action requests, and reviewing worker training records to ensure workers are appropriately trained. The QA Engineer receives direction from the PM regarding project priorities. QA Engineer reports to and receives technical direction from the QA Manger.

2.1.7 Project Engineer (PE)

The PE is responsible for completing engineering activities supporting the decommissioning project. The PE is responsible for complying with Engineering Department Procedures applicable to the project scope of work. He/she receives daily project direction from the PM and reports to the Engineering Manager for technical overview.

Responsibilities include the following:

- Developing, reviewing, and approving reports and studies for technical quality.
- Developing, reviewing, and approving project specifications and material requisitions.
- Approval disposition of non-conformance reports
- Writing and approving design changes (Field Change Requests/Field Change Notices, FCR/FCN) required during the decommissioning project.
- Exercises operational supervision over the engineers of all disciplines assigned to the project or in support of the project.
- Directing and coordinating engineering activities for the project.
- Assistance in establishing the detailed project scope, work plans and procedures.
- Developing, reviewing and approving engineering orders (EOs) and IWCP work packages.
- Reviewing engineering and IWCP work packages to ensure they are in conformance with applicable administrative requirements.
- Compilation of BOM and oversight of Procurement activities.
- Work with the Regulatory Compliance Engineer to ensure all project activities are completed within the requirements of applicable regulations.

2.1.8 Decommissioning Operations Superintendent

The Decommissioning Operation Superintendent reports to the Project Manager and is responsible for:

- Scheduling all surveillance and RCRA inspections.
- Completing any operations surveillance or requirement inspections.
- Coordinating any building maintenance with decommissioning activities.
- Coordinating deactivation activities with decommissioning activities.
- Coordinating NDA analysis with other building activities.
- Coordinating special nuclear material consolidation activities with other building activities.
- Coordinate and maintain all shift manager responsibilities.
- Maintain lock out/tag out log.
- Ensure compliance with Conduct of Operations requirements.
- Work with the Regulatory Compliance Engineer to ensure all project activities are completed within the requirements of applicable regulations.

2.1.9 Regulatory Compliance Engineer

The Regulatory Compliance Engineer reports to the Project Manager and is responsible (working with the PM) to ensure the project activities are conducted in a manner to maintain compliance with applicable environmental and regulatory requirements as identified in RFCA and Section 8 of this document. The Regulatory Compliance Engineer will review IWCPs and change work processes as necessary to ensure the projected work is completed within existing permit requirements or he will have the permits issued/ modified to include the proposed work. The Regulatory Compliance Engineer is the Project Managers' primary interface with state and federal regulations. The Regulating Compliance Engineer will track all regulatory commitments and coordinate their completion.

3.0 Area Descriptions And Planned Activities

3.1 Area Descriptions

The information provided in this section gives a brief description of the processes which were performed in Building 779 and establishes the current condition within each of the work areas by providing an area by area description. The room descriptions and characterization information (Section 3.1.2 and Appendix 3) is used during the work package development discussed in Section 3.2.

3.1.1 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 types of processes, equipment, and hazards that may be encountered during building decommissioning. 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

3.1.1.1 Process Chemistry Technology

The chemistry laboratories in Building 779 were engaged in production processes 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.

3.1.1.1.2 Ion Exchange Technology

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

3.1.1.1.3 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.

3.1.1.1.4 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 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.

3.1.1.1.5 Thermogravimetric Analysis

Equipment is in place which was used for characterizing solids and their interactions and reactions with solids and vapors at subatmospheric 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.

3.1.1.1.6 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.

3.1.1.1.7 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.

3.1.1.1.8 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.

3.1.1.1.9 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 and 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.

3.1.1.1.10 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.

3.1.1.1.11 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 electrorefining.

Molten salt extraction was performed to remove impurities (i.e., 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 molten salt extraction were melted and combined with calcium metal to reduce the plutonium and americium contained in the salt to pure metal form. A calcium/plutonium/americium alloy resulted, along with the purified salt. The salt was either reused or disposed of if plutonium levels were low enough. The metal alloy button was further treated by vacuum melting, which drove off the more volatile nonradioactive metal components, resulting in a purified plutonium/americium button, which could be separated by a variety of processes, including molten salt extraction as described above.

Direct oxide reduction was a one-step process for converting plutonium oxide into plutonium metal. PuO2, 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 then poured into mold and allowed to cool. Breakout of the cooled contents yielded a plutonium metal button and a discardable salt.

Electrorefining 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.

3.1.1.2 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 by the group 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.

3.1.1.2.1 Machining And Gauging

Machining operations within the buildings were conducted in three shops, two general machine shops and a general machining laboratory located in original Building 779 and in Building 779-2.

One 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, bandsaw, surface grinder, monoset grinder, and tool grinders.

3.1.1.3 Joining Technology

Joining Technology activities were conducted in original Building 779 and in Building 779-2. There was only one Joining area for the handling of nuclear material, which was in Building 779-2.

19

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.

3.1.1.4 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 dehydrided 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.

3.1.2 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. Note that these room descriptions are a snap shot in time. Deactivation activities to remove chemicals and other material is continuing. The walkdowns discussed in section 3.2.2 will re-verify room status prior to starting decommissioning work. The descriptions which follow are not all inclusive but, do cover the areas with the most potential for risk. Rooms not identified in this section are listed in Appendix 3.

3.1.2.1 B779, Room 123

Room 123 is a decontamination room and likely has contamination in the process drains leading from the room.

Room 123 will be emptied of any miscellaneous equipment and systems. The room surfaces will be decontaminated using one of the dry processes described in Appendix 2, (i.e., scabbling). The process drain will be surveyed and removed if found to be contaminated.

3.1.2.2. B779, Room 124

This room was a Radiation Control Technician (RCT) office. Radiation sources were stored in lockers in the center of the room.

3.1.2.3 B779, Room 125

This room was an RCT office. This room had radiation sources.

3.1.2.4 B779, Room 126

Room 126 is a utility area. Initial surveys indicate there are no appreciable amounts of plutonium in this area. The room has gloveboxes connected to the house vacuum and batteries for uninterrupted emergency power supply (UPS). The gloveboxes are clean or have low levels of contamination. 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 qualified under the Resource Conservation and Recovery Act (RCRA), this tank has been flushed, triple rinsed and 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.

3.1.2.5. B779, Room 127

Room 127 is a utility room containing chillers and part of the filter plenum. The filter plenum is contaminated and there is asbestos in the room. The chillers are expected to be uncontaminated.

3.1.2.6 B779, Room 128

Room 128 was used for repair of radiation instruments. Radiation sources were stored in this room.

3.1.2.7 B779, Room 131

Room 131 was an aqueous lab supporting pyrochemical technology.

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

Gloveboxes 131-A through E (GB-1B1C is a B-box) form an aqueous line. Various aqueous processing was performed ranging from cleaning tantalum stir rods with HCL to ion exchange. The boxes are lined with lead which has been epoxied on. 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 contain additional chemicals and supplies.

3.1.2.8 B779, Room 132

Room 132 housed an auger spectrometer which is no longer there. Room 132 is now being used as a calibration room/office. Sources were stored in a cabinet on the south wall, but have now been removed.

3.1.2.9 B779, Room 133

Room 133 was a lab for research and development (R & D) of pyrochemical processes. A number of small and medium scale furnaces were used for these operations, including Direct Oxide Reduction (DOR), Electrorefining (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 was never used. It is lined with lead which has been epoxied on. The glovebox is believed to contain very low levels of contamination. There is a covered well in the bottom of the box.

Glovebox 954 is lead-lined with the lead bolted on. 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 995 is lead-lined with the lead bolted on. 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 70's and 80's to remove americium.

Glovebox 956 has two story stationary furnaces with wells on the south and north end of the glovebox. The box is lead-lined with the lead shielding screwed on. In the middle of the box is an old furnace well underneath the box with a flat plate welded into the floor. The glovebox potentially is contaminated inside. 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. Glovebox 958 went into service in 1985.

Glovebox 959 is lined with lead which has been epoxied on and it has two furnace wells. There is an empty storage rack at the south end which can hold ten containers. The rack has three lower storage positions and four 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 contaminated.

There are four control panels on the west wall which may be internally 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.

3.1.2.10 B779, Room 134

Room 134 contained three flammable chemical storage cabinets containing chemicals.

3.1.2.11 B779, Room 135

Room 135 was used for storage by the RCT's.

3.1.2.12 B779, 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 denitration.

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 & 5 contained 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 enchant 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. 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 build-up on the floor of the recess.

3.1.2.13 B779, Room 138

Room 138 was used to store excess chemicals. Routine surface contamination surveys indicate no loose contamination is present in the room.

3.1.2.14 B779, Room 139

Room 139 was a soil analysis lab. It has extremely low levels of contamination.

Cabinet one contains equipment. Cabinet two through eight contain chemicals. The cabinet on the south wall next to the sink has contaminated soil samples on top of the cabinet. The sump pump under the sink has been tripled rinsed.

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

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

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

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

Box 139-3 has 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.

3.1.2.15 B779, 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 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.

3.1.2.16 B779, Room 140A

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

3.1.2.17 B779, Room 140B

Room 140B houses a scanning electron microscope (SEM). The SEM was used to analyze coated samples, such as saltcrete and cement. The SEM is not believed to be contaminated.

3.1.2.18 B779, Room 141

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

3.1.2.19 B779, Room 141A

Room 141A has 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.

3.1.2.20 B779, Room 141B

Room 141B has a scanning electron microscope (SEM). The SEM is not believed to be contaminated.

3.1.2.21 B779, Room 141C

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

3.1.2.22 B779, Room 142

Room 142 is a building utilities room. Room 142 was a RCRA storage unit for waste oil.

3.1.2.23 B779, Room 171, 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 contaminated.

3.1.2.24 B779, Room 217

Room 217 contains a contaminated auger and surface analysis The Electron Spectroscopy for Chemical Analysis (ESCA) was attached to a relatively new (late 1980's) stainless steel, non-lead-lined glovebox (Glovebox 330-371).

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

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

Glovebox 330-371 is unleaded. The glovebox contains miscellaneous tools and an auger which is internally contaminated. 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.

3.1.2.25 B779, Room 218

Hood 218SE is located on the southeast side of room 218. Hood 218SE is contaminated and houses a microbalance. There is a vacuum pump under the hood which is likely to have internal 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 218SW was used for preparing polymer and cementation samples which were slightly contaminated. 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. Glovebox 970 is highly contaminated. 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 contamination. There is an empty three position storage rack, miscellaneous tools, and a balance inside the glovebox. The filter (inside the glovebox) 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 a reaction vessel.

In the northwest corner of room 218 sits a Gamma Cell which has a cobalt 60 source. The cobalt 60 source was used for materials radiation studies.

3.1.2.26 B779, 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 (ie: 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 on. 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 on. GB-974 was used for plutonium studies. GB -974 contains a 3 position heat detector and contains miscellaneous equipment and tools.

There is a vacuum system connected to the glovebox which is contaminated. The glovebox has an airlock. Several cabinets on the south end of the room contain glassware and supplies.

3.1.2.27 B779, Rooms 221A, 277, 275, 274

Rooms 221A, 227, 275 and 274 were used as office and study areas. The rooms contain miscellaneous furniture and equipment.

3.1.2.28 B779, Room 221B

Room 221B was used as a storage area.

3.1.2.29 B779, 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, check weights, 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. There is a vacuum system (disconnected) under the glovebox airlock. The vacuum chamber is contaminated internally.

Glovebox 976 (GB - 976) was used to complete some R &D studies on reactive species. Glovebox 976 contains a 3 position heat detector, a vacuum furnace, balance, and miscellaneous tools. There is a vacuum line from the airlock with no 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 on. The box is not contaminated and is out of service. There are no gloves on the box. The glovebox is coated inside and there is an empty 3 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. These were for research and both boxes are 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 contaminated.

B-box 981 was not used very much but the glovebox is contaminated. The box is non-lead-lined.

Glovebox 980 (GB-980) is a nitrogen inert glovebox with an automatic dump valve and flow through system. There may have been some 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 there are items in the airlock. Beneath the box is an air sample bottle connected to piping entering the box.

B-box 105 is contaminated and was used as an entry for gloveboxes 105 and 106.

Glovebox 105 (GB-105) was used for plutonium studies. The glovebox is lead-lined with the lead bolted on and lead taped. The glovebox 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 contaminated and 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 contamination inside the hood. There are also some glass, and supplies underneath the hood.

Glovebox A60 was designed for gas and solid reactions. Contamination levels inside A60 should be very low. The box is lead-lined with the lead bolted on. The glovebox contains miscellaneous tools. An airlock is attached. There is a vacuum pump under the box which is likely to have internal contamination.

Glovebox (GB -983) was used for compatibility studies and is not expected to be contaminated. The glovebox is non-lead-lined. This glovebox has gloveports in 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 on.

Glovebox 017 is contaminated.

Glove box 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 3 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.

GB-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 contamination and has not been used since 1969.

Glovebox 230 (GB-230) is blanked off but contaminated. The bolts are silicone sealed. The box is lead-lined and the lead is bolted on. 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.

Glovebox 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 and there is an empty airlock. The glovebox vacuum pump is under the glovebox and is likely to have internal contamination.

Glovebox 992 (GB-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 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 (GB-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.

3.1.2.30 B779, Room 223

Hood 223-1 was used for beryllium work. The floor in front of the hood is contaminated and there is probable 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 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.

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.

3.1.2.31 B779, Room 225

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

3.1.2.32 B779, Room 228

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

Glovebox 045 (GB-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 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.

GB-192 contains six tube furnaces and miscellaneous tools. Four of the furnaces appear to be dated and could contain asbestos. The glovebox has an airlock.

Glovebox 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 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 on. Glovebox 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 contamination. There are two pass-throughs, one to Room 234 glovebox 205, and one to glovebox 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. The glovebox has a pass-through to room 234, glovebox 205C.

Glovebox 200 contains a tube furnace on the west end and a constant temperature bath. On the east end there is 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 internally contaminated.

GB-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 contaminated.

3.1.2.33 B779, Room 233

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

3.1.2.35 B779, Room 234

The room 234 gloveboxes (205A, B, C, D) were used for plutonium sample preparation as described below:

Glovebox 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 contamination is present. The floor below the metallographs also has radioactive contamination.

The room's refrigerator was used to store chemicals for photo 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.

3.1.2.35 B779, 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.

3.1.2.36 B779, Room 234B

This room was used as a dark room. There is no expected contamination in this room.

3.1.2.37 B799, Room 235

Room 235 has a TEM (transmission electron microscope). It is not anticipated that the unit has been radioactively contaminated.

3.1.2.38 B779, Room 270

In the southeast corner of Room 270 is a ESCA used for surface analysis. Glovebox 2115 was not used and should not be 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 contaminated). B-box 270 N is empty, but the B-box is contaminated with U-235. Glovebox 3072 is contaminated with V-235 and has some tools remaining inside the glovebox.

3.1.2.39 B779, Room 271

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

3.1.2.40 B779, Room 272

Room 272 was a testing laboratory. The center glovebox 6620 is uncontaminated. Glovebox 6621 was used to support testing and is plutonium contaminated.

3.1.2.41 B779, Room 273

Room 273 has fixed contamination on a box of electrical connectors.

3.1.2.42 B779, Room 147

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

3.1.2.43 B779, Room 150

Room 150 contains equipment used for welding and supercritical CO_2 cleaning. The room equipment includes 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, -S, and -W) connected to the building ventilation system. It is thought that minimal radiation operations were performed in this room. The possibility exits for contamination.

3.1.2.44 B779, Room 152

Glovebox 208 was deactivated in 1995. Glovebox 208 is 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 has been deactivated. Glovebox 211 is lead lined and epoxied and 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 contamination posting in the northwest corner of the room.

3.1.2.45 B779, Room 153

Room 153 was used for drum storage and had one RCRA drum storage location to collect leaded gloves. This room also contains a trash compactor.

3.1.2.46 B779, 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.

3.1.2.47 B779, Room 153B

Room 153B is a down draft room. Room 153B was used to open contaminated/potentially contaminated enclosures and for repackaging drums.

3.1.2.48 B779, Room 154

Room 154 was used for hydriding and dehydriding of plutonium.

Gloveboxes 1363 (GB -363) and 1364 (GB-1364) is where hydriding/dehydriding was accomplished. Glovebox 7248 (GB -7248) is lead lined which is bolted on. Lead tape has also been used. This glovebox contains three furnaces.

There is a vacuum pump underneath GB-1364 which has internal 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 (GB -1363) is lead lined which is bolted on. Lead tape has also been used. GB -1363 contains two furnaces and has an airlock at the south end. There are two internally contaminated vacuum pumps which were used to support GB-1363 operations. 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 (GB -1365) has bolted on lead lining with lead tape. The glovebox contains miscellaneous jugs and containers. The vacuum pump has a line to the airlock located on the north end. The criticality drain on GB-365 is painted with magenta paint indicating fixed contamination.

Glovebox 4933 (GB -4933) has bolted on leading lining with lead tape over seams. The glovebox has a three space heat detector and hot plate. The glovebox internal surface is coated.

3.1.2.49 B779, Room 155

Room 155 was a plutonium sample-mounting laboratory supporting auger spectroscopy. Room 155 had 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 is internally contaminated.

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

Glovebox 206-223 contains a polishing lap, miscellaneous tools and bushings. There are two vacuum pumps underneath glovebox 206-223, which access glovebox 222. The vacuum system is internally contaminated. There is a criticality drain which 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 contamination on the shelf in front of the B-box.

3.1.2.50 B779, Room 156

Room 156 is a calorimeter room. The calorimeter and two portable air handlers (which are contaminated) which remain in the room. The air handlers have been wrapped in plastic and tape.

3.1.2.51 B779, Room 157

Room 157 was used for various materials testing.

Glovebox 223 (GB-233) houses a 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 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.

3.1.2.52 B779, Room 159

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

3.1.2.53 B779, Room 160

This room was retrofitted in the early 1980's as a pyrochemical development facility. Operations that took place in this room included Direct Oxide Reduction, Molten Salt Extraction, Electrorefining 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 to fix any residual contamination remaining.

Glovebox 865 has a bolted lead lining. There are two stationary furnaces in this glovebox. Contamination exists on all internal surfaces of the glovebox and there is a vacuum pump located underneath the glovebox which is internally contaminated.

Glovebox 867 is radioactively uncontaminated (never used). The door to the main line is blanked off. This box is labeled as being out of service. It's lead lining is epoxied on. There are leaded glass windows over the plexiglas.

Glovebox 863 (GB-863) has a lead lining which is epoxied onto the glovebox. Attached toGB-863 box is a chainveyor for moving materials between boxes.

There are two stationary furnaces in this glovebox. The glovebox contains miscellaneous tools and a furnace lid in the south end.

Glovebox 866 (GB-866) has a lead lining which is epoxied onto the glovebox. This glovebox has two wells intended for calorimeter. The glovebox is connected to glovebox 863 by an intact rubber blank. The glovebox should be uncontaminated.

Glovebox 857 (GB-857) has a lead lining which is epoxied onto the glovebox. 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 contamination.

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

Glovebox 860 (GB-860) is an SNM storage box. It is water walled with lead epoxied on the front of the box. GB-860 contains a 32 position storage rack.

GB-859 was the glovebox used for removing buttons and salts from crucibles. GB-859 has a lead lining which is epoxied onto the glovebox. 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 (GB-864) has a lead lining which is epoxied onto the glovebox. 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 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.

3.1.2.54 B779, Room 160A

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

3.1.2.55 B779, Room 163

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

3.2.2.56 B779, Other Rooms

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

3.1.2.57 Building 729

As described in Appendix 1 (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 4 stage glovebox exhaust plenum system and the two stage building exhaust system.

The sources within Building 779 will all be removed before the filter plenums in Building 729 are disabled. Temporary ventilation will be provided, as necessary to supplement the Building 729 ventilation system during the decommissioning process. In addition the general decommissioning steps will be used in the Building 729 decommissioning process. No special activities are required in the remainder of Building 729 during decommissioning.

3.1.2.58 Building 782

As described in Appendix 1, (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 fire water collection tank. As with Building 729, the plenum filters in Building 782 are expected to be contaminated.

3.1.2.59 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.

3.1.2.60 Other Cluster Buildings

Building780	Paint/Storage Facility.
Building780A	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 contamination is expected to be found in any of these buildings.

3.2 Decommissioning Overview

This section provides a general description of the sequential steps which will be followed to decommission rooms/areas within the 779 Cluster. If a unique condition exists within a specific work area/component which requires special decommissioning techniques a brief summary of the proposed decommissioning approach is provided in Appendix 3. The detailed technical approach to decommission an area/room of the cluster will be developed and approved in accordance with the Integrated Work Control Package (IWCP) process. The IWCP contains detailed instructions on the sequence of decommissioning operations with specific controls and requirements to ensure protection of the workers, public and environment.

3.2.1 Objectives

The Engineering approach is based on achieving the following objectives:

1.) Maximize worker safety while completing the decommissioning activities. In order to accomplish this objective the use of engineering controls is maximized where feasible. Another important consideration is minimization of 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 review.

2.) Minimize the potential to release 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 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 adequate planning and risk projection. As discussed later, 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.) Minimize waste generation. 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. The surfaces will be wiped down with cleaning solution, sprayed with strippable paint and potentially cleaned using abrasive blasting. 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.

3.2.2 Decommissioning Engineering Package/IWCP Preparation

The following describes the steps and the integrated "project team" approach which will be used to develop IWCPs that adequately address the scope of work to be performed and specific administrative and engineering controls which are required to be applied to specific decommissioning operation.

- **Review Of Characterization Data and Historical Information**

  - The characterization will 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. The characterization will be conducted as described in Section 4 (Facility Characterization) and Appendix 3 (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 Forman
    - Mechanical, Civil, Electrical and Instrument Engineering
    - Waste Management
    - Building Operations
    - Industrial Health and Safety
    - Craft
    - Environmental Compliance Personnel

Engineering Package/IWCP Development

•

- The engineering package development and IWCP process has 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. The engineering packages will contain detailed work instructions for all 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 & instrument drawings, and photographs will be used as tools to supplement the work instructions. The IWCP will be reviewed and approved by critical members of the project team and applicable support groups.

3.2.3 Description of Decommission Operations

Provided below is a summary description and typical sequence of operation 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.

- As required, additional radiological, industrial hygiene and safety characterization will be performed to prepare appropriate work authorization documents such as Radiological Work Permits, (RWPs), ALARA reviews and Job Hazard Analysis (JHA). This characterization process will be an ongoing process throughout the decommissioning process to ensure the work area hazards are adequately quantified and proper 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 will be disturbed as part of the scope of decommissioning activity, the area will be abated by a qualified contractor prior to start of decommissioning work. The abatement activity will be carefully coordinated to minimize interface with other activities.

- Equipment and horizontal surfaces within a work area/room will be vacuumed and/or wiped down with tack rags. This 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, disconnected and locked out in accordance with site procedures. Electrical systems 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.

- 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.

- 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. 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 2 may be used if necessary. All equipment and components to be unconditionally released will be surveyed in accordance with the RFETS Radiation Control Manual and associated implementing procedures prior to release.

- Gloveboxes, B-boxes and hoods will be decommissioned using the following approach:

  - Equipment and components will be removed from the internal portions of the contamination containment device. This will facilitate the decontamination of the surfaces likely to be contaminated.

  - Internal surfaces will be wiped down using tack rags, non-ionic clean 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 2.

  - 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 and which minimize the volume of TRU waste generated.

  - Lead shielding on the external surfaces of the gloveboxes will 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, the containment may be erected around the equipment, the equipment may be moved to a semi-permanent size reduction facility located within Building 779 or the room/area in which the component is located will be equipped with an airlock. In any case the contamination control containment will be equipped with HEPA ventilation to control the spread of contamination and minimize worker exposure during size reduction and waste packaging operations.

  - 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 8.

- After all equipment and systems have been removed from the room/area the exposed room surface will be decontaminated 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 2.

3.2.4 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 worked. The annex was chosen as the first sub- area because:

1.) The annex was built as a stand alone structure.
2.) The annex also has separate ventilation and utilities which can be decommissioned without affecting the remaining building systems or structures.
3.) Deactivation is scheduled for completion in early 97'.

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 Building 779 Cluster's further 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 strip out of the satellite building associated with the Building 779. The satellite buildings will then be ready for demolition.

The final engineering packages will be demolition plans for the individual 779 Cluster facilities. These plans will detail the work steps and precautions required to accomplish the final dismantlement of the buildings in the cluster. The final demolitions are projected in the attached schedule.

4.0 FACILITY CHARACTERIZATION

4.1 Introduction

The decommissioning of Building 779 requires that the physical, radiological and chemical condition of the facility be assessed. Characterization will be achieved through a combination of facility walkdowns, review of historical records, interviews of personnel familiar with building operations, direct measurement, non-destructive assay, and sample collection for laboratory analysis. The characterization data will be utilized for assessing potential hazards, waste management, basis for the development of the technical approach to decommission, and support the unconditional release of property/waste. Facility characterization is an iterative process that will build on existing information and continue through the decommissioning project.

Characterization performed to support decommissioning activities will utilize the characterization results collected during deactivation. The information collected on the condition of the facility during Deactivation will be turned over to the Decommissioning Project in the form of the project close-out report and the endpoint document. This will include the location and quantity of any holdup, gross presence and location of loose and fixed radiological contamination, location and level of known chemical hazards and the location and contents of stored materials.

The results of characterization activities will be used to support decision making both prior to beginning decommissioning activities and throughout the decommissioning process. As such, the data will be available to project personnel, engineering, health and safety, radiological engineering and decommissioning workers. The characterization results will be an integral part of the decommissioning planning basis for both the DOP and the more detail work planning documents such as the IWCPs. Results from selected sampling activities will include radiological and hazardous constituent analysis.

Characterization will be an ongoing process throughout decommissioning and will be implemented in four basic phases as defined below:

- **Reconnaissance Level Characterization Survey**

A survey and report designed to collect in a single document sufficient information to establish a planning basis concerning the physical, chemical and radiological conditions of the facility. Characterization includes facility walkdowns, review and analysis of available characterization data and additional assessments, as required, to complement existing data. The Reconnaissance Level Characterization Survey Report will serve as the technical basis to develop preliminary project details and will be provided to the lead regulatory agency.

- **Process Survey**

- Process surveys are routine radiological, industrial hygiene, and chemical sampling conducted during decommissioning activities to assess equipment, component and building surface contamination levels.

These surveys will provide detailed and current information on pre-job conditions and provide an indication on the effectiveness of decontamination and decommissioning actions.

- **Final Decommissioning Survey**

The final decommissioning survey is conducted to demonstrate that the radiological and chemical contaminants within the facility have been reduced to levels that comply with the established release criteria. The final decommissioning survey report will included as part of the project administrative record and turned over to the Contractor's Environmental Remediation Department for final site Remediation, as required.

- **Confirmatory / Verification Survey**

This survey is conducted to verify that the facility and/or material removed meets established release criteria. The confirmatory/verification survey is performed by a third party, which provides an independent review of the final decommissioning survey methodology and survey data.

4.2 Reconnaissance Level Characterization Survey

The detailed results of the Reconnaissance Level Characterization Survey are contained in the Reconnaissance Level Characterization Report (RLCR). Provided in this section is a discussion of the purpose of the survey and how the information it contains was used to develop the DOP. Appendix 3 contains a hazard summary matrix for each room of the Building 779 Cluster. The hazard matrix identifies the hazards that are known or likely to be present. This information was used to develop the general decommissioning approach for Building 779.

The Reconnaissance Level Characterization has been performed for this project to establish a preliminary estimate of the type of the physical, chemical, and radiological hazards of the facility. This includes the assembly and review of existing characterization data, taking samples, and conducting inspections designed to complement existing information. The purpose of the characterization activities is (1) to evaluate the physical and chemical characteristics of radiological and hazardous material contamination and the extent of contaminant distribution; (2) to assess the environmental parameters that effect potential human exposure from existing and residual radiological or hazardous material contamination; (3) to support the preparation of the detailed decommissioning work plans, including the preferred approach for decontamination, equipment removal, and waste disposal; (4) to estimate the type and amount of waste to be generated during decommissioning; (5) to support required project plan considerations of dose assessments and As Low As Reasonably Achievable (ALARA) analyses.

The Reconnaissance Level Characterization Survey is designed to gather sufficient information to establish a baseline of information concerning the physical, chemical, asbestos, and radiological condition of the facility. This includes taking samples or conducting inspections designed to fill the gaps in the information currently available.

The Reconnaissance Level Characterization Survey is intended to serve as the technical basis to develop preliminary project details including cost, schedule, risk estimates, decommissioning project engineering approaches and estimates for the type and volume of waste to be generated. The Reconnaissance Level Characterization Survey is a planning tool which will be supplemented and further refined by pre-job and in-process characterization data. It is not intended, nor appropriate, to consider the Reconnaissance Level Characterization Survey as the final, wholly comprehensive assessment upon which worker protection and safety decisions will be made. Additional radiological, industrial hygiene, and safety characterization will be performed, as required, to prepare appropriate work authorization documents such as Radiological Work Permits, ALARA reviews, IWCP's and job hazard analysis (JHA). This type of characterization data will typically be obtained shortly before work is initiated to ensure conditions have not changed and to more accurately assess the hazards based on a detailed work plan. In addition, in-process characterization data will be used to assess the hazards associated with inaccessible areas and systems. This approach is both protective of the worker and environment and ensures the most cost effective collection of data.

The Reconnaissance Level Characterization Survey included the following elements:

- Review of Historical Information
- Identify Contaminants of Concern
- Define Initial Survey and Sampling Plans
- Specify Data Quality Objectives
- Conduct Sampling and Measurement
- Review, Analyze, and Verify Data
- Prepare Reconnaissance Level Characterization Report

A systematic review of information about the history of the facility was performed. Historical information reviewed consisted of records or recollection of process knowledge, process upsets or unusual events, and/or previous surveys and measurements. The RLCR contains a list of the documents that have been reviewed as part of the characterization effort. This information was used to narrow the list of potential contaminants and optimize the design of additional characterization sampling and measurement.

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:

Plutonium	-	Interior of gloveboxes and ventilation systems
Americium	-	Interior of gloveboxes and ventilation systems
Strontium	-	Interior of gloveboxes and ventilation systems
Yttrium	-	Interior of gloveboxes and ventilation systems
Thorium	-	Interior of gloveboxes and ventilation systems
Uranium	-	Interior of gloveboxes and ventilation systems
Cobalt 60	-	Source located in room 218

Lead	-	Painted surfaces and shielding
Asbestos	-	Thermal system piping insulation, tile, adhesive
Beryllium	-	Building and equipment surfaces
Acids	-	Nitric, sulfuric, and hydrochloric
PCBs	-	Electrical transformers
Solvents	-	Laboratory Chemicals

4.3 Radiological Characterization

The radiological characterization of the facility and equipment will make use of existing operational radiation protection surveys, supplemented by additional surveys, to determine the presence and/or level of contamination. The radiological monitoring of radiation exposure levels, contamination, and airborne radioactivity will comply with requirements of 10 CFR 835, Rocky Flats Environmental Technology Site (RFETS) Radiological Control Manual 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. 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 selected at random. Examples of these areas include office areas and areas where radioactivity is not expected.

4.4 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 building will be conducted in several phases. These phases will correspond to the work areas identified by the overall building decommissioning schedule. Work areas will be characterized prior to the disruption or removal of suspect materials.

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 will be designed and managed by a qualified individual per the requirements of 29 CFR 1926.1101. Samples will be collected at locations identified during the review of facility drawings and walkdowns. Surveys will be performed by trained individuals who follow written procedures. All samples will be tracked from sample collection, transport, and analysis. All samples will be analyzed at a certified laboratory. Data will be recorded in an orderly and verifiable manner and will be reviewed by a qualified Building Inspector for accuracy and consistency. A report will be prepared summarizing laboratory results including sample location, sample description, asbestos type and percent, non-asbestos fiber types, matrix types and sample color.

4.5 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.

4.6 Lead Characterization

Lead shielding and lead-based paint are known to be present in the facility. The general approach will be to assume that all painted surfaces are lead-bearing unless proven otherwise. This approach will minimize characterization costs and ensure worker protection. Selected lead sampling will be conducted by collecting media samples for analysis and/or with portable lead detection equipment. The sampling and analysis will be conducted by trained individuals using written procedures.

4.7 Documentation

During characterization activities, several direct, indirect, and sample media samples will be measured, obtained, and analyzed for radiological and hazardous material contaminants. The results will be used to determine the extent and magnitude of the contaminants and the basis for estimating waste quantities and decontamination options. Sample collection, analysis, and the associated documentation will follow standard written 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. Samples will be collected and documented in accordance with Laboratory Procedure No. L-6294-A "Sampling Within a RBA/CA". Results of all characterization activities will be documented in applicable field notebooks and summarized in a brief characterization report. This report will be distributed to appropriate project personnel to support decisions made for waste management, personnel protection decontamination, and other activities which may involve hazardous and radiological contaminants. Radiation protection for the sampling event and the sampling team will be addressed under a Radiological Work Permit. Additional personal protective equipment for the sampling activity will be as specified by Industrial Hygiene in the AHA.

Records will be maintained as part of the project files in accordance with the criteria established and outlined in the DPP. Appropriate project documents are sent to the Administrative Record.

5.0 BUILDING CLEANUP CRITERIA

5.1 Radiological

The purpose of this section is to provide the cleanup criteria for the most abundant contaminants. The cleanup criteria for these contaminants will be used to declare that the 779 Cluster facilities are ready to be dismantled. Although there are other contaminants not identified in this section, by using the decontamination methods necessary to obtain the cleanup criteria identified in this section will remove the other contaminants which may be present at the start of the decontamination efforts. Section 4, Facility Characterization, Appendix 3, Characterization Survey and Work Summary Matrix, and the Reconnaissance Level Characterization Report for this project identify the contaminants which are expected to be present at the start of the decontamination. The characterization information is used to ensure workers are properly protected from the hazards in the work area and to ensure the generated waste is properly/safely handled, packaged, and managed.

In accordance with the Rocky Flats Cleanup Agreement (RFCA), residual contamination levels present on 779 Cluster building surfaces, equipment and demolition materials will be reduced to a level that will not cause the maximally exposed member of the public to receive, through all potential pathways, an effective dose equivalent (EDE) of 15 mrem above background in any single year. The RFETS Building Radiation Cleanup Standard(BRCS) will delineate the specific levels of residual radioactive materials contained in remaining building surfaces, equipment and demolition debris that is compliant with the 15 mrem limit and appropriate ALARA considerations. The BRCS is currently being developed in coordination with the EPA, CDEH, and DOE. The specific surface contamination levels for removable and total activity will be determined using an appropriate dose model such a RESRAD or RESRAD-Build. Data collected during characterization and the Final Decommissioning Survey will be input into an approved dose model to demonstrate compliance. The Final Decommissioning Survey will be conducted prior to the demolition of the outer building structure. The survey techniques and methodologies described in NUREG 5849, Draft NUREG-1505, and Draft NUREG-1506 will be used as a guide to develop and implement the Final Decommissioning Survey. Until such time as the Building Radiation Cleanup Standard is approved, the criteria contained in DOE Order 5400.5 and associated RFETS radiation protection procedures will be used to determine if building surfaces, equipment and demolition debris is acceptable for unconditional release.

5.2 Equipment Unconditional Radiological Release Criteria

The unrestricted release of equipment removed from site will comply with DOE Order 5400.5, RFETS Radiological Control Manual and associated RFETS radiation protection implementing procedures. When 10 CFR Part 834 is approved the practices and procedures for the release of property and waste materials will be appropriately modified to ensure compliance.

5.3 Beryllium Release Criteria

The Beryllium release criteria and survey methods will conform with 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 residual contamination. The surface contamination action level for beryllium is 25 micrograms (ug) per square ft.

5.4 Asbestos Containing Materials (ACM) 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 Heath and Safety Practices Manual. Characterization, sampling/survey, abatement will be performed by qualified personnel per the requirements of OSHA and EPA and NIOSH. The clearance standard or maximum allowable asbestos level (MAAL) for areas after abatement was performed is as follows:

- 0.01 fibers/cc2 utilizing the phase contrast microscope means of analytical technique
- 70 structures/mm utilizing the transmission electron microscopy technique

51

6.0 Authorization Basis Transitions

An authorization Basis is the document or collection of documents recognized by the DOE as the contractual vehicle used to manage the risk of operting a nuclear facility and immediate support buildings. This group of buildings is typically called a cluster. The Authorization Basis currently addresses 779 Cluster and associated support buildings as described in section 1 of this document.

The Authorization Basis provides a framework for compliance with the Price Anderson Amendments Act under which a DOE nuclear facility must analyze the risk of operating the facility and establish controls to limit the risk. Engineering and Administrative controls are incorporated into the formalized risk reduction management docuemtns. These documents are described as the Authorization Basis for operation of the faiclity and include an auditable safety analysis such as a Safety Analysis Report (SAR). The 779 Cluster SAR document includes the information gathered inthe evaluation of the risks. Submittal and approval of the SAR contitutes a contract between the contractors and DOE to operate a facility in accordance with the controls established in the Authorization Basis.

As depicted in Figure 6.1 the SAR identifies the Operational Safety Requirements (OSR) including the verification of continued operation of critical equipment and monitors and operations within the facility when the prescribed operational requirements can not be maintained.

Prior to changine operations within a facility, a document is completed to verify that the proposed operation is within the limits established by the SAR. If the SAR limits are inadequate for the new operation, the SAR would be changed via formal revision or page chagne (when the change is minor). Should an operation or condition be discovered which is perceived to be outside the SAR safety limits an evaluation of the operation or condition is completed. This evaluation is called an Unreviewed Safety Questio Determination (USQD). The results of this evaluation could require the curtailment of the operation, change in the facility design and/or other action, if the operation or condition were found to be outside the SAR safety envelope. This condition is called an Unreviewed Safety Question (USQ). The USQ is the vehicle used to identify pootential safety problems to DOE and wherer necessary, to restirict operations within the facility.

6.1 Authorization Basis Transition

The authorization Basis for 779 Cluster is currently an approved SAR which was developed in 1987 under the DOE Albuquerque Field Office guidance and interpretation of DOE Order 5480.5. The SAR risk analysis and operationsl requirements were based on the conditions exisiting in the building during weapons production. The 779 Cluster SAR therefore, does not address the RFETS change in mission, (reduction in risk through deactivation and dedcommissioning of RFETS facilties). The 779 Cluster Operational Safety Requirements (OSRs) in Chapter 7 of the SAR contain outdated and inadequate information.

As decommissioning of 779 Cluster proceeds the risk and source term will be reduced. This will result in a condition where many of the contols and OSRs currently in place are not required.

A specific process has been established to transition from the current AB to a set of controls established within this docuemnt to protecxt the health and safety of the public workers and envirojnmt during the Decommissioning Project.

Inkeeping with the present decommissioing objectives of RFETS and RFCA, the 779 decommissioning will be completed as a CERCLA Non-Time Critical Removal Action (see section 9.0). To minimize decommissioning project cost, schedule and maximize efficiency, the existing infrastructure of RFETS will be used to the maximum extent possible in planning, engineering, controlling and implementing the decommissioning work effort. Wehn the existing infrastructure is not adequate to support the CERCLA decommissioning process, the conflicting document will be modified, revised or deleted. A new document which provides the necessary controls, while providing required worker safety will be written, approved and used to govern the decommissioning activites. The outdated authorization documents identified in Table 6.1 are part of this infrastructure. There,fore the substantive requirements of the Table 6.1 Authorization Basis documents have been extracted and placed in Table 6.2 for continued implementation during the decommissioning process.

6.2 779 Operational Safety Requirements (OSR) Re-Evaluated

An autible safety analysis of the reduced scope of activites is being completed to verify that the remaining OSR surveillances are adequate to maintain worker, general public and enviromental safety during th ecluster decommissioning. The results of this safety analysis will be added to the project specific Health and Safety Plan (HASP). The auditable safety analysis will be completed in compliance with CERCLA risk assessment guidance, taking due consideration of the RFETS nuclear safety analysis procedures. The RFETS nuclear safety analysis procedures implement the requirements of DOE Order 5480.23, Nuclear Analysis Report and DOE Order 5480.22, and Technical Safety Requirements.

A cross reference between the SAR's OSR requirements and the DOP OSR requirements has been provided in Table 6.2. The 779 Cluster conditions which allow further reduction in the OSR requirements have also been identified in Table 6.2. The auditable safety analysis discussed above will also include an evaluation of Table 6.2's Downgrading Criteria.

Documentationfor discontinuing the identified safety controls will be documented by a letter to the Project Administrative Record file.

Transition From SAR to DOP Based A/B

Facility Operation SAR

-SAR Accident Analysis Envelope Limits are continually Verified Through OSR implementation.

- IF OSRs are not satsified remedial actions are dictatd by LCO's.

↓

Deactivations

- Operations Curtailed.
-SNM Removal and Consolidation
-Reduced Facility Hazard

↓

Transition From SAR to DOP

- 779 Cluster Operational Safety Limits and Requirement Included In DOP.
- Limits defining safety envelope are expanded as hazards are reduced by completing decommissioning activites.
- Safety Limits Verfied as required in section 6 of DOP.

↓

Decommissioning Project Complete.

-Final State - No Operation Safety Requirements.

Table 6.1

Document	Status	Conditions	Comments
SAR	Approved 1987	weapons production operations	Outdated, needs revisioned.
OSRs	Approved 1987	weapons production operations	Outdated, needs revisioned.
USQD-RFP-93.1170-TLF	4/93	Pu storage HSP 31.11 non-compliance	These will be closed out (for the 779 Cluster) by the decommissioning project.
USQD-RFP-93.1503-GLS	3/95	Raschig Ring non-compliance	
USQD-RFP-94.0615-ARS	3/94	HEPA filter testing non-compliance	
USQD-RFP-94.1186-BWW	3/95 revised 2/96	DOE Pu ES&H vulnerability study	
USQD-779-96.0274-ARS	2/96	Pu holdup on GB1363 filter	
USQD-RFP-96.0741-GLW	6/96	Transport and handling SNM containing hither than normal americium	

Table 6.2
779 Cluster Decommissioning OSRs

Table 6.2A - Building Characterization

Nuclear Safety Control	Nuclear Safety Requirement	DOP Requirement	Downgrading Criteria
Category 2 facility	SAR or applicable other authorization basis and H&SP	DOP and H&SP including Bldg. 779 D&D Auditable Safety Analysis concerns	Pu Inventory less than 900 or 450 (if criticality is precluded) grams
Category 3 facility	SAR or applicable other authorization basis and H&SP	DOP and H&SP including Bldg. 779 D&D Auditable Safety Analysis concerns	Pu Inventory less than 8.4 grams
Radiological facility	H&SP	DOP and H&SP including Bldg. 779 D&D Auditable Safety Analysis concerns	
Industrial facility	H&SP	H&SP	Building Contamination levesl are determined to be below approved cleanup criteria.

Table 6.2B - Building Controls

Nuclear Safety Control	Nuclear Safety Requirement	DOP Requirement	Downgrading Criteria
7.3, 7.3.1, 7.3.2	Confinement System	The secondary confinement function must be maintained when decontaminaton activities are ongoing and contamination levesl exceed approved cleanup criteria. One stage of each installed Zone II exhaust system HEPA filter shall be verified to operate at 99.9% efficiency.	No additional Decontamination activites required in area served by confinement system and removable radioactive contamination, on building surfaces and components, have been reduced to meet the approved building cleanup standard.
7.3.4, 7.3.4.2, 7.3.4.3	Safety Monitoring, Detection, and Suppression Systems Criticality Alarm System, Fire Detection, Fire Suppression	Safety monitoring, detection, and suppression systems are the criticality alarm system, fire detection and fire suppression systems. These systems shall be maintained operable in accordance with the appropriate consensus standards as described in the Decommissioning Health and Safety Plan.	These systems and associated controls can be shutdown and removed when an analysis performed in accordance with the applicable standard shows the system is no longer needed. Documentation shall consist of a letter to the Administrative Record and the applicable site safety managers.

Table 6.2
779 Cluster Decommissionig OSRs

Table 6.2B - Building Controls (Continued)

Nuclear Safety Control	Nuclear Safety Requirement	DOP Requirement	Downgrading Criteria
7.4 7.4.1 7.4.2 7.4.4 7.4.4.2 7.4.4.3 7.4.4.4	Surveillance Requirements Primary Confinement System Secondary Confinement System Safety Monitoring, Detection, and Suppression Systems Criticality Alarm System Fire Detection Fire Suppression	Surveillance requirements apply to testing, calibration, monitoring, and/or inspection to ensure that necessary quality and operational status of systems and components are maintained. Surveillance ensures that parameters and set points are periodically verified to be within acceptable limits. Surveillance's shall be documented. These surveillance's are included in the Decommissioning Health and Safety Plan.	
7.6 7.6.1 7.6.2 7.6.3 7.6.4 7.6.5	Administrative Controls Training Internal Review & Change Program Procedures Facility Management 7.6.5	Building 779 administrative controls are described in this Building 779 Decommissioning Operations Program (DOP) and will comply with the Rocky Flats Environmental Technology Site (RFETS) Decommissioning Program Plan (DPP). This is in agreement with the approved Rocky Flats Cleanup Agreement in the (RFCA).	These D&D administrative controls shall remain in effect until this D&D project is completed.

7.0 HEALTH AND SAFETY.

7.1 Introduction

7.1.1 Scope

The purpose of this section is to describe the health and safety controls and monitoring program to be utilized during the decommissioning of the 779 Cluster. This program will be implemented utilizing federal OSHA standards and site specific plans and procedures.

7.1.2 Policy

It is the RFETS policy to ensure all employees are afforded a safe work environment while performing decommissioning activities on Building 779 and it's support facilities. Decommissioning operations will adhere to all federal, state, local and city regulations and ordinances as applicable, to assure worker safety and safety to the public is maintained at the highest level possible.

7.1.3 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 potential and real hazards during the decommissioning process.
- Ensure total 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.
- Establish a 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.

7.1.4 Technical Resources and Approach

Decommissioning will utilize the site specific Health and Safety Practices Manual as the upper tier document to govern health and safety of the workers during the decommissioning process. A building-specific safety plan will supplement the site Health and Safety Practices 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 (1910 and 1926) will be utilized and referenced as necessary to safely conduct decommissioning work activities in Building 779 and it's support facilities.

7.1.5 Job Safety Analysis

As discussed in section 4.0 (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 work instruction. These hazards are identified in the Appendix 3 matrix.

Based on these hazards, the work supervision and industrial hygiene personnel will perform a Job Safety Analysis (JSA) for the work tasks which have the potential to injure or damage personnel, property or the environment. This JSA (Job Safety Analysis) will identify things such as: potential hazards, training requirements, protective control measures and special equipment needs for specific job steps. The job safety analysis will be implemented utilizing the RFETS Health and Safety Practices Manual, Section 2.11, Job Safety Analysis.

7.2 INDUSTRIAL SAFETY

7.2.1 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
- PPE
- 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 for specific job task (s). A project specific training matrix will be used to identify training requirements for project personnel, (reference the RMRS training plan, RMS - 004).

7.3 TOXIC/HAZARDOUS MATERIALS AND CHEMICAL SAFETY

7.3.1 Applications

Hazardous materials and chemical hazards are governed by the applicable regulations and site specific Health and Safety Practices Manual. A job safety analysis (JSA) will be completed before handling, storing, transferring or disposing of these items. The JSA 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 (i.e., asbestos awareness), job specific training will be provided.

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

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

7.4 RADIOLOGICAL SAFETY

7.4.1 Applications

Radiological work activities are required to comply with 10 CFR 835 - Occupational Radiation Protection, The U.S. Department of Energy Radiological Controls Manual, The RFETS Radiological Controls Manual (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 for the most extreme hazard will be utilized for protective purposes.

7.5 PROGRAM ELEMENTS

7.5.1 Applications

In preparation for the decommissioning of Building 779 and it's support facilities, key elements of the Health and Safety Plan 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 (i.e., 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

7.6 EMERGENCY/INJURY MANAGEMENT

7.6.1 Applications

The decommissioning process for Building 779 and it's 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.

7.7 WORK AREA MONITORING

7.7.1 Applications

- Procedures to be utilized for work area monitoring include the RFETS Health and Safety Practices Manual and the RFETS Radiological Controls manual (site RCM). These procedures include, but are not limited to the following:

- Radiological Controls Manual - Chapter 4 - Section 422, Release Requirements to Uncontrolled areas.
- Site Health and Safety Practices Manual - Chapter 9 - Material Handling Storage.
- Site Health and Safety Practices Manual - Chapter 3 - Industrial Hygiene.
- Site Health and Safety Practices Manual - Chapter 18 - Section 18.10 and section 18.23, Radioactive Material Transfer and Area Monitoring.

- Site Health and Safety Practices Manual - Chapter 20 - Environmental Safety.
- Site Health and Safety Practices Manual - Chapter 21 - Material Disposal.
- Site Health and Safety Practices Manual - Chapter 30 - Fire Protection Policy, Programs, Organization.

Additionally, independent of decommissioning the 779 Cluster, the site air and water quality groups will complete normal monitoring requirements for the Rocky Flats Environmental Technology Site at time specified intervals. Reference Section 9.0 for a further discussion of environmental compliance.

8.0 FACILITY WASTE MANAGEMENT

Waste types which may 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 all relevant RFETS waste operations procedures. State and federal regulations and DOE Orders have been incorporated into the RFETS Waste Operations Procedures.

8.1 TRANSURANIC (TRU) 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 are the suspect items which may result in the production of TRU waste. Items will be decontaminated to the lowest level feasible in order to minimize the production of TRU waste.

8.2 LOW LEVEL (LL) 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 or equal to 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. 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 Property Utilization and Disposal (PUD) organization for appropriate handling.

8.3 MIXED WASTE

Mixed waste is defined as waste containing measurable amounts of radioactive and RCRA constituents. At RFETS mixed waste is characterized as either low level or transuranic based upon the amount of radioactivity at the time of assay. The 779 Cluster Decommissioning Project anticipates a minimum amount of mixed waste. 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 permitted areas on-site or, where feasible, shipped to an approved off-site disposal site.

8.4 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, 40 CFR 261, or 40 CFR 261, Subpart B. The 779 Cluster Decommissioning Project anticipates some amount of hazardous waste in addition to the mixed waste mentioned in Section 8.3.

8.5 INDUSTRIAL WASTE

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

8.6 WASTE MINIMIZATION

The philosophy of waste minimization will be utilized in the planning and management of the 779 Cluster decommissioning wastes. 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. 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.

8.7 WASTE MANAGEMENT STRATEGY

The overall strategy for decommissioning of Building 779 will be approached on a room by room basis. Typically, waste materials will be sorted at the time of removal and staged for further decontamination, survey, recycle, processing and packaging.

8.8 WASTE CHARACTERIZATION

The Building 779 Waste Stream Residue Identification and Characterization (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 help characterize the residual materials left in Building 779 (See section 4.0).

The Building 779 WSRIC has been revised to include anticipated decommissioning waste streams. The Waste Management Plan 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 in conjunction with decommissioning to remove radiological contamination and hazardous constituents. Hazardous materials and excess chemical swill be managed as waste, where applicable, and disposed of in accordance with established procedures. 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 8.1.

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

8.9 INTERIM STORAGE, TRANSPORTATION, AND FINAL DISPOSITION

The 779 Cluster Decommissioning Project will generate and package materials suitable to meet DOT transportation requirements. Although excess chemicals are to be removed during deactivation activities there could be some chemicals removed during the decommissioning process. All materials and waste will be characterized, stored and disposed of in accordance with the requirements of the Site Waste Management Program which meets the State and Federal regulations.

TABLE 8.1
BUILDING 779 WASTE MATRIX

Room #	Room Classif.	LL Waste ft³	TRU Waste ft³	PU&D ft³	Drums	Crates
001	RBA	0	0	246	-	
Main Hall flr 1	COLD	0	0	215	-	
100 Vestibule	COLD	0	0	187	-	
101 Hall	COLD	0	0	215	-	-
101A	COLD	0	0	57	-	-
103/103A 103B Mens Locker Rm	COLD	0	0	2572	-	-
104 Elevator	COLD	0	0	TBD	-	-
105	COLD	0	0	152	-	-
106	COLD	0	0	113	-	-
107	COLD	0	0	513	-	-
108	COLD	0	0	74	-	-
109	COLD	0	0	249	-	-
110	COLD	0	0	248	-	-
110A	COLD	0	0	TBD	-	-
111	COLD	0	0	250	-	-
113	COLD	0	0	2960	-	-
114	COLD	0	0	594	-	-
115	COLD	0	0	3189	-	-
115A	COLD	0	0	878	-	-
116 Hall to Dock	COLD	0	0	646	-	-
116A	COLD	0	0	TBD	-	-
116B	COLD	0	0	TBD	-	-
117	COLD	0	0	908	-	-
118 Airlock		0	0	TBD	-	-
119 Hall	RBA	0	0	TBD	-	-
120	COLD	0	0	TBD	-	-
121	COLD	0	0	1628	-	-
121A	COLD	0	0	414	-	-
121B Guard Stat	COLD	0	0	174	-	-
122	RBA	0	0	1348	-	-
123	RBA	0	0	TBD	-	-
124	RBA	0	0	332	-	-

TABLE 8.1
BUILDING 779 WASTE MATRIX

Room #	Room Classif.	LL Waste ft^3	TRU Waste ft^3	PU&D Ft^3	Drums	Crates
125	RBA	TBD	0	TBD	-	-
126	RBA	1271	0	38	-	11
127	RBA	8244	0	395	-	74
128	RBA	13	0	173	-	.5
129	RBA	TBD	0	TBD	-	-
130	RBA	72	0	0	-	1
131	CA	1046	16	125	2	9
132	RBA	253	0	172	-	2
133	CA/HCA	1843	16	111	2	17
134	RBA	0	0	163	-	-
135	RBA	0	0	TBD	-	-
136	RBA	0	0	236	-	-
137	RBA	1323	24	363	3	12
138 HALL	RBA	233	0	106		2
139	RBA	503	0	240	0.5	5
140	RBA	664	0	0	-	6
140A	RBA	330	0	25	-	3
140B	RBA	120	0	76	-	1
141	RBA	170	0	238	-	2
141A	RBA	276	0	128	-	3
141B	RBA	276	0	124	-	3
141C	RBA	149	0	81	-	1
142	RBA	0	0	196	-	-
143 Airlock	CA	0	0	TBD	-	-
144 Elevator	CA	0	0	TBD	-	-
145	CA	35	0	1046	-	0.5
146	CA	3	0	651	1	0
147	CA	8	0	18	1	0
148	CA	0	0	TBD	-	-
149, Annex Hall	CA	450	0	60	-	4
150	CA	4720	0	860	-	42
151	CA	0	0	225	-	-
152	CA	494	4	277	0.5	4
153	CA	54	0	0	-	0.5
153A	CA	83	0	0	-	1
153B	HCA	TBD	0	TBD	-	-
154	CA	2081	16	273	2	19
155	CA	1201	16	196	2	11
156	CA	426	0	18	-	4
157	CA	1041	0	138	0	9
159	CA	662	0	128	-	6

TABLE 8.1
BUILDING 779 WASTE MATRIX

Room #	Room Classif.	LL Waste ft3	TRU Waste ft3	PU&D Ft3	Drums	Crates
160	CA	2361	24	328	3	21
160A	CA	0	0	TBD	-	-
161	CA	72	0	TBD	-	1
162	COLD	0	0	TBD	-	-
163	CA	104	0	TBD	-	1
164 Airlock	CA	0	0	TBD	-	-
165	CA	0	0	TBD	-	-
166	COLD	0	0	TBD	-	-
167	COLD	0	0	TBD	-	-
167A	COLD	0	0	TBD	-	-
170 Dumb Waiter	CA	0	0	TBD	-	-
171	CA	0	0	TBD	-	-
172 Vault	CA	0	0	TBD	-	-
173	CA	0	0	TBD	-	-
2 Flr Hall	COLD	4	0	29	-	0
201	COLD	0	0	289	-	-
201A/B	COLD	0	0	322	-	-
202	COLD	0	0	633	-	-
202A	COLD	0	0	TBD	-	-
203	COLD	0	0	TBD	-	-
204	COLD	0	0	TBD	-	-
204A	COLD	0	0	TBD	-	-
204B	COLD	0	0	TBD	-	-
205	COLD	0	0	TBD	-	-
206	COLD	0	0	TBD	-	-
207	COLD	0	0	TBD	-	-
207A	COLD	0	0	TBD	-	-
207B	COLD	0	0	TBD	-	-
207C	COLD	0	0	TBD	-	-
208	COLD	0	0	TBD	-	-
209	COLD	0	0	TBD	-	-
210	COLD	0	0	TBD	-	-
210A	COLD	0	0	TBD	-	-
211	COLD	0	0	TBD	-	-
212	COLD	0	0	TBD	-	-
212A	COLD	0	0	TBD	-	-
213	COLD	0	0	TBD	-	-
214	COLD	0	0	TBD	-	-
215Airlock	COLD	0	0	TBD	-	-
216 Hall	CA	104	0	43	-	1
217	CA	1063	8	212	1	10
218	CA	TBD	8	TBD	1	-

TABLE 8.1
BUILDING 779 WASTE MATRIX

Room #	Room Classif.	LL Waste ft3	TRU Waste ft3	PU&D Ft3	Drums	Crates
219	CA	0	0	TBD	-	-
220	CA	1029	8	373	1	9
221	CA	139	0	134	-	1
221A	CA	55	0	82	-	0.5
221B	CA	64	0	94	-	1
221C	CA	46	0	42	-	0.5
222	CA	3675	28	190	3.5	33
222A	CA	50	0	0	-	0.5
223	CA	1018	0	24	-	9
224	CA	145	0	0	-	1
225	CA	394	0	149	0	4
226 Stair	CA	TBD	0	TBD	-	-
228	CA	3641	8	1640	1	33
229	CA	19	0	230	0	0
230	CA	40	0	127	-	0
231	CA	365	0	94	0	3
232	CA	TBD	0	TBD	-	-
233	CA	13	0	323	-	0
234	CA	655	12	423	1.5	6
234A	CA	76	0	3	0	1
234B	CA	336	0	0	-	3
235	CA	520	0	30	0	5
236 Airlock		TBD	0	TBD	-	-
237 Hall		TBD	0	TBD	-	-
270	CA	566	4	140	0.5	5
271	CA	149	0	97	0	1
272	CA	631	0	72	-	6
273	CA	21	0	48	-	0
274	CA	99	0	44	-	1
275	CA	115	0	100	-	1
277	CA	53	0	58	-	0.5
	SUM	45666	192	30515	24.5	412.5

Cold - Uncontaminated Area
CA - Contamination Area
HCA - High Contamination Area
RBA - Radiological Boundary Area

9.0 REGULATORY AND COMPLIANCE ADMINISTRATION

All decommissioning actions will be in accordance with site procedures and infrastructure which integrates applicable State and federal regulations. In addition, these actions will be completed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) removal action implementing both Rocky Flats Clean-up Agreement (RFCA) and the Decommissioning Program Plan (DPP). Actions beyond the scope of decommissioning, such as Environmental Restoration activities, will not be addressed by this document.

9.1 CERCLA REMOVAL ACTION

CERCLA was enacted by Congress in 1980 and amended by the Superfund Amendments and Reauthorization Act (SARA) in 1986. CERCLA was created to respond to situations involving the past disposal of hazardous substances at industrial sites. As such, it complements the Resource Conservation and Recovery Act (RCRA) which regulates on-going hazardous waste handling and disposal. CERCLA does not contain specific requirements, but section 121 codified EPA's existing approach to comply with other environmental laws which are applicable or relevant and appropriate.

Non-Time Critical Removal Action (40 CFR 300.815) under CERCLA is the regulatory methodology currently identified for the completion of Decommissioning activities. The Department of Energy (DOE) and the Environmental Protection Agency (EPA) issued the "Policy on Decommissioning at DOE Facilities" (May, 1995), providing the structure for actions taken at those facilities. This policy was integrated into the Rocky Flats Clean-up Agreement (RFCA) and is implemented in the Decommissioning Program Plan (DPP) and in this document.

9.2 RFCA

The DOE, EPA, and the Colorado Department of Public Health and the Environment (CDPHE) has developed a TRI-party agreement, (called RFCA), for the cleanup of the Rocky Flats Environmental Technology Site. RFCA directs the process for decommissioning by providing a regulator action time - table for CERCLA regulatory document review and a regulatory approach utilizing single regulator oversight. The provisions of RFCA comprise the legal document that describes the relationships between the Agencies during decommissioning actions. This was completed by creating a common vision, 10 year plan, and implementable elements for near-term and intermediate site conditions, (found in the preamble to RFCA). The Building 779 cluster is being decommissioned to remove the risk associated with the facilities. The decommissioning project is part of the ten year plan to put Rocky Flats in a safe environmental status.

This DOP will follow the Interim Measures/Interim Remedial Action (IM/IRA) process as specified in RFCA for its approval process. This document was constructed with consultation of the Lead Regulatory Agency (LRA). This document will be provided to the public, LRA, and CDPHE for a simultaneous "review and comment" period of 45 days. Within 14 days after the "review and comment" period, DOE will develop responses to all comments and provide them to the LRA.

The LRA then has 14 days to approve or disapprove the comment responses and resulting modified document. The LRA may request an extension of the approval period based on good cause communicated to DOE in a timely manner. If the LRA disapproves of any responses or the modified document, the LRA shall provide specific direction on how the document can be modified to get LRA approval.

9.3 Applicable or Relevant And Appropriate Requirements (ARARs)

To ensure protection of human health and the environment, the DOE, with oversite of the LRA, in conjunction with the supporting regulatory agencies (SRA), are required to identify those promulgated standards, requirements, criteria, or limitations that will be met during the implementation of the remedy. The identified promulgated, requirements, and statutes are called Applicable or Relevant and Appropriate Requirements. ARARs are made up of:

> Applicable Requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Only those standards that are identified by a State in a timely manner and that are more stringent than Federal requirements may be applicable. (See 40 CFR 300.5)
>
> Relevant and Appropriate Requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those State standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate. (see 40 CFR 300.5)

Substantive requirements are those requirements that pertain directly to actions or conditions in the environment. Examples of substantive requirements include quantitative health-or risk-based restrictions upon exposure to types of hazardous substances (e.g., MCLs establishing drinking water standards for particular contaminants), technology-based requirements for actions taken upon hazardous substances (e.g., incinerator standards requiring particular destruction and removal efficiency), and restrictions upon activities in certain special locations (e.g., standards prohibiting certain types of facilities in floodplains).

Administrative requirements are those mechanisms that facilitate the implementation of the substantive requirements of a statute or regulation. Administrative requirements generally include the approval of, or consultation with administrative bodies, issuance of permits, documentation, reporting, recordkeeping, and enforcement actions. In general, administrative requirements prescribe methods and procedures by which substantive requirements are made effective for purposes of a particular environmental or public health program. On-site response actions must comply with substantive requirements and not administrative requirements, except as provided in the Interagency Agreement (IAG) dated January 22, 1991.

Types of ARARs

The EPA established the three ARAR categories listed below to identify and classify ARARs. The categories are used as guidance since some ARARs do not necessarily fall into this classification system. The type of ARAR is identified in the "Type" column in Table 1.

- Chemical(C) - specific requirements are usually health or risk based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in or discharged to the ambient environment (i.e., air emissions, wastewater discharges, etc.)
- Location(L) - specific requirements are restrictions placed on the concentration of hazardous substances solely because they occur in special locations. Typical location restrictions include areas with sensitive or unique characteristics such as wetlands, areas of historical significance, or areas situated in locations requiring special precautions because of seismic activity or floodplains.
- Action(A) - specific requirements are usually technology or activity based requirements or limitations on actions taken with respect to management of the remediation waste or closure of the facility. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy.

To-Be-Considered Standards

DOE may, when appropriate, identify other non-promulgated advisories, criteria, guidance documents, or proposed regulations that are to be considered (TBC) to supplement an ARAR provision for a particular release. TBCs are typically issued by Federal or State governments, are not legally binding, and do not have the status as potential ARARs. However, TBCs are used in determining the necessary level for the protection of human health and the environment. The March 8, 1990 preamble to the final NCP rule (see 55 FR 8746) indicates that the use of TBCs is discretionary rather than mandatory.

Of particular importance to the RFETS is the inclusion of DOE Orders. Since DOE Orders are not promulgated standards, they do not qualify as ARARs under the CERCLA definitions. DOE facility. To the extent that DOE Orders supplement the implementation of an identified ARAR, they will be treated as TBCs to develop a protective remedy.

State ARARs

Under NCP and CERCLA section 121, remedial actions must comply with ARARs which include State promulgated environmental regulations that are more stringent than federal environmental requirements and that are identified in a timely manner by the State. The 1988 preamble to the NCP states that the phrase of general applicability is meant to preclude consideration of State requirements promulgated specifically for one or more CERCLA sites as potential ARARs. For a state requirement to be a potential ARAR it must be applicable to all remedial situations described in the requirement, not just CERCLA sites (see 53 FR 51438).

The March 8, 1990 preamble to the NCP defines the term "legally enforceable" to mean State regulations issued in accordance with pertinent State procedures and that "contain specific enforcement provisions or (are) otherwise enforceable under State law" (see 55FR 8746).

In terms of identifying more stringent State requirements as ARARs, Section 121(d) (2) (C) (iii) of CERCLA states that a state standard, requirement, criteria, or limitation (including any State siting standard or requirement) which could effectively result in the statewide prohibition of land disposal of hazardous substances, pollutants, or contaminants shall not apply unless the following conditions are met:

- The State standard, requirement, criterion, or limitation is of general applicability and was adopted by formal means;
- The state standard, requirement, criterion, or limitation was adopted on the basis of hydrologic, geologic, or other relevant considerations and was not adopted for the purpose of precluding on site remedial actions or other land disposal for reasons unrelated to protection of human health and the environment; and
- The State arranges for, and assures payment of the incremental costs of utilizing, a facility for disposition of the hazardous substances, pollutants, or contaminants.

ARAR Identification Process

The process of identifying ARARs and TBCs is specified in 40 CFR 300.400 (g), 40 CFR 300.430 (e) (2), and 40 CFR 300.515 (d). In addition to the above mentioned statutory and regulatory requirements, the EPA has published the following guidance documents for identification of ARARs and TBCs.

- CERCLA Compliance with Other Laws Manual: Interim Final (EPA/540/G-89/006), August 1988;

- CERCLA Compliance with Other Laws Manual: Part II. Clean Air Act and Other Environmental Statutes and State Requirements (EPA/540/G-89/009), August 1989;

- Superfund LDR Guide #5 - Determining When Land Disposal Restrictions Are Applicable to CERCLA Response Action (OSWER 9347.3 - 05/FS), July 1989;

- Superfund LDR Guide #7 - Determining When Land Disposal Restrictions Are Relevant and Appropriate to CERCLA Response Action (OSWER 9347.3-07FS), December 1989;

- ARARs Q&As: Compliance with Federal Water Quality Criteria (OSWER 9234.2-09/FS), June 1990;

- ARARs Q&As: Compliance with the Toxicity Characteristics Rule: Part 1 (OSWER 9234.2-08/FS), May 1990;

- ARARs Q&As: General Policy RCRA, CWA, SDWA (OSWER 9234.2-12/FS), January 1991;
- ARARs Q&As: The Fund-Balancing Waiver (OSWER 9234.2-13/FS), January 1991;
- CERCLA Compliance with Other Laws Manual: RCRA ARARs - Focus on Closure Requirements (OSWER 9234.2-04/FS), October 1989; and
- CERCLA Compliance with Other Laws Manual: Overview of ARARs - Focus on ARAR Waivers (OSWER 9234.2-03/FS), December, 1989.

The process of identification of ARARs is described and graphically depicted in Section 1.2.4 of the CERCLA Compliance with Other Laws Manual: Interim Final (EPA/540/G-89/006), August 1988. In general, the identification process involves a two-part evaluation to determine if the promulgated environmental requirement is applicable or, if not applicable, relevant and appropriate.

The first step in this process is to determine if the requirement is applicable. The basic criterion for determining if a requirement is applicable is that it directly and specifically addresses or regulates the hazardous substance, pollutant, contaminant, action being taken, or other circumstance at the site. To determine if the particular requirement is legally applicable, it is necessary to refer to the terms, definitions, and jurisdictional prerequisites must be met for the requirement to be applicable. In addition, previous court decisions could also play an important role in determining if a particular requirement is applicable.

If the requirement is not applicable, the second step is to decide if it is both relevant and appropriate. The basic considerations to make this decision are to determine if the requirement:

1) regulates or addresses problems or situations sufficiently similar to those encountered at the CERCLA site (i.e., relevance), and

2) is appropriate to the circumstances of the release or threatened release such that its use is well suited to the particular site.

Determining if requirements are relevant and appropriate is site-specific and must be based on best professional judgement including the characteristics of the remedial action, the hazardous substances present at the site, and the physical circumstance of the site and of the release.

The site-specific conditions must be compared to the statutory or regulatory requirements. The EPA further clarifies that requirements determined to be relevant and appropriate do not need to be legally enforceable (see 55 FR 8743).

The ARARs will be implemented in the Integrated Work Control Package (IWCP) by direct reference to a procedure or by inclusion of a Site procedure modification. This process provides a documented compliance step, with a signature of completion for each action, within the decommissioning process.

The ARARs list on Table 9.1 includes the applicable requirements that have been identified for this 779 Cluster Decommissioning Project. Table 9.1 also documents the associate regulation for each requirement and the Site's procedure that implements these requirements.

9.4 ENVIRONMENTAL ISSUES

The decommissioning efforts being completed will be in compliance with the RFCA, the DPP, and this Decommissioning Operations Plan (DOP). RFCA dictates that the remedial actions are taken to meet the requirements of a non-time critical CERCLA action. A separate National Environmental Policy Act (NEPA) evaluation (EIS or EA) is not required as the NEPA values required for a CERCLA action are included in the DPP (identified by RFCA) which governs the decommissioning program at RFETS.

As specified in Site procedures, an Environmental Checklist was created during the planning phase of the 779 Cluster Decommissioning project. This document assists the project manager in the identification of any environmental issues which must be addressed in completing the decommissioning project.

The 779 Cluster buildings are located within an Industrial Area. The surface water, sub-basin boundary roughly borders the south sides of Buildings 705 and 706, the west side of Building 779 and the south side of Solar Pond 207A. The majority of surface water in this sub-basin flows to a storm water drain east of Building 779 (North of Building 727).

Surface water samples from the Building 779 Cluster drainage sub-basin will be collected using an automated station located to pull samples from the entire sub-basin's runoff. The station consist of a flow meter set to trigger a portable sampler when surface water runoff from a storm event and/or snow melt rises to a predesignated level. A Geomation remote measurement and control radio-telemetry unit is used to notify Surface Water personnel when a sample has been collected.

Air issues associated with Building 779 will be addressed in an evaluation of APENS permit for this action, as well as, annual air stack emissions reviews. Required monitoring will be evaluated for each stage of the project.

The Reconnaissance Level Characterization Report identifies the potential hazardous contaminates and the need for further analysis. The Waste Management Plan and Building 779 WSRIC book identifies waste streams which may be generated, approximate volumes, and other requirements needed to ensure the packaging and waste identification meet the Waste Acceptance Criteria (WAC) for the ultimate disposal site..

RCRA permitted units currently located in Building 779 will be closed by the Deactivation Group or by decommissioning using an approved RCRA closure plan.

After the decommissioning efforts described in this document have been completed the area's custodianship will be transferred the Environmental Restoration (ER) organization so that ER can complete the final remedial actions.

9.5 PERMIT IMPACTS

An evaluation of impacted permits has been be conducted during the review of the Environmental checklist. Air issues will be documented, through out the project via letter to file indicating requirements for monitoring, development of APEN, and/or appropriate methodologies to minimize the origination of an effluent. Water issues will be identified and monitoring will continue with a baseline of at least one month to identify deviations. Waste will be generated by site approved waste generators and waste shall be managed in accordance with the Waste Management Plan for this project. RCRA permitted units will be closed in accordance with State regulation and the Rocky Flats Part B Permit.

9.6 HUD/HISTORICAL SITE

Building 779 is eligible for listing on the National Register of Historic Places because of its various missions in the "cold war>" Remediation of the destruction of the building is required. The appropriate remediation documentation is being prepared and will be completed before the building is demolished.

Similarly, the Housing and Urban Development evaluation (McKinney Act) for reuse as homeless housing is in progress and will be completed before the building is demolished. The building is expected to be determined to be unsuitable for housing reuse because among other reasons, its contamination levels and the inability to relocate the structure economically.

9.7 PROPERTY ACTIONS

The Building 779 Cluster equipment removed during decommissioning will be evaluated for reuse at RFETS or other federal facilities by the Property Utilization and Disposition (PU&D) organization. The equipment free-released (verified as uncontaminated) from the 779 Cluster is sent to PU&D for final disposition.

TABLE 9.1 - FEDERAL AND STATE ARARs FOR THE DECOMMISSIONING OF 779 CLUSTER

.Requirement	Citation	Type	Comment/Implementation Process
ATOMIC ENERGY ACT (AEA) [42 USC 2200 et. seq.]			
RADIATION OF THE PUBLIC AND THE ENVIRONMENT • Radiation Protection Standard - All Pathways. • Radiation Protection Standard - Airborne Emissions. • ALARA Process • Effluent Discharges to Surface Waters • Effluent Discharges to Sanitary Sewer Systems. • Residual Radioactivity Levels (Real Property, Materials, and Equipment) • Monitoring and Surveillance	DOE Order 5400.5 {10 CFR 834, Proposed} Chapter II.1a and III {834.101} Chapter II.1b {834.102} Chapter II.1c {834.109} Chapter II.2 {834.11} Chapter II.3a {834.201} Chapter II.5 and IV {834, Subpart D} Chapter II.6 {834.10}	TBC	This DOE Order establishes criteria for the protection of human health and the environment to ensure radiation exposure resulting from DOE activities does not exceed an effective equivalent dose for 100 mrem per year. This radiation dose limit also forms the basis for the release of radionuclides to the environment and the release of properties for unrestricted use. Compliance with these citations is ensured through adherence to implemented through the RFETS Radiological Controls Manual and Site Dosimetry Program. Radiological Work Permit controls are used as direct input to the IWCP.
ENVIRONMENTAL RADIATION PROTECTION STANDARDS FOR MANAGEMENT AND DISPOSAL OF SPENT NUCLEAR FUEL, HIGH LEVEL, AND TRANSURANIC RADIOACTIVE WASTE - Radioactive Dose Standards	40 CFR 191.03	C	Standards apply to TRU waste only. Compliance with 40 CFR 191.03 is ensured by adherence to the Radiological Controls Manual.
RADIOACTIVE WASTE MANAGEMENT • Management of Transuranic Waste - Temporary Storage at Generating Sites • Management of Low-Level Waste - Performance Objectives - Performance Assessment - Waste Characterization - Disposal - Disposal Site Closure/Post Closure - Environmental Monitoring	DOE Order 5820.2A Chapter II 3e Chapter III 3a 3b 3e 3i 3j 3k	TBC	Waste packaging requirements of Waste Management Operations Procedures, 1001-1103, implement these guidance functions into all Radiological Waste Streams.
STATE OF COLORADO LOW LEVEL WASTE	6 CCR 1007-14	A	Same as above.
OCCUPATIONAL RADIATION PROTECTION	10 CFR 835	C/A	Radiological Control Manual and RadCon Procedures implement this function.

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

TABLE 9.1 - FEDERAL AND STATE ARARs FOR THE DECOMMISSIONING OF 779 CLUSTER

Requirement	Citation	Type	Comment/Implementation Process
CLEAN AIR ACT (CAA) [42 USC 7401 et. seq.]			
AMBIENT AIR QUALITY STANDARDS	5 CCR 1001-14 [40 CFR 50]	C	National Ambient Air Quality Standards (NAAQS) are considered to be chemical-specific ARARs to assess the quality of ambient air and the need to remediate a particular IHSS to maintain the quality of the ambient air. The site's Air Monitoring Program is implemented in 4D21-ENV-AQ.11 and several level four procedures.
COLORADO AIR POLLUTION REGULATIONS • Emission Control Regulations of Particulates, Smokes, Carbon Monoxide, and Sulfur Oxides - Particulates - Emission Monitoring Requirements for Existing Sources -Sulfur Dioxide Emission Regulations • Air Contaminant Emissions Notices • Standards of Performance for New Stationary Sources • Control of Hazardous Air Pollutants • Emissions of Ozone-Depleting Compounds	5 CCR 1001 [40 CFR 52, Subpart G] [5 CCR 1001-3] [5 CCR 1001-5] [5 CCR 1001-8] [5 CCR 1001-10] [5 CCR 1001-19]	A	Regulation No.1 Section III.D(2)(b), (e), (f), and (h) requires control measurements to be implemented for construction activities, haul roads, haul trucks, and demolition activities, respectively, to prevent the emission of fugitive particulates in excess of air standards. Regulation Nos. 3, 6, 7, 8, and 15 would be an ARAR only if the remedial action involves the specific emission source regulated. The Site's Air Monitoring Program is implemented in 4D21-ENV-AQ.11 and several level four procedures.
NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS • National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities - Standard - Compliance and Reporting	40 CFR 61, Subpart H .92 .93	C/A	Demonstration of compliance with 40 CFR 61.92 is performed on a sitewide basis taking into consideration all RFETS sources. Stack monitoring is required for all release points which could contribute greater than 0.1 mrem/yr. The Site's Air Monitoring Program is implemented in 4D21-ENV-AQ.11 and several level four procedures.
COLORADO AIR QUALITY CONTROL COMMISSION • Part B - Emission Standards for Asbestos	Regulation 8	A	Integrated into site procedure for Asbestos and training requirements for Decommissioning workers. The Site's Air Monitoring Program is implemented in 4D21-ENV-AQ.11 and several level four procedures.

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

TABLE 9.1 - FEDERAL AND STATE ARARs FOR THE DECOMMISSIONING OF 779 CLUSTER

TBC - To Be Considered Requirement	Citation	Type	Comment/Implementation Process
FEDERAL WATER POLLUTION CONTROL ACT{aka Clean Water Act (CWA)} [33 USC 1251 et. seq.]			
COLORADO BASIC STANDARDS AND METHODOLOGIES FOR SURFACE WATER • Antidegradation Rule • Water Quality-Based Designations • Basic Standards Applicable to Surface Waters of the State • Testing Procedures.	5 CCR 1002-8 3.1.8 3.1.11 3.1.12 3.1.16	C	Non-AEA radionuclides that have Statewide surface water standards will be considered potential ARAR's. Site-specific standards not associated with a use classification and AEA regulated radionuclides are not ARARs because they do not meet the criteria of "general applicability" and/or enforceability in 40 CFR 300.400(g)(4) and are, therefore, not "promulgated." Implementation of these requirements are found in Site EMD Standard Operation Procedures, Vol. IV SW.02.
COLORADO BASIC STANDARDS FOR GROUND WATER • Classifications of Ground Water • Ground Water Quality Standard • Point of Compliance	5 CCR 1002-8 3.11.4 3.11.5 3.11.6	C	Implementation of these requirements are found in Site EMD Standard Operation Procedures, Vol. IV SW.02.

Requirement	Citation	Type	Comment/Implementation Process
OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA)			
OSHA Standard for Construction Activities	29 CFR 1926	A	This is implemented in the Health and Safety Manual for Decommissioning.

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

TABLE 9.1 - FEDERAL AND STATE ARARs FOR THE DECOMMISSIONING OF 779 CLUSTER

Requirement	Citation	Type	Comment/Implementation Process
SOLID WASTE DISPOSAL ACT {aka: Resource Conservation and Recovery Act) [42 USC δ 6901 et. seq.] SUBTITLE C: HAZARDOUS WASTE MANAGEMENT [Colorado Hazardous Waste Act (CRS δδ 25-15-101 to -217)]			
The State of Colorado is authorized to administer portions of the hazardous waste management program (e.g., RCRA) to regulate the generation, treatment, storage, and disposal of hazardous waste within Colorado. Although the Colorado hazardous waste management regulations are similar to the federal requirements, both the federal and the state regulatory citations are provided for reference purposes and to denote that both federal and state requirements were considered in establishing the identifying the ARAR requirement adopted for remediation of the RFETS. Only substantive portions of the regulations are required under CERCLA actions for onsite activities.			
IDENTIFICATION AND LISTING OF HAZARDOUS WASTES	6 CCR 1007-3, 261 [40 CFR 261]	A	RCRA Requirements are implement through the Hazardous Waste Requirements Manual (1-10000-HRM).).
GENERATOR STANDARDS • Hazardous Waste Determinations • Record Keeping and Reporting Requirements - Record Keeping and Reporting Requirements	6 CCR 1007-3, 262 [40 CFR 262] .11 .40 to .43	A	Persons who generate solid wastes are required to determine if the waste is hazardous. The definition and procedures contained in 6 CCR 1007-3, 261 [40 CFR 261] are to be followed to make this determination. RCRA Requirements are implemented through the Hazardous Waste Requirements Manual (1-10000-HRM).
CONTINGENCY PLAN AND EMERGENCY PROCEDURES • Purpose and Implementation • Content of Plan • Emergency Coordinator • Emergency Procedures	6 CCR 1007-3, 264, Subpart D [40 CFR 264 Subpart D] .51 .52 .55 .56	A	The existing RFETS contingency plan will be reviewed and revised accordingly to ensure that the procedures are adequate to respond to any new conditions posed by the remedial actions and/or the operation of new hazardous waste management facilities. RCRA Requirements are implemented through the Hazardous Waste Requirements Manual (1-10000-HRM).

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

TABLE 9.1 - FEDERAL AND STATE ARARs FOR THE DECOMMISSIONING OF 779 CLUSTER

Requirement	Citation	Type	Comment/Implementation Process
SOLID WASTE DISPOSAL ACT (aka: Resources Conservation and Recovery Act) [42 USC δ 6901 et. seq.] SUBTITLE C: HAZARDOUS WASTE MANAGEMENT [Colorado Hazardous Waste Act (CRS δδ 25-15-101 to - 217)]			
MANIFEST SYSTEM, RECORDKEEPING, AND REPORTING • Applicability • Operating Record • Availability, Retention, and Disposition of Records	6 CCR 1007-3 Part 264, Subpart E [40 CFR 264, Subpart E] .70 .73 .74	A	RCRA Requirements are implemented through the Hazardous Waste Requirements Manual (1-1000-HRM).
CLOSURE AND POST-CLOSURE • Closure Performance Standards • Disposal or Decontamination of Equipment, Structures and Soils • Maintenance, Monitoring, Security, and Care Post-Closure Use of Property	6 CCR 1007-3, 264 Subpart G [40 CFR 264, Subpart G] .111 .114 .117	A	RCRA Requirements are implemented throughout the Hazardous Waste Requirements Manual (1-10000-HRM).
USE AND MANAGEMENT OF CONTAINERS • Condition of Containers • Compatibility of Waste with Containers • Management of Containers • Inspections - Containment System Design and Operation - Containment for Ignitable or Reactive Wastes - Containment for Incompatible Wastes • Closure	6 CCR 1007-3, 264, Subpart I [40 CFR 264, Subpart I]	A	RCRA Requirements are implemented throughout the Hazardous Waste Requirements Manual (1-10000-HRM).

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

TABLE 9.1 - FEDERAL AND STATE ARARs FOR THE DECOMMISSIONING OF 779 CLUSTER

Requirement	Citation	Type	Comment/Implementation Process
SOLID WASTE DISPOSAL ACT (aka: Resources Conservation and Recovery Act) [42 USC δ 6901 et. seq.] SUBTITLE C: HAZARDOUS WASTE MANAGEMENT [Colorado Hazardous Waste Act (CRS δδ 25-15-101 to - 217)]			
TANK SYSTEM • Containment and Detection of Releases - Secondary Containment - Secondary Containment Devices -- External Liner -- Vault System -- Double-Walled Tanks -- Ancillary Equipment • Inspections • Response to Leaks or Spills and Disposition of Leaking or Unfit-for-Use Tank Systems • Closure and Post-Closure Care	6 CCR 1007-3 Part 264, Subpart J [40 CFR 264, Subpart J]	A	Either existing or new tank systems will be used to treat or store hazardous waste generated as a result of remedial activities. Existing tank systems will only be used if it is determined that the tank system is adequate and has sufficient integrity to prevent failure of the tank system during the proposed new use. Existing tank systems will be closed in accordance with approved closure plans or IM/IRA documents. RCRA Requirements are implemented through the Hazardous Waste Requirements Manual (1-10000-HRM).
LAND DISPOSAL TREATMENT STANDARDS • General (Subpart A) - Dilution Prohibition as a Substitute for Treatment -Waste Analysis -Special Rules Regarding Wastes that Exhibit a Characteristic • Prohibitions on Land Disposal (Subpart C) - Waste Specific Prohibitions - Solvent Wastes - Waste Specific Prohibitions - Dioxin-Containing Wastes - Waste Specific Prohibitions - California List Wastes - Waste Specific Prohibitions - First Third Wastes - Waste Specific Prohibitions - Second Third Wastes - Waste Specific Prohibitions - Third Third Wastes - Waste Specific Prohibitions - Newly Listed Wastes	6 CCR 1007-3, 268 .7 .9 .30 .31 .32 .33 .34 .35 .36	A	Waste Management plans will be developed to ensure compliance with the Land Disposal Restrictions. The performance requirements for hazardous waste treatment systems will be based on the LDR Treatment Standards contained in Subpart C. RCRA Requirements are implemented throughout the Hazardous Waste Requirements Manual (1-10000-HRM).

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

TABLE 9.1 - FEDERAL AND STATE ARARs FOR THE DECOMMISSIONING OF 779 CLUSTER

Requirement	Citation	Type	Comment/Implementation Process
TOXIC SUBSTANCES CONTROL ACT (TSCA) [15 USC 2601 et. seq.]			
LABELING OF PCBs AND PCB ITEMS	40 CFR 761.40 AND .45	A	TSCA Requirements are implemented through the TSCA Requirements Manual (1-10000-TRM).
STORAGE REQUIREMENTS FOR PCBs • Time Limits • Facility Criteria • Temporary Storage • Inspections • Container Specifications • Marking • Laboratory Sample Exemption From Manifesting	40 CFR 761.65	A	TSCA Requirements are implemented through the TSCA Requirements Manual (1-10000-TRM).
DECONTAMINATION • Containers • Movable Equipment	40 CFR 761.79	A	TSCA Requirements are implemented through the TSCA Requirements Manual (1-10000-TRM).
PCB SPILL CLEANUP • Requirements for PCB Spill - Disposal of Cleanup Debris and Materials - Determination of Spill Boundaries - Spills of < 500 ppm PCBs, Involve, < 1 lb. of PCBs by wt. - Spills of ≥ 500 ppm PCBs, Involve, ≥1 lb. of PCBs by wt. - Time Limits and Actions Within the First 24 Hours - Requirements for Decontaminating Spills in Outdoor Electrical Substations - Requirements for Decontaminating Spills in Restricted Access Areas - Sampling Requirements	40 CFR 761.125	A	40 CFR 761 Subpart G is entitled *PCB Spill Cleanup Policy* and thus many of the sections in Subpart G, specifically for spills after May 4, 1987, are "to be considered" (TBC); 40 CFR 761.125 contains PCB cleanup requirements that may be considered enforceable substantive environmental standards and thus potential ARARs. TSCA Requirements are implemented through the TSCA Requirements Manual (1-10000-TRM).

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

10.0 QUALITY

10.1 INTRODUCTION

Currently Rocky Mountain Remediation Services (RMRS) is task with the management control and oversite of the Building 779 Cluster Decommissioning Project. As such, RMRS quality assurance plan will be used to monitor the quality aspects for the project activities. RMRS has developed a Quality Assurance Program Plan (QAPP)document number 95-QAPP-001 which will be used to ensure the Building 779 Cluster Decommissioning Project activities meet the necessary quality requirements. The QAPP that describes 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). Since the Order and the Rule are inclusive of the same criteria, RMRS incorporates the requirements into a single QAPP. The QAPP is a controlled document and is distributed through the RMRS document control system.

The 779 Cluster Decommissioning Project will follow the requirements of the RMRS QAPP. The development and approval of the Decommissioning Program Plan will further define the requirements applicable to quality assurance needs for decommissioning projects, and will be utilized to meet the governing Quality Assurance Program Plan.

10.2 PURPOSE AND SCOPE

The RMRS QAPP defines the strategy and controls currently employed, or to be developed and implemented by RMRS to consistently deliver products and services that meet the requirements of customers/stakeholders. The QAPP serves as a map of the current controls employed by RMRS, and presents a concise strategy for the continuing development of the RMRS QA Program. Currently, RMRS is implementing the established Site controls, procedures and documents approved by the Integrating Management Contractor, Kaiser-Hill.

The QAPP is relevant and applicable to the specific operations of RMRS and its subcontractors, and where applicable, to the interface controls between RMRS and Kaiser-Hill, and between RMRS and other Kaiser-Hill subcontractors. Subcontractors to RMRS are required to submit a quality program which meets equivalent standards to RMRS's QAPP.

10.3 PROGRAM REQUIREMENTS

The QAPP identifies the QA elements of the RMRS QA Program and defines them in the context of implementing programs and controls. Specific programs and controls are also identified in the QAPP, such as floor level procedures, plans, and documents used to control all activities involved in the 779 Cluster Decommissioning Project. The QAPP is binding on all RMRS personnel. RMRS personnel understand the program's impact from training, indoctrination, and the commitment evidenced by management.

10.3.1 Quality Assurance Systems and Description

General

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

RMRS places accountability for quality with the individuals accomplishing the work activities, and further holds those individuals accountable for seeking means to continuously improve. RMRS provides its participants with the tools, continuing training, and latitude to do the right things, above merely doing things right.

All RMRS personnel are responsible for performing activities in accordance with approved documents; identifying and participating in quality improvements; knowing customers, suppliers, and processes with which associated; exercising stop work authority over significant conditions adverse to quality; and for attending training.

RMRS QA Organization

One of the key elements of an effective quality assurance program is identification of organizations and responsibilities. Complete organizational descriptions and responsibilities are defined elsewhere in this document and in the QAPP, however, the following responsibilities are important to note from a quality perspective.

The RMRS QA Manager is designated by the RMRS President as the representative for quality assurance activities, and is responsible and authorized to stop work when significant conditions adverse to quality are detected. The QA Manager is responsible for assessing the effectiveness and compliance of RMRS to the quality concepts, requirements, and directives identified in this QAPP and associated implementing procedures. The RMRS QA Manager is also responsible for documenting identified deficiencies, facilitating appropriate corrective actions, verifying corrective action effectiveness, and tracking deficiencies to preclude recurrence and promote continuous improvement.

The QA organization has a designated group responsible for quality assurance program implementation and oversight of the Engineering/Construction/Decommissioning department. The 779 Cluster Decommissioning Project is receiving QA support, and is taking a proactive approach in its work planning activities to ensure programmatic compliance and to streamline QA review cycles.

The RMRS QA Program is inherent with the work being performed. This is accomplished during the planning of work, through the participation of Quality Engineers, reducing the need for extensive inspections and assessments. The primary principle supported is that the achievement of quality is embedded in the work processes, and that assessment should only be a tool for monitoring and continuous improvement.

10.3.2 Personnel Qualifications and Training

Project personnel are qualified to perform their respective tasks based on a combination of related experience, 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, at a centralized training record repository, maintained and operated by RMRS.

The RMRS 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 has been established and recorded within the QAPP.

10.3.3 Improvement

Employee participation in the assurance of quality and the continuous improvement process is gained 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.

As team members, Quality Engineers are able to identify problems early on and help implement actions to correct identified problems. Specifically, the Quality Engineers matrixed to the project participate in the planning process, review work control packages prior to implementation, and conduct surveillances of work as it is being performed. The QA group also supports process improvement through process reviews, audits, inspections, and planned surveillances.

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.

10.3.4 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 of RMRS 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, as defined by approved processes and plans 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 E/C/D projects, maintaining a consistent, and approved method.

10.3.5 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 reference standards, engineering specifications, workmanship criteria, quality plans or other requirements.

Quality affecting activities are prescribed by and performed according to documented instructions, procedures, and drawings. Additionally, the methods for creating and revising procedures are controlled.

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 Integrated Work Control Program (IWCP) is the formalized process that controls the development of the decommissioning work packages. Well established Waste Management Procedures and other controls ensure that the generation and handling of wastes meet governing requirements as well.

10.3.6 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, 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, well established, approved and documented 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.

10.3.7 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, Quality Engineers, to assure incorporation of appropriate quality assurance requirements and health and safety 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.

RMRS employs 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.

10.3.8 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, data management plans, etc. 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.

10.3.9 Assessment Program

RMRS has established and maintains 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, brought to the attention of 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 requirement compliance and implementation. Decommissioning Program management also perform documented Management Assessments of the decommissioning organization to determine the effectiveness of the QA Program and overall organization performance.

10.4 REFERENCES

The following references are utilized as sources for obtaining appropriate control requirements: Additional reference documents concerning Quality Assurance are located in the RMRS QAPP.

DOE Order 5700.6C, Quality Assurance, August 21, 1991

10 CFR 830.120, Quality Assurance Requirements, May 1994

Kaiser-Hill Team Quality Assurance Program

RMRS Quality Assurance Program Plan, 95-QAPP-001

11.0 FACILITY SECURITY

All the containerized special nuclear material (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 Safegaurds Category 3 building (clearance required for free access). After the completion of the SNM consolidation and deactivation activities the building will be further down graded to a Category 4.

Entry into the Building 779 Cluster can only be accessed through the tripple-fenced Protected Area (PA). Individuals entering the PA must hold a DOE clearance or be escorted by a cleared individual. The building 779 Cluster has been downgraded from a "Classified" plutonium facility to ta "non-classified facility, but visitors must be escorted within the 779 Cluster by a building qualified individual. General public access to these facilities are not permitted.

APPENDIX 1

1.0 BUILDING 779 CLUSTER DESCRIPTION

1.1 SCOPE

1.2 SUMMARY DESCRIPTION OF THE 779 COMPLEX

Main structures in the Building 779 Cluster are the research and development 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 the Rocky Flats plant, east of Buildings 776/777 and north of Building 750.

The building is constructed primarily of 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 Building 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.

1.2.1 Description Of Facility

This section describes the physical arrangement of principal buildings in the Building 779 Cluster, architectural and structural features, significant equipment, environmental control systems, and safety aspects of each. Building 779 (1 in Figures 1.2-1 and 1.2-2) has been in use since May 1965. Since then, two major additions have been constructed. The first addition (2 in Figures 1.2-1 and 1.2-2), also referred to as Building 779A, was built in 1968. The second addition (3 in Figures 1.2-1 and 1.2-2 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.

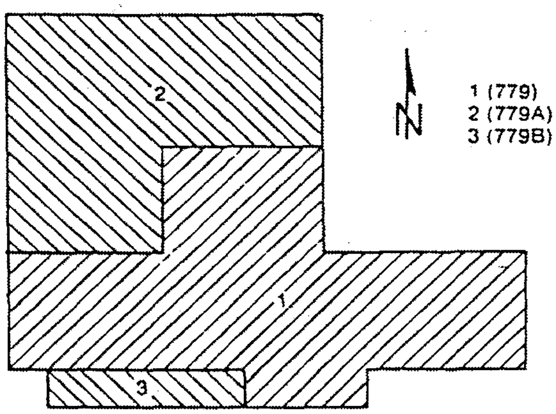


Figure 1.2-1 First Floor Key Plan, Building 779

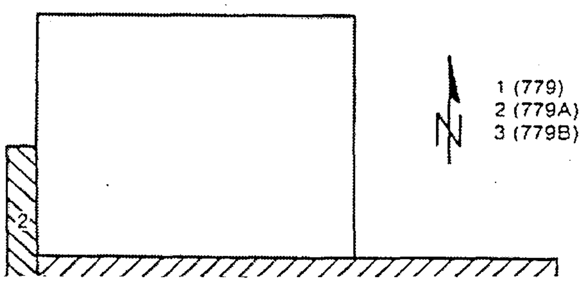


Figure 1.2-2 Second Floor Key Plan, Building 779

93

1.2.2 General Description

Building 779 is the primary structure in the 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 folows: 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.

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, heating, ventilating, air conditioning (HVAC), electricity, gas and compressed air, steam, water, process waste, sewer, fuel oil, and fire protection utility systems serve the Cluster.

1.2.3 Building 779 Description

The primary functions of Building 779 were 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 1.2-3 and 1.2-4. The facility has joining, coating, and electroplating 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.

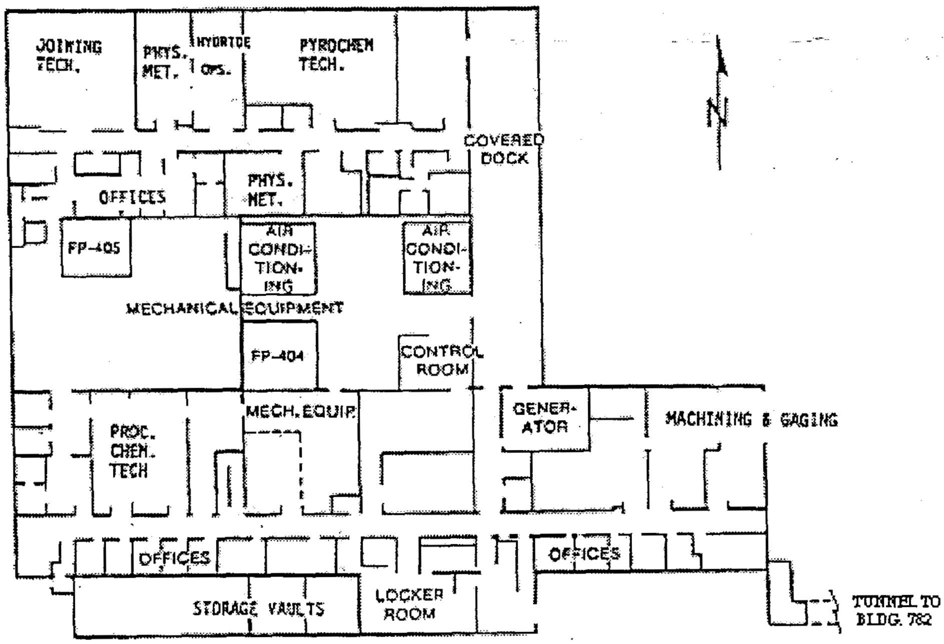


Figure 1.2-3 First Floor Plan, Building 779

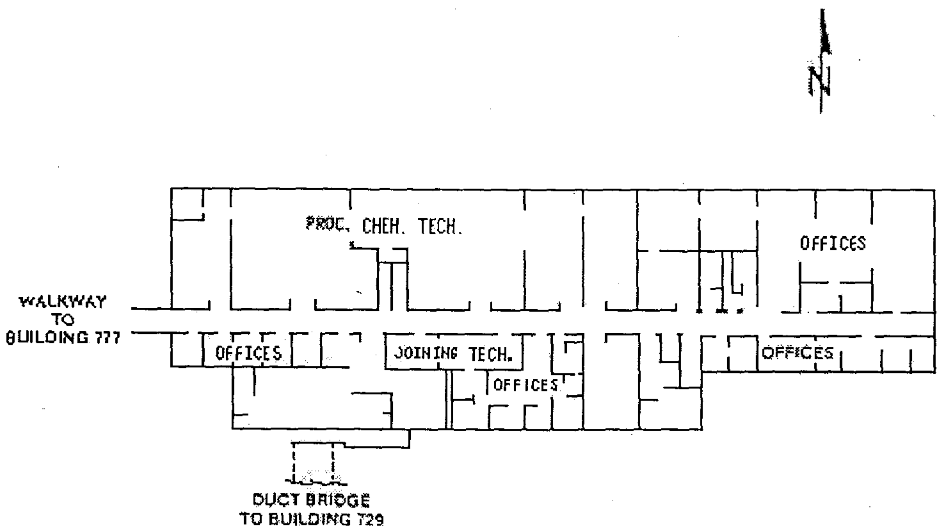


Figure 1.2-4 Second Floor Plan, Building 779

779 5-5 5/87

1.2.3.1 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.

1.2.3.2 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.

1.2.3.3 Exterior Walls

The exterior walls of Building 779 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.

1.2.3.4 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.

1.2.3.5 Roofs

Three different roof systems have been used on Building 779. The single-story portion of the original structure (1 in Figure 1.2-1) 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.

1.2.3.6 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.

1.2.3.7 Ceilings

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

1.2.3.8 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.

1.2.3.9 Windows

There are few windows in Building 779. The addition (Building 779-3) on the south side of Building 779 (Figure 1.2-2) resulted in sealing most of the original windows. However, some windows remain on the south-east end of the building where the offices are. The southeast end of the building has four windows on the first floor and seven on the second.

1.2.3.10 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.

1.2.3.11 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.

1.2.3.12 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.

1.2.3.13 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.

1.2.3.14 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.

1.2.3.15 Arrangement of Building 779

Building 779 is comprised of three main areas (Figures 1.2-1 and 1.2-2). 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.

1.2.4 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.

1.2.5 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 supression system water that could be contaminated. Figure 1.2-5 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.

1.2.6 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 space.

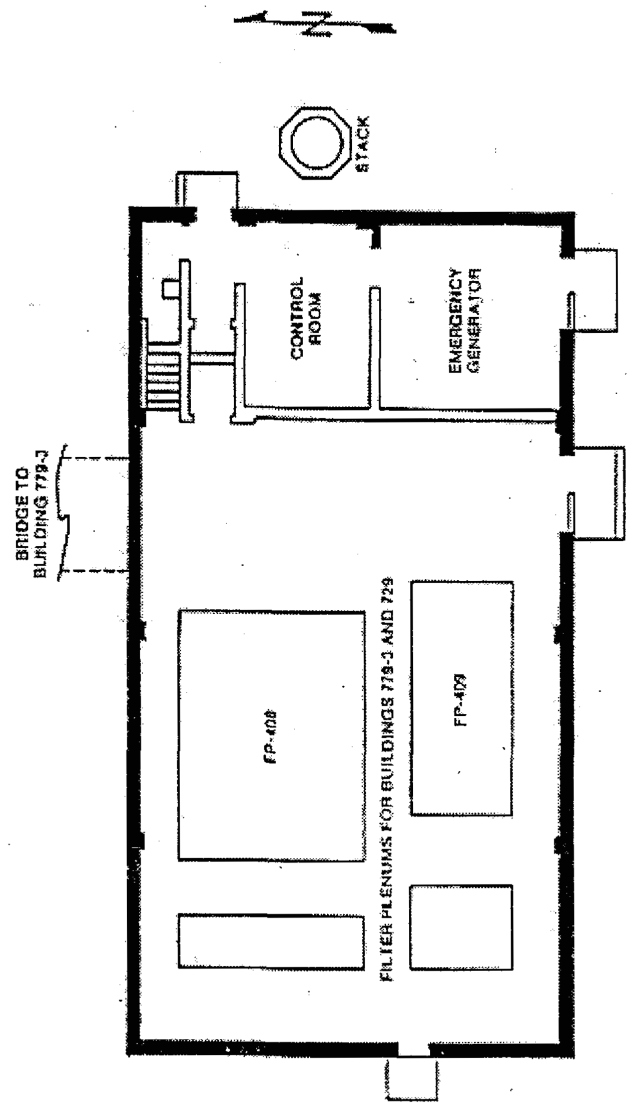


Figure 1.2-5 First Floor Plan, Building 729

1.2.7 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.

1.2.8 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, glovebox, 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 1.2-6 is a floor plan of the building.

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 supression 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 Plant Protection Dispatch Center, provide fire protection for the building.

1.2.9 Zone Concept for Confinement

To ensure that radioactivity is contained and controled 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.

1.2.10 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 l/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. Glove ports are stainless steel rings welded to glovebox walls. Thick rubber gloves are attached to glove ports 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.

1.2.11 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 Building 779 complex 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.

1.2.11.1 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 1.2-7). 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 1.2-8 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-lOlA 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-l. (With the AC-l 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.

1.2.11.2 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-l. One hundred percent of the air from Room 127 is exhausted through the building exhaust plenum, FP-403, in Building 782.

1.2.11.3 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.

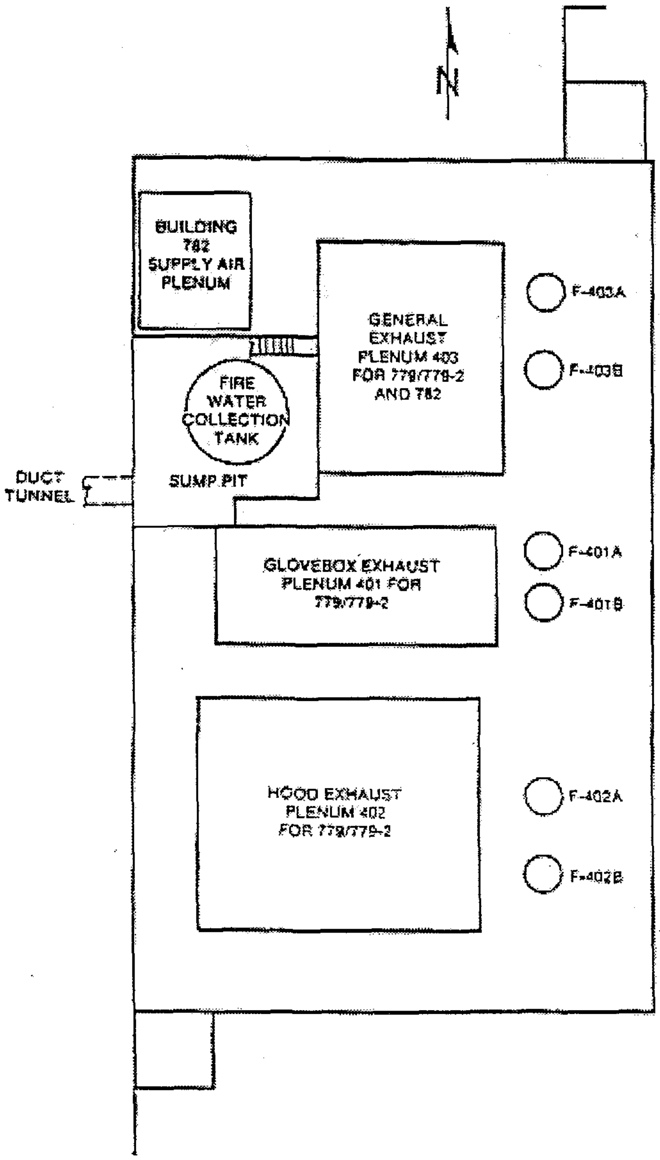


Figure 1.2-6 Floor Plan, Building 782

1.2.11.4 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 1.2.9). 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 1.2-7).

1.2.11.5 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 1.2-10).

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.

1.2.11.6 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.

1.2.11.7 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 original Building 779.

1.2.12 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.

1.2.13 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 1.2-11 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

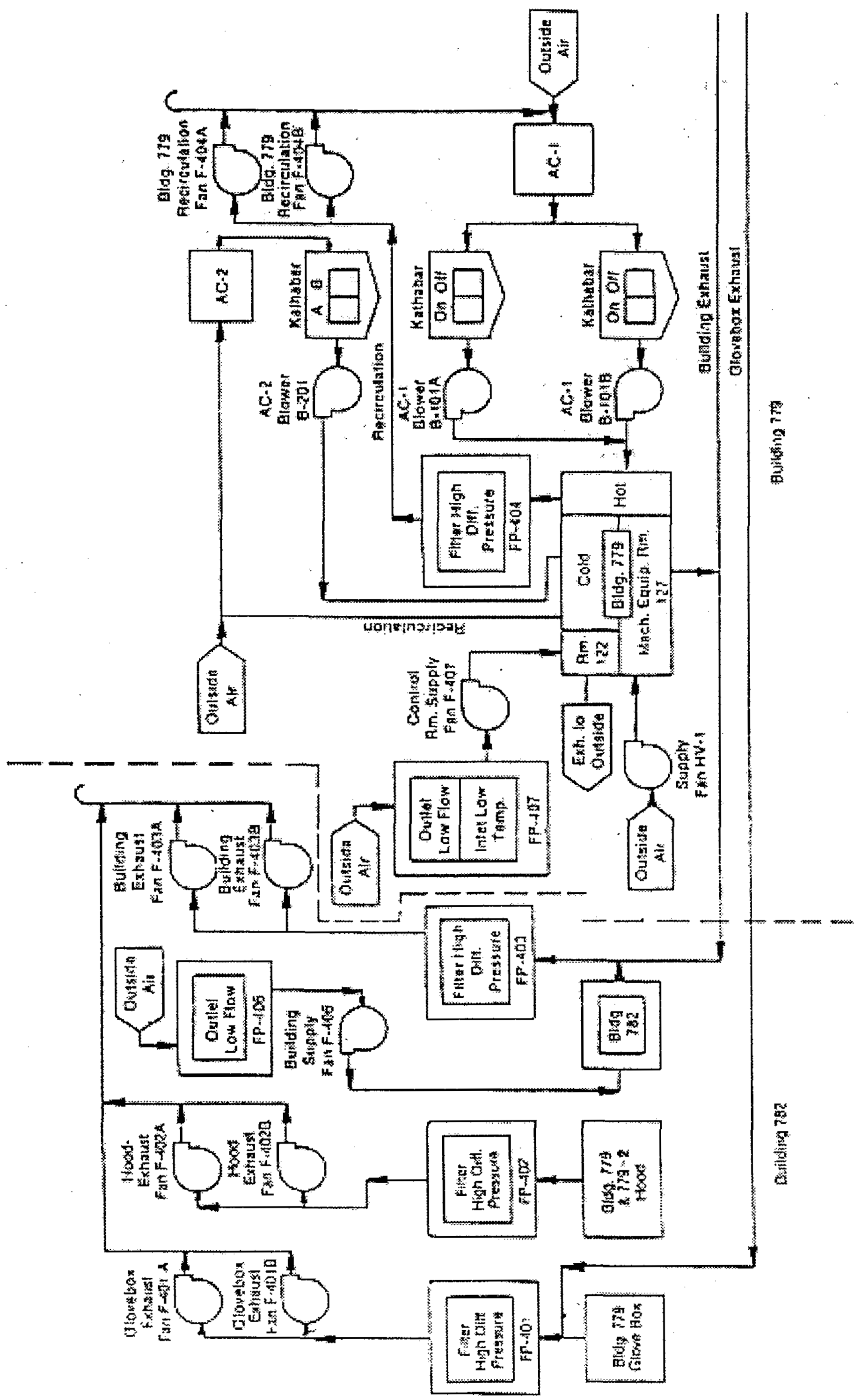


Figure 1.2-7 Building 779 Airflow

108

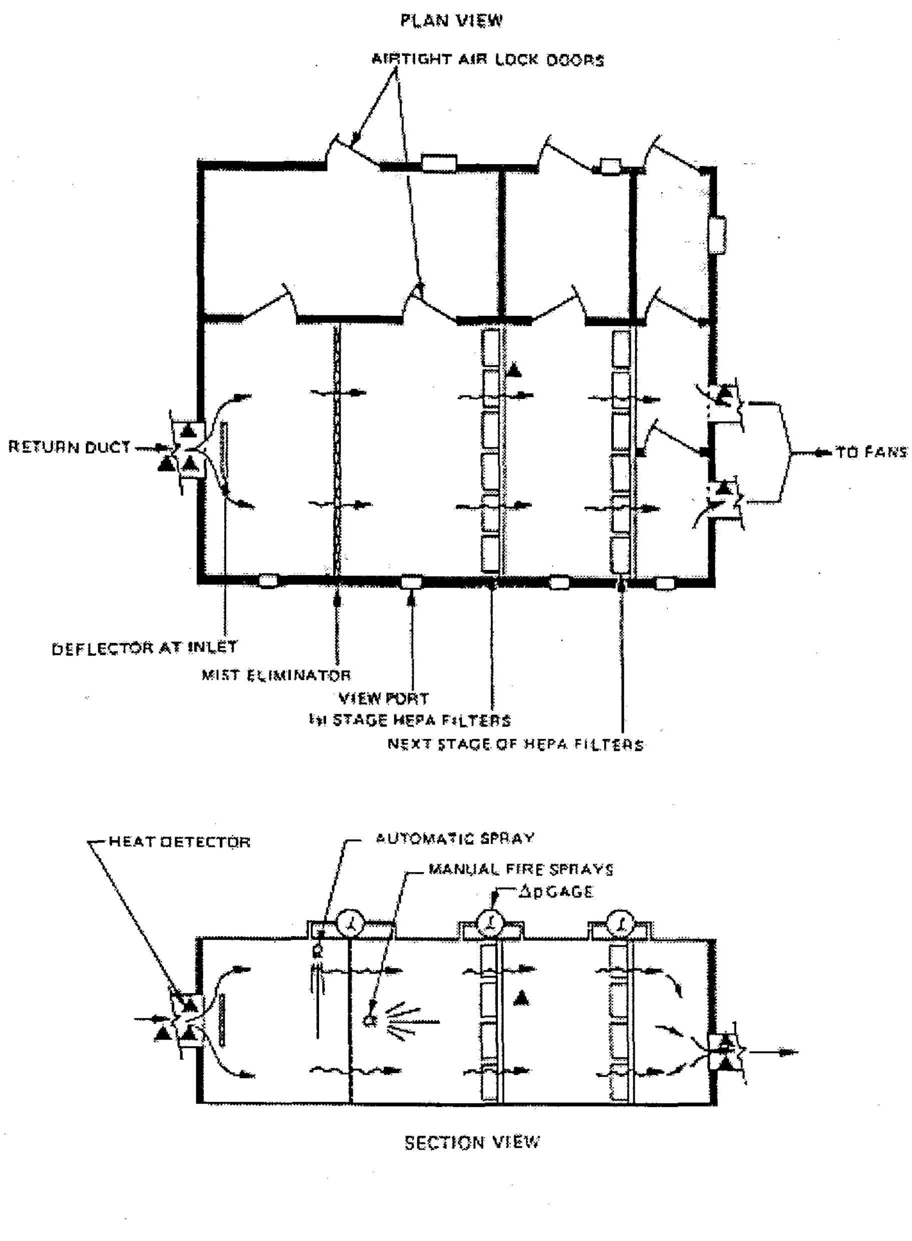
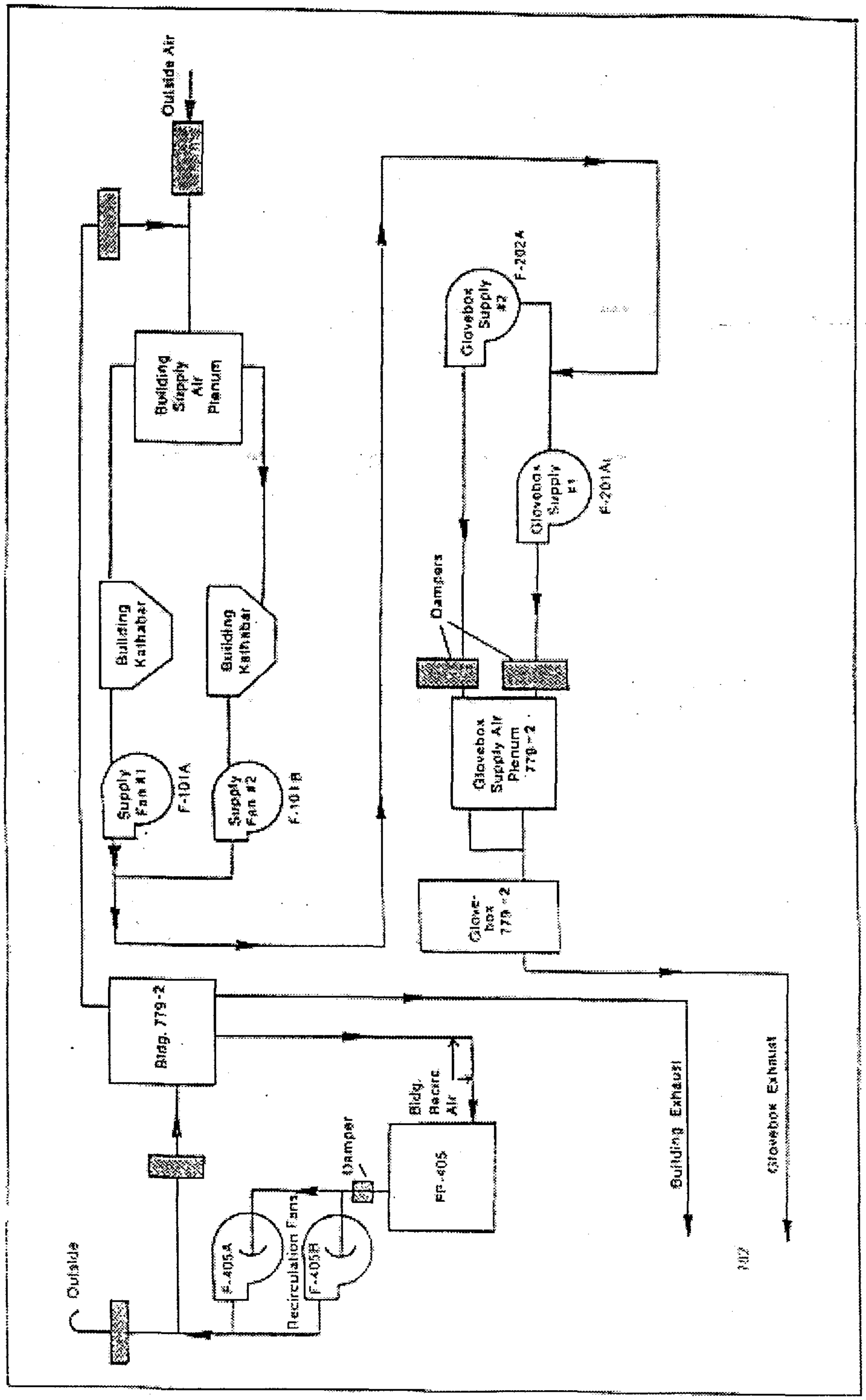


Figure 1.2-8 Typical Two-Stage Filter Plenum for exhaust Air



779

Figure 1.2-9 Building 779-2 Airflow

1.2.13.1 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 restored via emergency generators. The function and operation of the EMCCs are discussed in the following section.

1.2.13.2 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.

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.

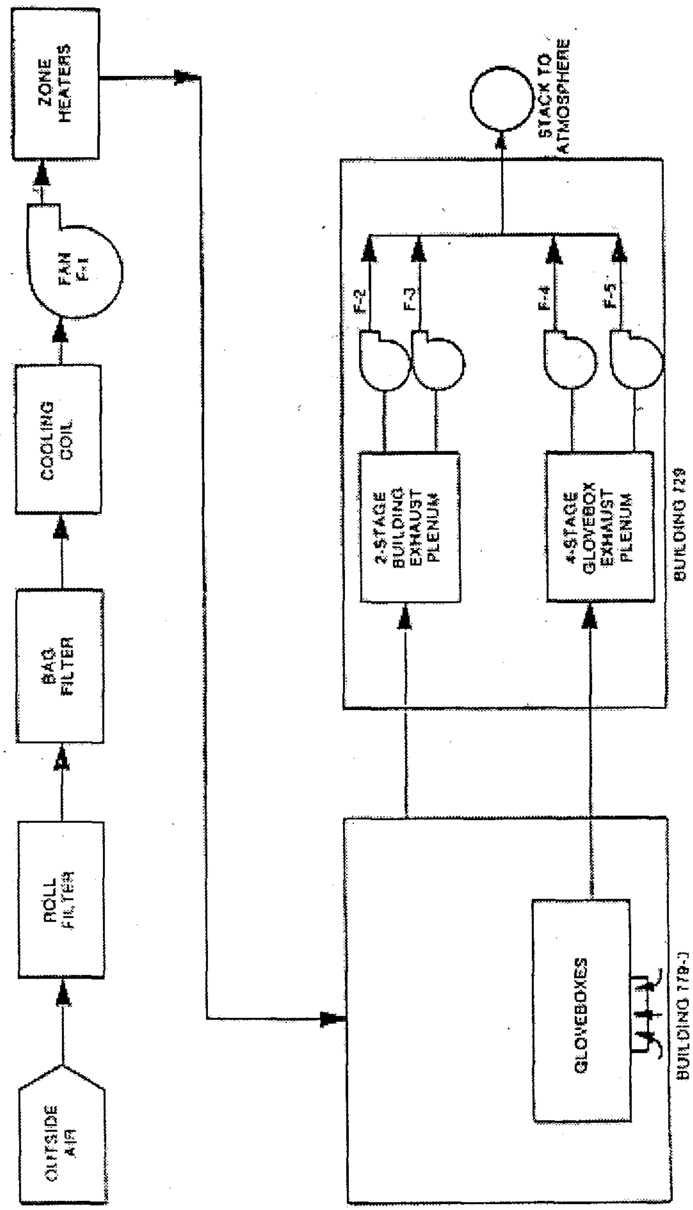


Figure 1.2-10 Building 779-3 Airflow

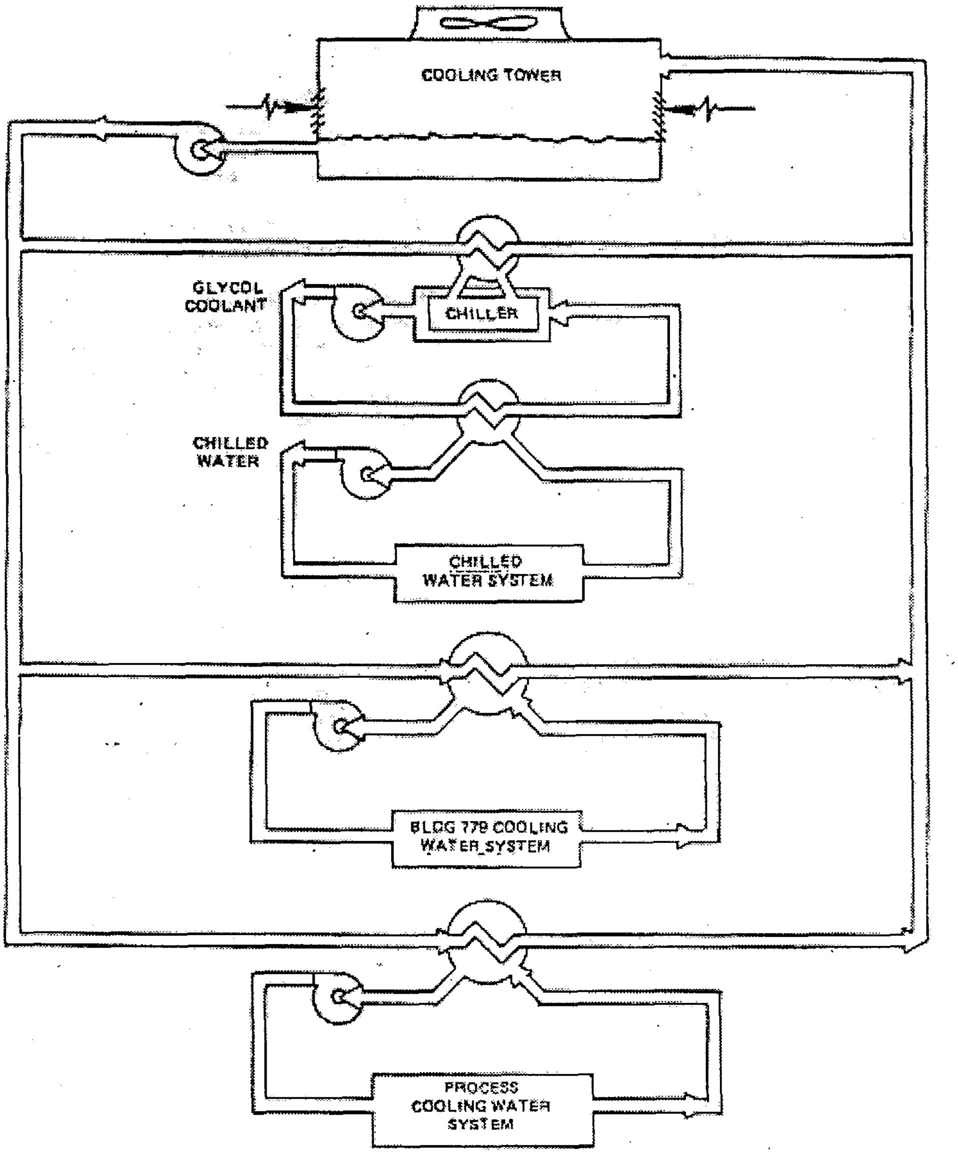


Figure 1.2-12 Cooling System

113

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 Table 1.2-1 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-kU), 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 1.2-1 Equipment on Emergency Power

EMCC 782-A -- Fed from 500-kU 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-kU 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-kU 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

(Table continued on next page)

TABLE 1.2-1 Equipment on Emergency Power (continued)

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-kU 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
Inverter 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

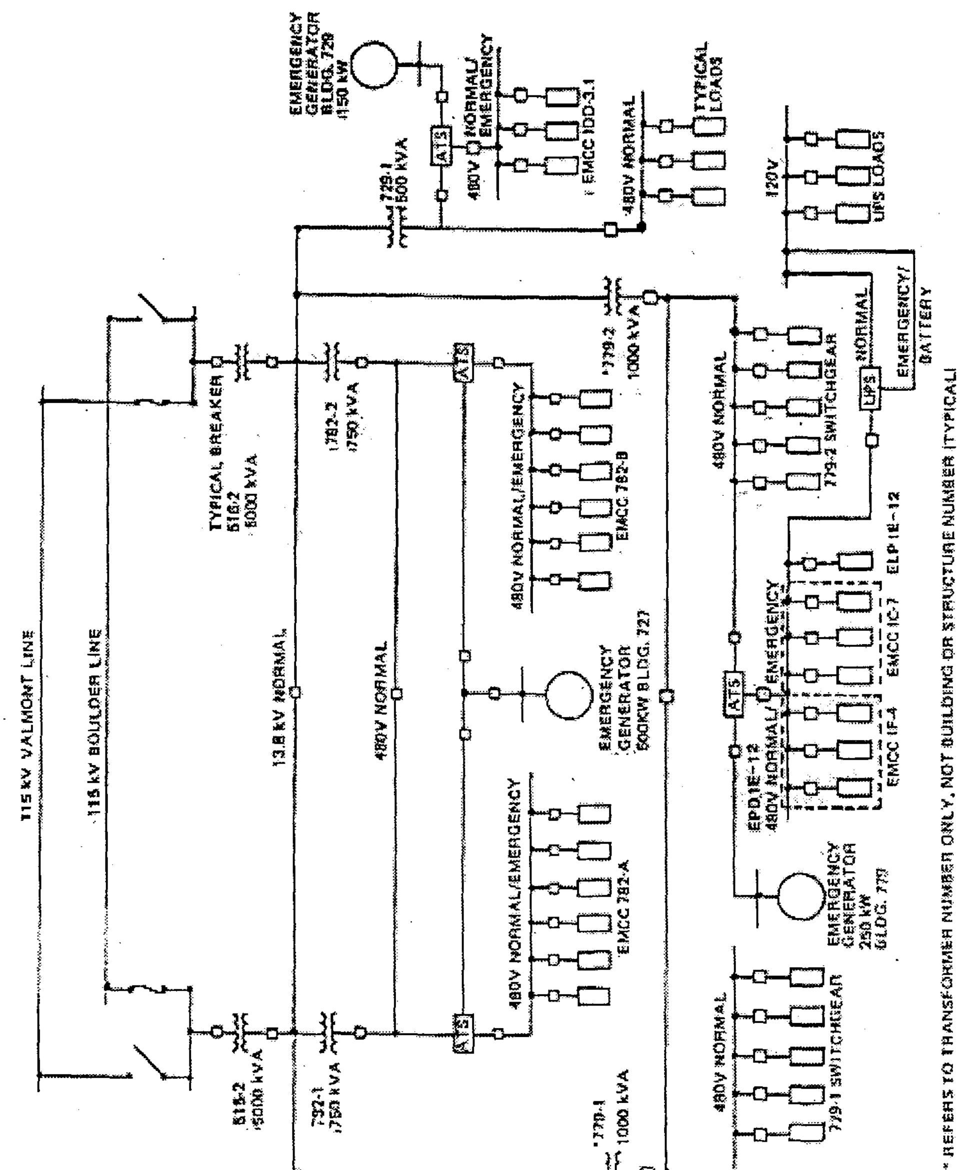


Figure 1.2-11 Basic Electrical Distribution System for Buildings 727, 729,779, and 782

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 sec before starting each succeeding motor.

1.2.13.3 Uninterruptible Power Supply (UPS) 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 inverter, 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 inverter 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 inverter which can remain connected and operational for up to 8 hours. Since the inverter 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.

1.2.13.4 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 dissapates (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 Building 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.

1.2.13.5 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 in the Plant Protection Dispatch Center. 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 disel fuel tank which contains approximately a 2-hr supply of fuel. The other emergency generators have disel 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 (e.g., HVAC instrumentation) connected to it to effect a safe shutdown of critical systems. All loads on emergency power, (e.g., 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 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 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 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.

1.2.14 Gas and Compressed Air

Inert gas for the Building 779 complex is supplied from various sources outside the complex. Compressed air is piped to the complex for use in pneumatic equipment. Inert gas will not be used during decommissioning.

1.2.14.1 Inert Gas Systems

Nitrogen is used for inerting 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 is 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.

1.2.14.2 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.

1.2.14.3 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).

1.2.14.4 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.

1.2.15 Steam Supply and System

Steam for the Building 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.

1.2.16 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 1 Section 1.2.20.

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.

1.2.17 Process Waste System

The areas in which radioactive operations are performed drain into one holding tank in the basement (Room 001) of Building 779.

1.2.18 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.

1.2.19 Fuel Oil System

Fuel oil for the emergency generators is stored in separate, underground 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.

1.2.20 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 Plant Protection Dispatch Center 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 plant 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 1.2-8.

1.2.21 Radiation, Contamination, and Criticality Safeguards

1.2.21.1 Radiation Control

Gamma and alpha 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.

1.2.21.2 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 descharged 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 activites.

1.2.21.3 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.

1.2.22 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.

1.2.22.1 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 Plant Protection Dispatch Center and Fire Department. In some instances, alarms also sound locally.

1.2.22.2 Selective Alpha Air Monitors (SAAMs)

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.

1.2.22.3 Security Alarms

Security alarms in Buildings 779 include door alarms on all outside entrances. These alarms are also transmitted to the Plant Protection Dispatch Center.

1.2.22.4 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 Plant Protection Dispatch Center, 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 2

1.0 DECONTAMINATION OPTIONS

The following sections have been excepted 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 is however, receiving additional funds to demonstrate new technologies. Some of the sections which are included discuss new decontamination technologies. Although an attempt has been made to include a discussion of the decontamination methods which may be used, one or more methods other than identified below may be required/used.

Decontamination is a major decommissioning activity that may be used to accomplish several goals, such as reducing 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. The additional cost for the disposal of materials is expected to outweigh the potential increase in:

- (1) Occupational exposure rates,
- (2) The potential for a release, and

(3) 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 nuclear industry as decontaminates. The objective of chemical decontamination in the nuclear 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 oxidatCion 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 has been 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 the 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 (e.g., 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.

1.2.2.1 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 onsite 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 (e.g., a laboratory within a building). The techniques described in this chapter remove various depths of surface contamination (e.g., 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 (e.g., 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

1.3.1.1 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).

1.3.1.2. 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. I t 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

1.3.2.1 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 high efficiency particulate air (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.

1.3.2.2. 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, carbonwaxes (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.

1.3.3.2 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

1.3.4.1 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 be used 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 wastes 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.

1.3.4.2 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

1.3.5.1 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 (i.e., Pu-238) care must be taken to prevent excessive heat generation (e.g., separate material into smaller portions).

1.3.5.2 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

1.3.6.1 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.

1.3.6.2 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 wastewater 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

1.3.7.1 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 (i.e., 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 (i.e., 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 wastewater 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 robotic system.

1.3.7.2 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 f 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 washwater 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 $C0_2$ Blasting

1.3.8.1 Description of Technique

This technique is a variation of grit blasting in which $C0_2$ 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 $C0_2$ (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 $C0_2$ 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.

1.3.8.2 Applications

Blasting with C02 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, $C0_2$ 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 workspace, ventilation is usually sufficient to prevent undue $C0_2$ buildup; in a confined space, however, ventilation needs to be actively monitored. Because $C0_2$ 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

1.3.9.1 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.

1.3.9.2 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, feedwater 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 wastewater 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

1.3.10.1 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 wastewater require a processing system in which the contaminant is separated, containerized, and disposed of and the wastewater treated and recycled.

1.3.10.2 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 (i.e., a cleaning head or a cutting head) (MMES 1993, Flow International, K&S Engineering).

1.3.11 Shot Blasting

1.3.11.1 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.

1.3.11.2 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

1.3.12.1 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 air 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 wastewater 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.

1.3.12.2 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 x5-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

1.3.13.1 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.

1.3.13.2 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 wastewater, the abrasive, and the removed debris. These wastes must be properly treated and/or disposed of. If the wastewater 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

1.3.14.1 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.

1.3.14.2 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

1.3.15.1 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 80 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.

1.3.15.2 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

1.3.16.1 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 workpiece past stationary cutters that are perpendicular to the cutter's axis. Other types of milling machines (i.e., where the workpiece 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.

1.3.16.2 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

1.3.17.1 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.

1.3.17.2 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

1.4.1.1 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 robotic viewing, aiming, and handling system to gain access to and decontaminate otherwise inaccessible areas (Flesher, 1992).

1.4.1.2 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).

GLOSSARY

alpha- radiation - The most energetic but least penetrating form of radiation. It can be stopped by a sheet of paper and cannot penetrate human skin. If an alpha-emitting isotope enters the body, however, through inhalation, on food, or through a cut in the skin, it will cause highly concentrated local damage. (See also beta radiation and gamma radiation.)

asbestos - Asbestos form; varieties of chrysotile, amosite, aocidolite, anthophyllite, tremolite, and actinolite. A strong and incombustible fiber widely used in the past for fireproofing and insulation. The small, bouyant fibers are easily inhaled or swallowed, causing a number of serious diseases including: asbestosis, a chronic disease of the lungs that makes breathing more and more difficult; cancer; and mesothelioma, a cancer of the membranes that line the chest and abdomen, specific to asbestos exposure.

as low as reasonably achievable- A standard applied to regulate radiation exposure limits at nuclear facilities. The principle takes into account the state of technology, the economics of improvements in relation to benefits to the public health and safety, other societal and socioeconomic considerations, and the utilization of atomic energy in the public interest.

background radiation - The natural radioactivity in the environment. Natural radiation consists of cosmic rays, filtered through the atmosphere from outer space, and radiation from the naturally radioactive elements in the earth (primarily uranium, thorium, radium, and potassium). Also known as natural radiation.

best available technology (BAT) - Treatment technologies that have been shown through actual use to yield the greatest environmental benefit among competing technologies that are practically available.

beta radiation - High-energy electrons (beta particles) emitted from certain radioactive material. Can pass through 1 to 2 centimeters of water or human flesh and can be shielded by a thin sheet of aluminum. Beta particles are more deeply penetrating than alpha particles but, due to their smaller size, cause less localized damage.

characterization - Facility or site sampling, monitoring, and analysis activities to determine the extent and nature of a contamination. Characterization provides the basis for acquiring the necessary technical information to develop, screen, analyze, and select appropriate cleanup techniques.

Clean Water Act- Controls waste emissions into surface water bodies or publicly owned treatment systems. Requires best conventional technology and best available demonstrated controls to limit the impact of the contaminants.

Comprehensive Environmental Response, Comprehensive, and Liability Act- A federal law passed in 1980, and modified in 1986 by the Superfund Amendments and Reauthorization Act. The Acts created a special tax that goes into a Trust Fund, commonly known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous waste sites.

contamination - The presence of foreign materials, chemicals, or radioactive substances in the environment (facilities, soil, sediment, water, or air) in significant concentrations.

curie - A unit of radioactivity that represents the amount of radioactivity associated with one gram of radium. To say that a sample of radioactive material exhibits one curie of radioactivity means that the element is emitting radiation at the rate of 3.7×10^{10} disintergrations per second. Named after Marie Curie, an early nuclear scientist.

decay - The process whereby radioactive particles undergo a change from one form, or isotope, to another, releasing radioactive particles and/or energy.

deactivation - The process of placing a facility in a safe and stable condition to minimize the long-term cost of a surveillance and maintenance program that is protective of workers, the public, and the environment until decommissioning is complete. Actions include the removal of fuel, draining and/or de-energizing of nonessential systems, removal of stored radioactive and hazardous materials and related actions. As the bridge between operations and decommissioning, based upon facility-specific considerations and final disposition plans, deactivation can accomplish operations-like activities such as final process runs, and also decontamination activities aimed at placing the facility in a safe and stable condition.

decommissioning - Takes place after deactivation and includes surveillance and maintenance, decontamination, and/or dismantlement. These actions are taken at the end of the life of the facility to retire it from service with adequate regard for the health and safety of workers and the public and protection of the environment.

decontamination - The removal or reduction of radioactive or hazardous contamination from facilities, equipment, or soils by washing, heating, chemical or electrochemical action, mechanical cleaning or other techniques to achieve a stated objective or end condition.

dismantlement - The disassembly or demolition and removal of any structure, system, or component during decommissioning and satisfactory interim or long-term disposal of the residue from all or portions of the facility.

disposal - Waste emplacement designed to ensure isolation of waste from the biosphere, with no intention of retrieval for the foreseeable future, and that requires deliberate action to regain access to the waste.

dose - Quantity of radiation or energy absorbed; measured in rads.

dose equivalent - A term used to express the amount of effective radiation received by an individual. A dose equivalent considers the type of radiation, the amount of body exposed, and the risk of exposure. Dose equivalent is measured in rems.

environmental restoration- The process of environmental cleanup designed to ensure that risks to the environment and to human health and safety from waste sites are either eliminated or reduced to prescribed, safe levels.

friable asbestos - Asbestos, when dry, may be crumbled, pulverized, or reduced to powder by hand pressure and non-friable asbestos containing material, that when damaged, may be crumbled, pulverized, or reduced to powder by hand pressure.

gamma rays - Penetrating electromagnetic waves or rays emitted from nuclei during radioactive decay, similar to x-rays. Dense materials such as concrete and lead are used to provide shielding against gamma radiation.

half-life - The time required for a radioactive substance to lose 50 percent of its activity by decay. The half-life of the radioisotope plutonium-239, for example, is about 24,000 years. Starting with a pound of plutonium-239, in 24,000 years there will be one-half pound of plutonium-239, in another 24,000 years there will be one-fourth pound, and so on. (A pound of material remains, but it gradually becomes a stable element.)

hazard - A source of danger (i. e., material, energy source, or operation) with the potential to cause illness, injury, or death to personnel or damage to a facility or to the environment (without regard for the likelihood or credibility of accident scenarios or consequence mitigation).

hazard categories - The consequences of unmitigated releases of radioactive or hazardous material as evaluated in accordance with DOE Order 5480.23, Nuclear Safety Analysis Reports, and classified by the following hazard categories:

- Hazard Category 1. The hazard analysis shows the potential for significant off site consequences. (No Hazard Category 1 facilities are designated at Rocky Flats).
- Hazard Category 2. The hazard analysis shows the potential for significant on site consequences.
- Hazard Category 3. The hazard analysis shows the potential for only significant localized consequences.

hazardous materials - Any solid, liquid, or gaseous material that is toxic, explosive, flammable, corrosive, or otherwise physically or biologically threatening to health.

hazardous waste - A solid waste or combination of solid wastes, that because of quantity, concentration, or physical, chemical, or infectious characteristics, may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness or pose a substantial hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

health and safety plan- Prepared during the scoping phase of a Superfund remediation, this plan describes the measures that will be taken to ensure health and safety at the site.

isotopes - Atoms of the same element that have equal numbers of protons, but different numbers of neutrons. Isotopes of an element have the same atomic number but different atomic mass. For example, uranium-238 and uranium-235.

low-level waste - Discarded radioactive material such as rags, construction rubble, glass, etc., that is only slightly or moderately contaminated. They pose few health hazards and are usually disposed of by shallow land burial.

mixed waste - Contains both radioactive and hazardous components.

National Environmental Policy Act- Requires federal agencies to consider environmental factors when making decisions and to evaluate environmental impacts prior to making major federal actions. Environmental assessments and environmental impact statements are NEPA documents.

National Priorities List- The Environmental Protection Agency's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response under CERCLA. Based primarily on the score a site receives on the Hazard Ranking System.

natural radiation - Radiation that is alwayspresent in the environment from such sources as cosmic rays and radioactive materials in rocks and soil. Also known as background radiation.

nuclear facility - A facility whose operations involve radioactive materials in such form and quantity that a significant nuclear hazard potentially exists to the employees or the general public. Included are facilities that:

(a) produce, process, or store radioactive liquid or solid waste, fissionable materials, or tritium;

(b) conduct separations operations;

(c) conduct irradiated materials inspection, fuel fabrication, decontamination, or recovery operations;

(d) conduct fuel enrichment operations. Incidental use of radioactive materials in a facility operation (e.g., check sources, radioactive sources, and X-ray machines) does not necessarily require the facility to be included in this definition.

nuclear radiation - Ionizing radiation originating in the nuclei of atoms; alpha, beta, and gamma radiation.

nuclear material safeguards categories- As defined in DOE order 5633.3B, "Control and Accountability of Nuclear Materials" and DOE order 5632.1C, "Protection and Control of Safeguards and Security Interests."

Categories as they apply to Decommissioning Projects at RFETS for materials with an attractiveness level D or E are:

- Category 1 - Not applicable.
- Category 2 - Requires "Q" clearance for access to the protected area (PA). Applies if quantities of Pu or U-233 are in excess of 16 kilograms or quantities of U-235 are in excess of 50 kilograms in the facility.
- Category 3 - Requires "L" clearance for access to the PA. Applies if quantities of Pu or U-233 are less than 16 kilograms or quantities of U-235 less than 50 kilograms, but not greater than 8 kilograms in the facility.

- Category 4 - No security clearance required to enter the area although the area may be locked. Applies if quantities of Pu or U-233 are less than 3 kilograms or quantities of U-235 are less than 8 kilograms.

pathways - The means by which contaminants move. Possible pathways include air, surface water, groundwater, plants, and animals.

operable unit- Term for each of a number of separate activities undertaken as part of a Superfund site cleanup. A typical operable unit would be removing drums and tanks from the surface of a site.

Polychlorinated Biphenyl (PCB) - A synthetic, organic chemical once widely used in electrical equipment, specialized hydraulic systems, heat transfer systems, and other industrial products. Highly toxic and a suspect carcinogen. Any wastes that contain more than 50 parts per million of PCBs are subject to regulation under the Toxic Substances Control Act.

plutonium - An artificially produced element that is fissile and radioactive. It is created when an atom of uranium-238 captures a slow neutron in its nucleus.

Proposed Action Memorandum- The decision document that describes an accelerated cleanup activity which DOE expects can be completed during a six-month period.

potentially responsible party- An individual(s) or company(ies) (such as owners, operators, transporters, or generators) potentially responsible for, or contributing to, the contamination problems at a Superfund site. Whenever possible, EPA requires PRPs, through administrative and legal actions, to clean up hazardous waste sites they have contaminated.

Quality Assurance Project Plan- A plan that describes the protocols necessary to achieve the data quality objectives defined for a remedial investigation.

radiation - Fast particles and electromagnetic waves emitted from the nucleus of an atom during radioactive disintegration.

radioactive - Giving off, or capable of giving off, radiant energy in the form of particles (alpha or beta radiation) or rays (gamma radiation) by the spontaneous disintegration of the nuclei of atoms. Radioisotopes of elements lose particles and energy through the process of radioactive decay. Elements may decay into different atoms or a different state of the same atom.

radioactive waste - A solid, liquid, or gaseous material of negligible economic value that contains radionuclides in excess of threshold quantities except for radioactive material from post-weapons-test activities.

radioisotope - An unstable isotope of an element that will eventually undergo radioactive decay (i.e., disintegration). Radioisotopes with special properties are produced routinely for use in medical treatment and diagnosis, industrial tracers, and for general research.

radiological facility - A facility containing measurable amounts of radioactive materials in quantities less than the thresholds for Hazard Category 3 established in DOE-STD-1027-92 but more than the thresholds established in 40 CFR 302, Appendix B, RQs.

radionuclide - A radioactive species of an atom.

radon - A radioactive gas produced by the decay of one of the daughters of radium. Radon is hazardous in unventilated areas because it can build up to high concentrations and, if inhaled for long periods of time, may cause lung cancer.

Resource Conservation Recovery Act- A federal law that established a regulatory system to track hazardous substances from the time of generation to disposal. The law requires safe and secure procedures to be used in treating, transporting, storing and disposing of hazardous substances.

risk - The quantitative or qualitative expression of possible loss that considers both the probability that a hazard will cause harm and the consequences of that event.

risk assessment - The study and estimation of risk from a current or proposed activity. Involves estimates of both the probability and consequence of an action.

Rocky Flats Cleanup Agreement- The legally binding agreement between the DOE, the EPA, and the CDPHE to accomplish the cleanup of radioactive and other hazardous substances contamination at RFETS.

Safe Drinking Water Act- A law that establishes regulations designed to protect drinking water resources. Incorporated both into RCRA and CERCLA under provisions dealing with groundwater protection.

safety analysis - A documented process to (1) provide systematic identification of hazards within a given DOE operation; (2) describe and analyze the adequacy of measures taken to eliminate, control, or mitigate identified hazards; and (3) analyze and evaluate potential accidents and their associated risks. For the purposes of this document, the term "analysis" and "assessment" are used interchangeably.

safety analysis report (SAR) - A report that documents the adequacy of safety analysis for a nuclear facility to ensure that the facility can be constructed, operated, maintained, shut down, and decommissioned safely and in compliance with applicable laws and regulations.

safety basis - The combination of information relating to the control of hazards at a nuclear facility (including design, engineering analyses, and administrative controls) upon which DOE depends for its conclusion that activities at the facility can be conducted safely.

standard industrial hazards - Hazards that are routinely encountered in general industry and for which national consensus codes and/or standards (e. g., OSHA, transportation safety, etc.) exist to guide safe design and operation without the need for special analysis to define safe design and/or operational parameters. Some site SAR hazards assessments refer to these as "typical" industrial hazards or just "industrial hazards."

scoping - In CERCLA, scoping is the initial planning phase of the cleanup process, when requirements are discussed and the projects defined. In the NEPA process, scoping relates to public involvement to help identify significant issues early so that efforts can be focused on those areas requiring resolution and to present a balanced environmental impact statement.

Sitewide Environmental Impact Statement- Document which serves as an action-forcing device to insure that the policies and goals defined in NEPA are included in the ongoing restoration programs. Provides full discussions of significant environmental impacts and informs the public of alternatives which would avoid or minimize adverse impacts.

Toxic Substance Control Act- A law which gave the EPA the authority to regulate the manufacture, distribution, use, and disposal of chemical substances. Special emphasis was placed on the regulation of PCBs, or polychlorinated biphenyls (see PCB).

transuranic (TRU) mixed waste - Radioactive waste containing a concentration of alpha-emitting transuranic nuclides greater than 100 nCi/g and contains non-radioactive hazardous constituents.

transuranic (TRU) waste - Waste materials contaminated with isotopes above uranium in the periodic table. Transuranic waste is long-lived, but only moderately radioactive. Radioactive waste containing a concentration of alpha-emitting transuranic nuclides greater than 100 nCi/g.

treatment - Any active that alters the chemical or physical nature of a waste to reduce its toxicity or prepare it for disposal.

United States Environmental Protection Agency- A federal agency that develops standards for acceptable limits of water, air, and environmental contaminants, and oversees adherence to those standards. Region VIII of the EPA will have oversight responsibilities for RFETS.

uranium - The heaviest element found in nature. Approximately 997 of every 1000 uranium atoms are uranium-238. The remaining 3 atoms are the fissile uranium-235. The uranium-235 atom splits, or fissions, into lighter elements when its nucleus is struck by a neutron.

ACRONYMS

The following is a partial listing of acronyms and abbreviations that are commonly used in the Decommissioning Program.

ACBM - Asbestos Coating Building Material

AEA - Atomic Energy Act

ALARA - As Low as Reasonably Achievable

APEN - Air Pollution Emission Notice

ARAR - Applicable or Relevant and Appropriate Requirement

ASAP - Accelerated Site Action Project (referred to as the Vision)

ATS - Automatic Transfer Switch

BAT - Best Available Technology Treatment

BOM - Bill of Material

BRCS - Building Radiation Cleanup Equivalent

CA - Contamination Area

CAA - Clean Air Act

CCC - Chemical Constituent Code

CCR - Code of Colorado Regulations

CDPHE - Colorado Department of Public Health and the Environment

CDTA - Cyclohexanediaminetetraacetic Acid Sodium Salt

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act

CFR - Code of Federal Regulations

COOP - Conduct of Operations Manual

CWA - Clean Water Act

D&D - Decontamination and Decommissioning

DCHP - Dicesiumhexachloroplutonate

DF - Decontamination Factors

DOE - U.S. Department of Energy

DOE/HQ - U.S. Department of Energy, Headquarters

DOP - Decommissioning Operations Plan

DOR - Direct Oxide Reduction

DP - Defense Program

DPP - Decommissioning Program Plan

DQO - Data Quality Objectives

E/C/D - Engineering/Construction/Decommissioning

EA - Environmental Assessment

EB - Electron Beam

EDE - Effective Dose Equivilant

EIS - Environmental Impact Statement

EM-60 - Office of Nuclear Material and Facilities Stabilization

EMCC - Emergency Control Centers

EO - Engineering Orders

EPA - U.S. Environmental Protection Agency

ER - Environmental Restoration

ESCA - Electron Spectroscopy for Chemical Analysis

FCN - Field Change Notices

FCR - Field Change Requests

FFCA - Federal Facility Compliance Agreement

FONSI - Finding of no significant importance

FR - Federal Regulation

FY - Fiscal Year

GB - GloveBox

HASP - Health and Safety Plan

HCA - High Contamination Area

HCL - High Concentration Level

HEPA - High Efficiency Particulate

HASP - Health and Safety Plan

HVAC - Heating, Ventilating, and Ari Conditioning

IAEA - International Atomic Energy Agency

IAG - Interagency Agreement

IHSS - Individual Hazardous Substance Site

IM/IRA - Interim Measures/Interim Remedial Action.

IWCP - Integrated Work Control Package.

JHA - Job Hazard Analysis.

JSA - Job Safety Analysis.

LDR - Land Disposal Restriction

LLM - Low Level Mixed.

LLW - Low-Level Waste

LRA - Lead Regulatory Agency

MAA - Material Access Area

MAAL - Maxium Allowed Asbestos Level

MCC - Motor Control Centers

MCL - Maximum Concentration Level

MSE - Molten Slat Extraction

NAAQS - National Ambient Air Quality Standards

NCP - National Contingency Plan

NCR - Nonconformance Reporting.

NDA - Nondestructive Assay.

NEPA - National Environmental Policy Act

NPL - National Priorities List

NRC - U.S. Nuclear Regulatory Commission

NRWOLS - Non-Routine Waste Organization Logs.

NUREG - Nuclear Regulation

OSHA - Occupational Safety and Health Administration

OU - Operable Unit

PAM - Proposed Action Memorandum

PCB - Polychlorinated Biphenyl

PM - Project Manager

PNL - Pacific Northwest Laboratories.

PPE - Personal Protective Equipment.

PRP - Potentially Responsible Party

PSZ - Protective Zone.

PU - Plutonium.

PU&D - Property Utilization and Disposal.

QA - Quality Assurance

QAPP - Quality Assurance Project Plan

QCR - Quality Conditioning Reporting.

R&D - Reserach and Development.

RBA - Radiation Boundary Area

RC - Response Center.

RCA - Radiological Controled Area.

RCM - Radiological Controls Manaual.

RCRA - Resource Conservation and Recovery Act

RCT - Radiation Control Technician.

RE - Radiation Engineers.

RFCA - Rocky Flats Cleanup Agreement

RFETS - Rocky Flats Environmental Technology Site

RLCR - Reconnaissance Level Characterization Report.

RMRS - Rocky Mountain Remediation Services.

ROD - Record of Decision

RPOSO - Radiation Protection snf Occupational Safety Officer.

RRA - Rubber Reclaimers Association.

RTT - Residue Treatment Technology.

RWP - Radiation Work Package.

S&M - Surveilance and Maintenance

SAAM - Selective Alpha Air Monitor System.

SARA - Superfund Amendments and Reauthorization Act.

SDWA - Safe Drinking Water Act

SEIS - Sitewide Environmental Impact Statement

SEM - Scanning Electron Microscopy

SNM - Special Nuclear Material

SRA - Support Regulatory Agencies.

TBC - To Be Considered.

TEM - Transmission Electron Microscope.

TIRA - Temperature Indicating Recording Enuciating System.

TRM - Training Reference Manual.

TRU - Transuranic Waste.

TSCA - Toxic Substances Control Act

U - Uranium.

UG - Micrograms.

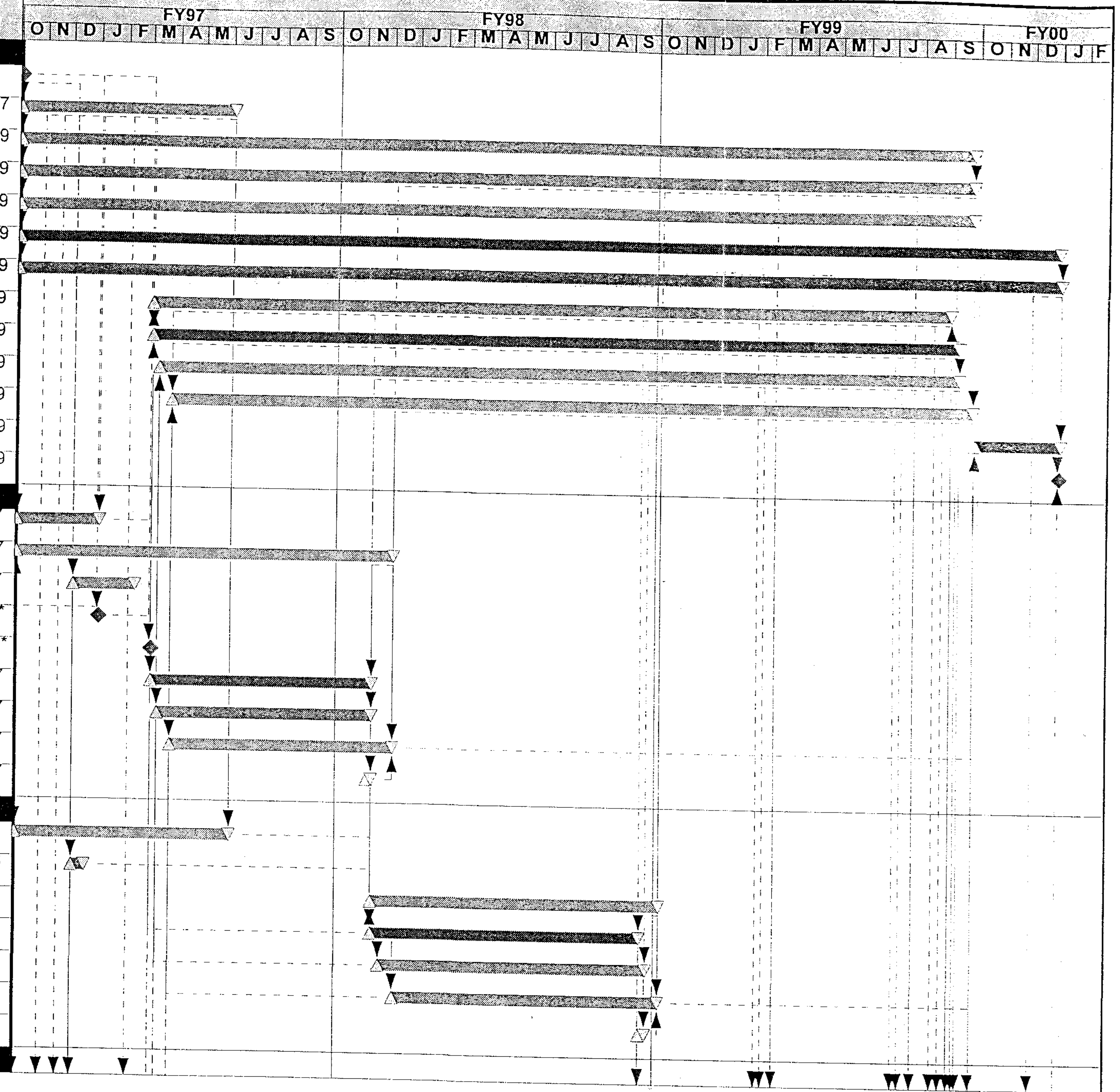
UPS - Uninterrputed Emergency Power Supply.

UST - Underground Storage Tank

WRT - Waste Residue Traveler.

WSRIC - Waste Stream and Residue Identification and Characterization.

WBS	Activity ID	Activity Description	Orig dur	Early start	Early Finish
Summary Level Activities					
1.06.14.04.	AEKTBG2701	Start Project for FY97	0	01OCT96	
1.06.14.04.03.02.	AEKTBHEA06	Initial Characterization Areas 1-6	152*	01OCT96	02JUN97
1.06.14.04.03.03.	AEKTBG2700	Site Preparation	680*	01OCT96	24SEP99
1.06.14.04.03.	AEKTBGEA00	Decommissioning	680*	01OCT96	24SEP99
1.06.14.04.03.02.	AEKTBHEA05	Characterization	680*	01OCT96	24SEP99
1.06.14.04.03.03.	AEKTBHE201	Site Prep and outyear Hammock	822*	01OCT96	30DEC99
1.06.14.04.03.01.	AEKTBG3200	Planning & Engineering	740*	01OCT96	31DEC99
.06.14.04.03.05.	AEKTBGER00	Dismantlement	571*	04MAR97	01SEP99
.06.14.04.03.02.	AEKTBGEA08	Continuing Characterization	576*	04MAR97	10SEP99
.06.14.04.03.04.	AEKTBGEP00	Decontamination	571*	12MAR97	10SEP99
.06.14.04.03.02.	AEKTBHEA09	Final Characterization	571*	26MAR97	24SEP99
.06.14.04.03.06.	AEKTBGER03	Building Demo	60	27SEP99	31DEC99
.06.14.04.	AEKTBG2799	Finish project	0		30DEC99
Work Area 1					
.06.14.03.04.02.01.	AEKTBHEF00	SSOC B779 Area 1 Initial Physical Deactivatio	64	01OCT96	03JAN97
.06.14.04.03.	779512600	SS WA1 HAMMOCK	299*	01OCT96	05DEC97
.06.14.02.03.02.	AE1423435	SSOC Bldg 779 Area 1 SNM Cleanout	49	05DEC96*	13FEB97
.06.14.04.03.02.	AEKTBHEA07	Initial Characterization Report	0		03JAN97*
.06.14.04.03.01.01.	AEKTBGEA02	Bldg 779 Decommissioning Opns Plan Approval	0		03MAR97*
.06.14.04.03.05.01.	AEKTBGER10	Bldg 779 Area 1 Process Equipment Removal	160	04MAR97	11NOV97
.06.14.04.03.04.	AEKTBGEP10	Bldg 779 Area 1 Decontamination	155	12MAR97	11NOV97
.06.14.04.03.02.01.	AEKTBGEA10	Bldg 779 Area 1 Final Survey	160	26MAR97	05DEC97
.06.14.04.03.05.02.	AEKTBGER15	Bldg 779 Area 1 Utility Removal	5	05NOV97	11NOV97
Work Area 2					
.06.14.03.04.02.02.	AEKTBHEG00	SSOC B779 Area 2 Initial Physical Deactivatio	169	01OCT96	02JUN97
.06.14.02.03.02.	AE1423440	SSOC Bldg 779 Area 2 SNM Cleanout	12	05DEC96	20DEC96
.06.14.04.03.	7791201101	SS WA 2 HAMMOCK	227*	12NOV97	06OCT98
.06.14.04.03.05.01.10.	AEKTBGER20	Bldg 779 Area 2 Process Equipment Removal	190	12NOV97	14SEP98
.06.14.04.03.04.	AEKTBGEP20	Bldg 779 Area 2 Decontamination	190	20NOV97	22SEP98
.06.14.04.03.02.10.	AEKTBGEA20	Bldg 779 Area 2 Final Survey	190	08DEC97	06OCT98
.06.14.04.03.05.02.	AEKTBGER25	Bldg 779 Area 2 Utility Removal	5	15SEP98	22SEP98
Work Area 3					



t Start 01JAN93
t Finish 31DEC99
Date 01OCT96
Date 04JAN97

Early Bar
Progress Bar
Critical Activity

ISBA

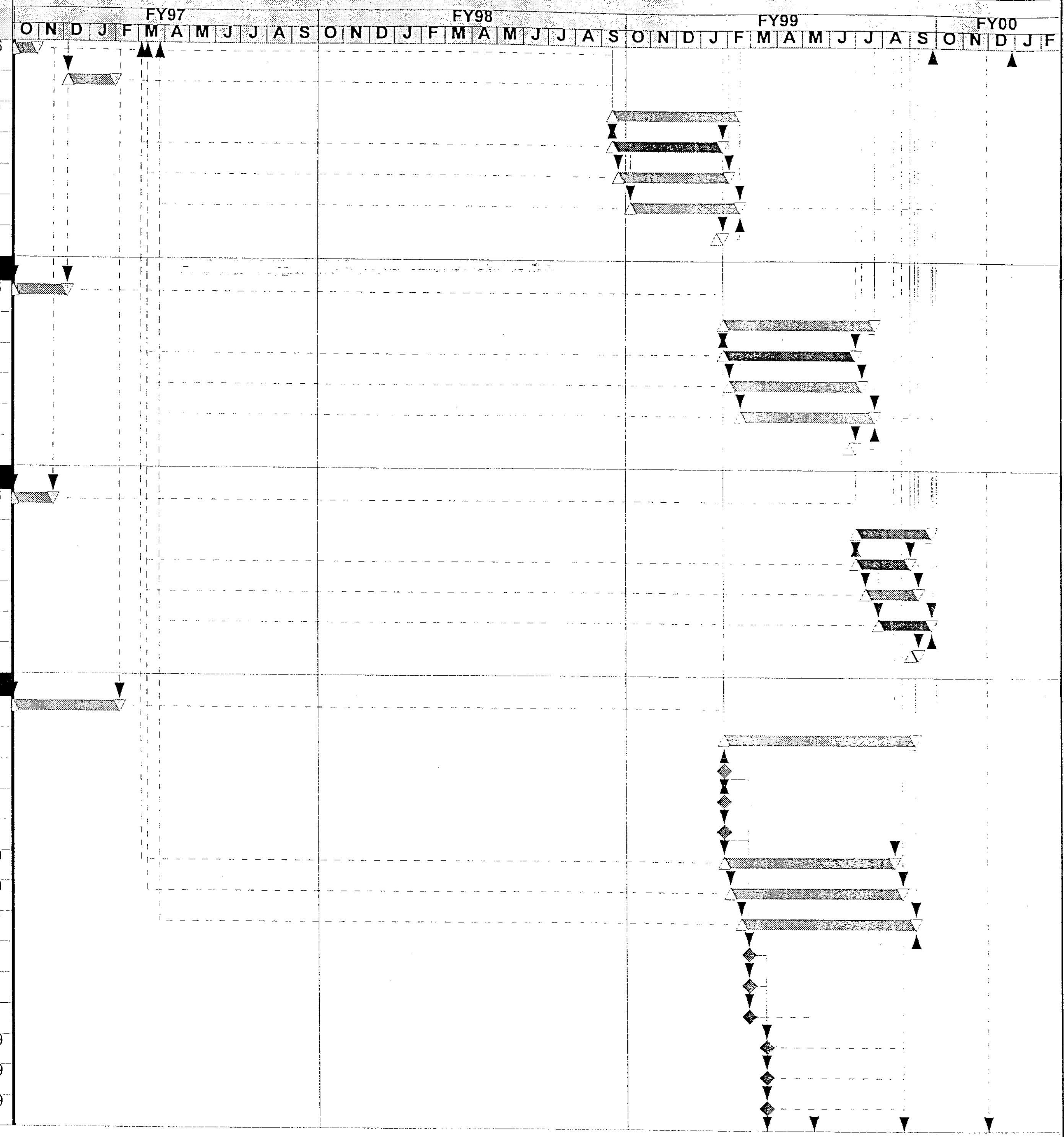
© Primavera Systems, Inc.

Building 779 Decommisioning Project

Sheet 1 of 3

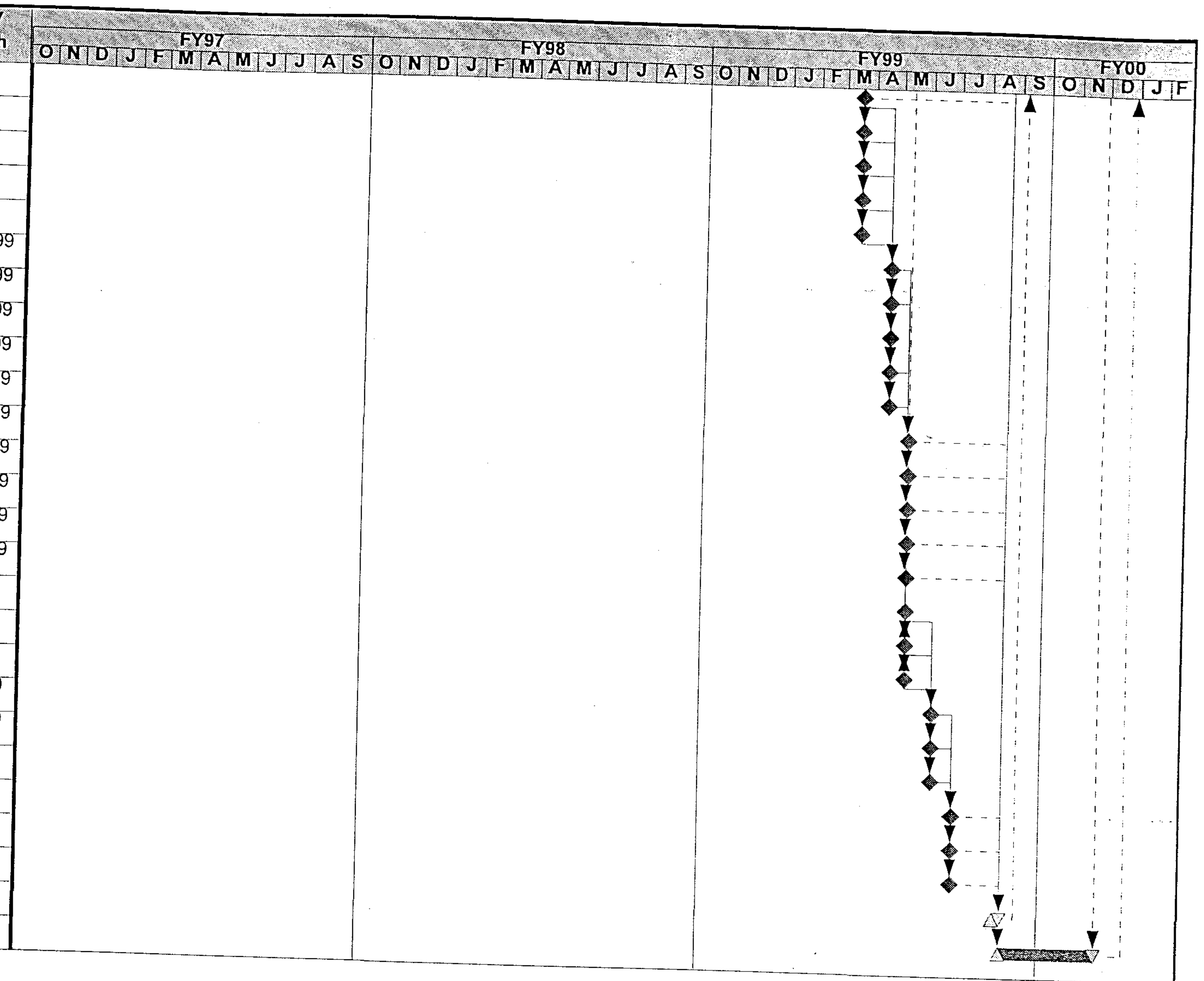
195

WBS	Activity ID	Activity Description	Orig dur	Early start	Early Finish
.06.14.03.04.02.03. . .	AEKTBHEH00	SSOC B779 Area 3 Initial Physical Deactivatio	21	01OCT96	29OCT96
.06.14.02.03.02. . . .	AE1423442	SSOC Bldg 779 Area 3 SNM Cleanout	40	05DEC96	31JAN97
.06.14.04.03.	AEKTBHEH01	SS WA 3 HAMMOCK	106*	15SEP98	15FEB99
.06.14.04.03.05.01.05.	AEKTBGER30	Bldg 779 Area 3 Process Equipment Removal	81	15SEP98	25JAN99
.06.14.04.03.04. . . .	AEKTBGEP30	Bldg 779 Area 3 Decontamination	81	23SEP98	01FEB99
.06.14.04.03.02.05. . .	AEKTBGEA30	Bldg 779 Area 3 Final Survey	81	07OCT98	15FEB99
.06.14.04.03.05.02. . .	AEKTBGER35	Bldg 779 Area 3 Utility Removal	5	18JAN99	25JAN99
Work Area 4					
.06.14.03.04.02.04. . .	AEKTBHEK00	SSOC B779 Area 4 Initial Physical Deactivatio	44	01OCT96	04DEC96
06.14.04.03.	AEKTBHEK01	SS WA 4 HAMMOCK	126*	26JAN99	22JUL99
06.14.04.03.05.01.11.	AEKTBGER40	Bldg 779 Area 4 Process Equipment Remova	100	26JAN99	30JUN99
06.14.04.03.04. . . .	AEKTBGEP40	Bldg 779 Area 4 Decontamination	100	02FEB99	08JUL99
06.14.04.03.02.11. . .	AEKTBGEA40	Bldg 779 Area 4 Final Survey	100	16FEB99	22JUL99
06.14.04.03.05.02. . .	AEKTBGER45	Bldg 779 Area 4 Utility Removal	5	23JUN99	30JUN99
Work Area 5					
06.14.03.04.02.05. . .	AEKTBHEM00	SSOC B779 Area 5 Initial Physical Deactivatio	35	01OCT96	18NOV96
06.14.04.03.	AEKTBHEM01	SS WA 5 HAMMOCK	60*	01JUL99	24SEP99
06.14.04.03.05.01.24.	AEKTBGER50	Bldg 779 Area 5 Process Equipment Removal	40	01JUL99	01SEP99
06.14.04.03.04. . . .	AEKTBGEP50	Bldg 779 Area 5 Decontamination	40	12JUL99	10SEP99
06.14.04.03.02.24. . .	AEKTBGEA50	Bldg 779 Area 5 Final Survey	40	26JUL99	24SEP99
06.14.04.03.05.02. . .	AEKTBGER55	Bldg 779 Area 5 Utility Removal	5	02SEP99	10SEP99
WA 6					
06.14.03.04.02.06. . .	AEKTBHEN00	SSOC B779 Area 6 Initial Physical Deactivatio	87	01OCT96	05FEB97
06.14.04.	AEKTBHEN01	SS WA 6 HAMMOCK	158*	26JAN99	07SEP99
06.14.04.04.	AEKTBGER76	B780 Start Equip Removal	0	26JAN99	
06.14.04.05.	AEKTBGER79	B780A Start Equip Removal	0	26JAN99	
06.14.04.06.	AEKTBGER82	B780B Start Equip Removal	0	26JAN99	
06.14.04.	AEKTBGER60	Bldg 779 Area 6 Process Equipment Removal	128	26JAN99	13AUG99
06.14.04.03.04. . . .	AEKTBGEP60	Bldg 779 Area 6 Decontamination	128	02FEB99	23AUG99
06.14.04.03.02. . . .	AEKTBGEA60	Bldg 779 Area 6 Final Survey	128	16FEB99	07SEP99
06.14.04.04.	AEKTBGER77	B780 Finish Equip Removal	0		24FEB99
06.14.04.05.	AEKTBGER80	B780A Finish Equip Removal	0		24FEB99
06.14.04.06.	AEKTBGER83	B780B Finish Equip Removal	0		24FEB99
06.14.04.05.	AEKTBGEA62	B780A Final Survey	0		17MAR99
06.14.04.06.	AEKTBGEA63	B780B Final Survey	0		17MAR99
06.14.04.04.	AEKTBGEA71	B780 Final Survey	0		17MAR99



196

WBS	Activity ID	Activity Description	Orig dur	Early start	Early Finish
1.06.14.04.08.	AEKTBGER88	B783 Start Equip Removal	0	18MAR99	
1.06.14.04.09.	AEKTBGER90	B784 Start Equip Removal	0	18MAR99	
1.06.14.04.10.	AEKTBGER93	B785 Start Equip Removal	0	18MAR99	
1.06.14.04.11.	AEKTBGER96	B786 Start Equip Removal	0	18MAR99	
1.06.14.04.12.	AEKTBGER98	B787 Start Equip Removal	0	18MAR99	
.06.14.04.08.	AEKTBGER89	B783 Finish Equip Removal	0		19APR99
.06.14.04.09.	AEKTBGER91	B784 Finish Equip Removal	0		19APR99
.06.14.04.10.	AEKTBGER94	B785 Finish Equip Removal	0		19APR99
.06.14.04.11.	AEKTBGER97	B786 Finish Equip Removal	0		19APR99
.06.14.04.12.	AEKTBGER99	B787 Finish Equip Removal	0		19APR99
06.14.04.08.	AEKTBGEA65	B783 Final Survey	0		10MAY99
06.14.04.09.	AEKTBGEA66	B784 Final Survey	0		10MAY99
06.14.04.10.	AEKTBGEA67	B785 Final Survey	0		10MAY99
06.14.04.11.	AEKTBGEA68	B786 Final Survey	0		10MAY99
06.14.04.12.	AEKTBGEA69	B787 Final Survey	0		10MAY99
06.14.04.02.	AEKTBGER73	B729 Start Equip Removal	0	11MAY99	
06.14.04.07.	AEKTBGER85	B782 Start Equip Removal	0	11MAY99	
06.14.04.01.	AEKTBGER70	B727 Start Equip Removal	0	11MAY99	
06.14.04.01.	AEKTBGER71	B727 Finish Equip Removal	0		10JUN99
06.14.04.02.	AEKTBGER74	B729 Finish Equip Removal	0		10JUN99
6.14.04.07.	AEKTBGER86	B782 Finish Equip Removal	0		10JUN99
6.14.04.01.	AEKTBGEA61	B727 Final Survey	0		02JUL99
6.14.04.07.	AEKTBGEA64	B782 Final Survey	0		02JUL99
6.14.04.02.	AEKTBGEA70	B729 Final Survey	0		02JUL99
6.14.04.	AEKTBGER65	Bldg 779 Area 6 Utility Removal	5	16AUG99	23AUG99
5.14.04.	AEKTBGER05	Support Building Demos	60	24AUG99	29NOV99



197/197

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
001	Basement sumps	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 Practice (Section 3.2) will be used. - Confirmed Space Entry may be required. - Aggressive decontaminational techniques are expected to be used.
Room 001 Total Grams		0				
100	Maintenance Airlock	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) will be used.
Room 100 Total Grams		0				
101	Hallway	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) will be used.
Room 101 Total Grams		0				
103	Men's Locker Room	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) will be used.
Room 103 Total Grams		0				
103A	Men's Locker Room	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) will be used.
Room 103A Total Grams		0				

* ACM = Asbestos Containing Material.

152

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
103B	Men's Locker Room	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) will be used.
Room 103B Total Grams		**0**				
104	Hallway	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) will be used.
Room 104 Total Grams		**0**				
105	Hallway	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) will be used.
Room 105 Total Grams		**0**				
106	Office	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) will be used.
Room 106 Total Grams		**0**				
107	Office	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) will be used.
Room 107 Total Grams		**0**				
108	Office	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) will be used.
Room 108 Total Grams		**0**				

* ACM = Asbestos Containing Material.

153

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
109	Office	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) will be used.
Room 109 Total Grams		0				
110	Office	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) will be used.
Room 110 Total Grams		0				
110A	Office	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) will be used.
Room 110A Total Grams		0				
111	Office	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) will be used.
Room 111 Total Grams		0				
113	Machine Shop	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) will be used. - Possibly present in equipment oil - to be sampled
Room 113 Total Grams		0				
114	Storage	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) will be used. - Satellite Accumulation Area.
Room 114 Total Grams		0				

* ACM = Asbestos Containing Material.

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
115	Office/Storage	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) will be used.
Room 115 Total Grams		**0**				
115A	Electronics Labs	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) will be used.
Room 115A Total Grams		**0**				
116	Hallway	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) will be used.
Room 116 Total Grams		**0**				
116A	Office	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) will be used.
Room 116A Total Grams		**0**				
116B	Office	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) will be used.
Room 116B Total Grams		**0**				
117	Emergency Generator	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) will be used. -Possibly present in electrical equipment - to be sampled.
Room 117 Total Grams		**0**				

* ACM = Asbestos Containing Material.

55

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
118	Hallway	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) will be used.
Room 118 Total Grams		0				
119	Hallway	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) will be used.
Room 119 Total Grams		0				
121	Machine Shop	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) will be used.
Room 121 Total Grams		0				
121A	Electrician Office	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) will be used.
Room 121A Total Grams		0				
121B	Security Access	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) will be used.
Room 121B Total Grams		0				

* ACM = Asbestos Containing Material.

156

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
122	Control Room	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) will be used.
Room 122 Total Grams		**0**				
123	Store Room	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) will be used.
Room 123 Total Grams		**0**				
124	Office	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) will be used.
Room 124 Total Grams		**0**				
125	Office	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) will be used.
Room 125 Total Grams		**0**				
126	Utilities Room	Lg. Duct **17.9** GB-126 **0** 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) will be used. - Possibly present in electrical equipment - to be sampled
Room 126 Total Grams		**17.9**				
127	Utilities Room	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) will be used.
Room 127 Total Grams		**0**				

* ACM = Asbestos Containing Material.

157

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
128	Instrument Repair Facility	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) will be used.
Room 128 Total Grams		**0**				
130	Chemical Storage	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) will be used.
Room 130 Total Grams		**0**				
131	Aqueous Lab	Lg. Duct **11.5** GB-961 **118** 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) 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		**663.5**				
132	Office	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) will be used.
Room 132 Total Grams		**0**				

* ACM = Asbestos Containing Material.

158

Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
133	R & D Pyrochemical Lab	Lg. Duct **30.6** GB-954 **161** GB-956 **31** GB-957 **33** GB-959 **74** GB-954 **3.9** GB-955 **36.7** GB-956 **26** GB-957 **12** GB-959 **36** All others < LLD	- 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) 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		**444.2**				
134	Flammable Liquid Storage	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) will be used. - Satellite Accumulation Area.
Room 134 Total Grams		**0**				
135	RCT Storage Area	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) will be used.
Room 135 Total Grams		**0**				
136	Chem Tech Office	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) will be used.
Room 136 Total Grams		**0**				

* ACM = Asbestos Containing Material.

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
137	Aqueous R &D Lab	Lg. Duct **3.1** GB-106-6 **85** GB-106-2 **19** GB-106-1 **26** GB-106-5 **47** GB-1063 **127** GB-106-4 **88** 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) 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		**395.1**				
138	Excess Chemical Storage	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) will be used.
Room 138 Total Grams		**0**				
139	Soil Analysis Lab	- Small quantity present in ventilation duct. 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) will be used. - Known Materials Used in Room: Plutonium, Americium, Uranium, Sodium Hydroxide
Room 139 Total Grams		**3.9**				

* ACM = Asbestos Containing Material.

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
140	Metal Preparation Lab	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) will be used. Known materials used in room: Depleted Uranium, Beryllium.
Room 140 Total Grams		**0**				
140A	Scanning Electron Support Room	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) will be used.
Room 140A Total Grams		**0**				
140B	Scanning Electron Microscope (SEM)	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) will be used.
Room 140B Total Grams		**0**				
141	Electron Spectroscopy for Chemical Analysis	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) will be used.
Room 141 Total Grams		**0**				

* ACM = Asbestos Containing Material.

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
141A	Microprobe	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) will be used.
Room 141A Total Grams		0				
141B	Scanning Electron Microscope (SEM)	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) will be used.
Room 141B Total Grams		0				
141C	Metallography & Optical Reduction Equipment	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) will be used.
Room 141C Total Grams		0				
142	Utilities Room	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) will be used. - Satellite Accumulation Area.
Room 142C Total Grams		0				
146	Office	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) will be used.
Room 146 Total Grams		0				
147	Office/Storage	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) will be used.

* ACM = Asbestos Containing Material.

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
Room 147 Total Grams		**0**				
149	Hallway	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) will be used.
Room 149 Total Grams		**0**				
150	Metal Joining Facility	Lg. Duct **7.4** GB-W. HOOD **6** All Others < LLD.	- No loose surface contamination on room surfaces. - Possible isolated spots of fixed low-level 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) 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		**13.4**				
151	Office	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) will be used.
Room 151 Total Grams		**0**				

* ACM = Asbestos Containing Material.

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
152	Experimental Casting Lab	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) 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		**97.2**				
153	Drum Staging Room	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) will be used. - Satellite Accumulation Area.
Room 153 Total Grams		**0**				
153A	Compact Room	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) will be used. - Room previously handled tritium contaminated waste.
Room 153A Total Grams		**0**				
153B	Downdraft Room	Lg. Duct **0.6**	- 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) will be used.
Room 153B Total Grams		**0.6**				

* ACM = Asbestos Containing Material.

164

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
154	Plutonium Hydriding Lab	Lg. Duct **2.8** GB-1363 **626** GB-1364 **692** GB-1365 **134** GB-7248 **129** GB-4933 **67** GB-283 **66** 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) will be used. - Known materials used in process - Plutonium, sulfamic acid, hydraulic oil, nitric acid, Tantalum, and other heavy metals.
Room 154 Total Grams		**1716.8**				
155	Plutonium Sample - Mounting Lab	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) will be used. Acids residue inside hoods and gloveboxes. 90 Day Area.
Room 155 Total Grams		**64.4**				
156	Calorimeter Room	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) will be used.
Room 156 Total Grams		**0**				
157	Tensile Testing Lab	- Present in gloveboxes and ventilation duct. 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) will be used.
Room 157 Total Grams		**3.7**				

* ACM = Asbestos Containing Material.

165

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
159	Waste Packaging	- Some holdup present in ventilation ducting. 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) will be used. - 90 Day Area
Room 158 Total Grams		**34.6**				
160	Pyrochemical Development Facility	Lg. Duct **172.2** GB-862 **255** GB-860 **121** GB-865 **210** GB-859 **78** GB-862 **243** All Others < LLD.	- Widespread fixed contamination. - All electrical boxes posted internal contamination. - High Contamination levels inside gloveboxes. - Areas of loose surface contamination. - Areas of loose surface contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2) 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		**1079.2**				
160A	Material Storage (Vault)	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) will be used.
Room 160A Total Grams		**0**				
161	Janitor Closet	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) will be used.
Room 161 Total Grams		**0**				

* ACM = Asbestos Containing Material.

Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
162	Machining Lab	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) will be used. - Possibly present in electrical transformers, requires additional sampling.
Room 162 Total Grams		**0**				
163	Empty Drum Storage	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) will be used.
Room 163 Total Grams		**0**				
163A	Office	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) will be used.
Room 163A Total Grams		**0**				
164	Hallway (Airlock)	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) will be used.
Room 164 Total Grams		**0**				
166	Entry Way	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) will be used.
Room 166 Total Grams		**0**				
167	Men's Locker Room	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) will be used.
Room 167 Total Grams		**0**				

* ACM = Asbestos Containing Material.

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
167A	Men's Locker Room	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) will be used.
Room 167A Total Grams		**0**				
170	Dumb Waiter	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) will be used. - Possibly present in electrical transforms, requires additional sampling.
Room 170 Total Grams		**0**				
171	Material Storage (Vault)	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) will be used.
Room 171 Total Grams		**0**				
172	Material Storage	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) will be used.
Room 172 Total Grams		**0**				
173	Utility Area	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) will be used.
Room 173 Total Grams		**0**				
201	Office	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) will be used.

* ACM = Asbestos Containing Material.

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
Room 201 Total Grams		0				
201A	Office	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) will be used.
Room 201A Total Grams		0				
202	Office	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) will be used.
Room 202 Total Grams		0				
202A	Office	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) will be used.
Rom 202A Total Grams		0				
203	Office	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) will be used.
Room 203 Total Grams		0				
204	Office	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) will be used.
Room 204 Total Grams		0				
204A	Office	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) will be used.
Room 204A Total Grams		0				

* ACM = Asbestos Containing Material.

Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
204B	Office	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) will be used.
Room 204 Total Grams		0				
205	Conf. Room	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) will be used.
Room 205 Total Grams		0				
206	Office	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) will be used.
Room 206 Total Grams		0				
207	Office	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) will be used.
Room 207 Total Grams		0				
207A	Office	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) will be used.
Room 207A Total Grams		0				
207B	Office	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) will be used.
Room 207B Total Grams		0				

* ACM = Asbestos Containing Material.

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
207C	Office	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) will be used.
Room 207C Total Grams		0				
208	Office	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) will be used.
Room 208 Total Grams		0				
209	Office	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) will be used.
Room 209 Total Grams		0				
210	Office	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) will be used.
Room 210 Total Grams		0				
210A	Office	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) will be used.
Room 210A Total Grams		0				
211	Janitors Closet	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) will be used.
Room 211 Total Grams		0				

* ACM = Asbestos Containing Material.

171

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
212	Office	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) will be used.
Room 212 Total Grams		**0**				
212A	Office	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) will be used.
Room 212A Total Grams		**0**				
213	Office	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) will be used. Known materials used in room - Trichloroethane, Freon, Ethanol and Methanol
Room 213 Total Grams		**0**				
214	Office	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) will be used.
Room 214 Total Grams		**0**				
215	Hallway (Airlock)	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) will be used.
Room 215 Total Grams		**0**				
216	Hallway	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) will be used.

* ACM = Asbestos Containing Material.

172

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
Room 216 Total Grams		0				
217	Gas - solid kinetic studies	Lg. Duct 3.6 GB-330-371 4 GB-963 8 GB-964 17 GB-HOOD E 1	- 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) will be used. - Deleted Uranium Storage Area. - Known materials used in room - trichloroethane, freon, ethanol and methanol.
Room 217 Total Grams		33.6				
218	Gas - solid kinetic studies	Lg. Duct 2.4 GB-218S 1 GB-970 11 GB-971 25	- 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) will be used. Room contains C0-60 shielded source. Known materials used in room - oils, solvents, trichloroethane, methanol, freon and ethanol.
Room 218 Total Grams		39.4				

* ACM = Asbestos Containing Material.

173

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
219	Gas - solid kinetic studies	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) will be used.
Room 219 Total Grams		**0**				
220	Gas - solid kinetic studies	Lg. Duct **10.9** GB-463 **97** GB-462 **70** GB-974 **82** All Others < LLD.	-Little or no loose surface contamination on room surfaces. - Fixed contaminations at isolated spots up to 5000 dpm/cm sq. - High contamination levels inside gloveboxe.D154	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2) will be used.
Room 220 Total Grams		**259.9**				
221	Office/storage	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) will be used.
Room 221 Total Grams		**0**				
221A	Storage	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) will be used.
Room 221A Total Grams		**0**				
221B	Office/Storage	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) will be used.
Room 221B Total Grams		**0**				
221C	Office/Storage	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) will be used.

* ACM = Asbestos Containing Material.

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
Room 221C Total Grams		0				
222	Gas - solid kinetic studies	Lg. Duct 37.3 GB-105 35 GB-976 17 GB-989 14 GB-992 21 GB-975 62 All Others < LLD.	- 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) will be used. - Known materials used in room - Plutonium, Uranium, Oils, Solvent, Inks, Trichloroethane, Methanol, Freon and Ethanol.
Room 222 Total Grams		186.3				
222A	Storage room	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) will be used.
Room 222A Total Grams		0				
223	Coating studies	- Present in gloveboxes and ventilation duct.	- Little or no surface contamination 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) 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	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) will be used.
Room 224 Total Grams		0				

* ACM = Asbestos Containing Material.

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	[illegible] s)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
225	Coatings Lab		- Little or no loose surface contamination on room surfaces. - Fixed contaminations on floors. - 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) will be used. - Known materials used in room: Uranium, beryllium, nitric acid, and ethyl alcohol
Room 225 Total Grams						
226	Stairway		- 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) will be used.
Room 226 Total Grams						
228	Metallurgy Lab	3B	- 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) will be used. .- Known materials used in room: Plutonium, Uranium, Oils, Organic Solvents, Isopropanol, Diamond Paste and Freon.
Room 228 Total Grams						
229	Office		- 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) will be used.
Room 229 Total Grams						

* ACM = Asbestos Containing [illegible]

176

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
230	Office	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) will be used.
Room 230 Total Grams		0				
231	Office	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) will be used.
Room 231 Total Grams		0				
232	Office	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) will be used.
Room 232 Total Grams		0				
233	Office	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) will be used.
Room 233 Total Grams		0				
234	Metallurgy Lab	Lg. Duct 3.5 GB-205 42 GB-205A 21 GB-205B 16 GB-205C 40 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) 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		122.5				

* ACM = Asbestos Containing Material.

1/6/97

177

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
234A	Met Lab	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) will be used.
Room 234A Total Grams		0				
234B	Dark Room	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) will be used. - Photo processing chemicals
Room 234B Total Gram		0				
235	Electron Microscope	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) will be used.
Room 235 Total Grams		0				
270	Poly Solid Studies	Lg. Duct **8.0** All Others < LLD.	- Little or no loose surface contamination on room surfaces. - No known 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) will be used. Known Materials used in the room: Plutonium, Uranium, Oils, Solvents, Inks, Trichloroethane, Methanol, Freon, TF and Ethanol.
Room 270 Total Grams		8.0				

* ACM = Asbestos Containing Material.

178

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
271	Hallway	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) will be used.
Room 271 Total Grams		0				
272	Gas Testing Electron Microscope	None	- Little or no loose surface contamination on room surfaces. - No known 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) will be used.
Room 272 Total Grams		0				
273	Office/Storage	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) will be used.
Room 273 Total Grams		0				
274	Office Storage	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) will be used.
Room 274 Total Grams		0				
275	Office Storage	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) will be used.
Room 275 Total Grams		0				
277	Office Storage	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) will be used.

* ACM = Asbestos Containing Material.

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
Room 277 Total Grams		0				
Building 729	Filter Plenum	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.	- Standard Work Practice (section 3.2) will be used. - Possibly present in electrical transformer equipment. To be confirmed.
Bldg. 729 Total Grams		0				
Building 782	Filter Plenum	None	- No loose surface contamination on room surfaces. - 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.	- Standard Work Practice (Section 3.2) will be used.
bldg. 782 Total Grams		0				
Building 727	Emergency Diesel Generator	None	No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (section 3.2) will be used. - Possibly present in electrical transformer equipment. To be confirmed.
Bldg. 727 Total Grams		0				
780	Storage Facility	None	No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2) will be used.
Bldg. 780 Total Grams		0				
780A	Metal Storage Facility	None	No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2) will be used.
Bldg. 780A Total Grams		0				
780B	Gas Bottle Storage Facility	None	No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2) will be used.
Bldg. 780B Total Grams		0				

* ACM = Asbestos Containing Material.

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
782	Filter plenum	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) will be used.
Bldg. 782 Total Grams		40				
783	Cooling Tower Pump House	None	No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2) will be used.
Bldg. 783 Total Grams		0				
784	Cooling Tower Pump House	None	No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2) will be used.
Bldg. 784 Total Grams		0				
785	Cooling Tower Pump House	None	No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2) will be used.
Bldg. 785 Total Grams		0				

* ACM = Asbestos Containing Material.

(8)

Appendix 3
779 Cluster
Characterization Survey And Work Summary Matrix

Room/ Area	Description	PU Holdup (grams)	Radiological Contamination	Asbestos	Beryllium	Work Description/Remarks
786	Cooling Tower and West Chiller	None	No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2) will be used.
Bldg. 786 Total Grams		0				
787	Cooling Tower and East Chiller	None	No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (Section 3.2) will be used.
Bldg. 787 Total Grams		0				
East Dock	Dock	None	No Suspected Contamination.	Floor/Wall/Ceiling materials and piping insulation, possible ACM*. To be characterized.	None	- Standard Work Practice (section 3.2) will be used.
Room East Dock Total Grams		0				
Total Grams						

* ACM = Asbestos Containing Material.

182