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DOE/RL-93-104

Decontamination and Decommissioning Assessment for the Waste Incineration Facility (Building 232-Z) Hanford Site, Washington

United States
Department of Energy
Richland, Washington

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Decontamination and Decommissioning Assessment for the Waste Incineration Facility (Building 232-Z) Hanford Site, Washington

L. N. Dean
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ACRONYMS AND ABBREVIATIONS

ACM	asbestos-containing material
ALARA	as low as reasonably achievable
CAM	continuous air monitor
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfm	cubic feet per minute
CH	contact handled
CM	controlled manual
CO_2	carbon dioxide
CPS	criticality prevention specification
Cr	chromium
CSP	common support pool
DBE	design basis earthquake
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy-Richland Operations Office
DQA	data quality assurance level
DQOs	data quality objectives
dpm	disintegrations per minute
DWP	decommissioning work plan
EA	environmental assessment
EDL	economic discard level
EP	electrical panel
EPA	U.S. Environmental Protection Agency
FONSI	Finding of No Significant Impact
FSAR	final safety analysis report
FSP	field sampling plan
FY	fiscal year
G&A	general and administrative
HEPA	high-efficiency particulate air (filter)
HPT	health physics technician
HWOP	hazardous waste operating permit
JSA	job safety analysis
LLRW	low-level radioactive waste
MCC	motor control center
mCi	microcuries
mr/hr	millirems per hour
ms/msd	matrix spike/matrix spike duplicate
nCi	nanocuries
nCi/g	nanocuries per gram
NDA	non-destructive analysis
NEPA	National Environmental Policy Act
NIST	National Institute of Standards and Technology
OD	outside diameter
PARCC	precision, accuracy, representativeness, comparability, and completeness
PFP	Plutonium Finishing Plant
QA	quality assurance

QAP	quality assurance program
QC	quality control
RAC	risk-acceptance criteria
RCRA	Resource Conservation and Recovery Act
RPT	radiation protection technician
RR	readiness review
RWP	radiation work permit
SAD	safety assessment document
SAP	sampling and analysis plan
SAR	safety analysis report
SDAR	storage/disposal approval record
SFMP	surplus facilities management program
TCLP	toxicity characteristic leaching procedure
TRU	transuranic
TRUSAF	transuranic storage and assay facility
VDU	vibratory decontamination unit
WAC	Washington Administration Code
WBS	work breakdown structure
WHC	Westinghouse Hanford Company
WIPP	Waste Isolation Pilot Plant

1.0 INTRODUCTION

The Decontamination and Decommissioning (D&D) Assessment for the Building 232-Z will be implemented pursuant to the provisions of the following U.S. Department of Energy (DOE) Orders:

DOE Order 5400.2, Environmental Compliance Issue Coordination, August 1987

DOE Order 5400.5, Radiation Protection of the Public and the Environment, February 1990

DOE Order 5440.1D, National Environmental Policy Act Compliance Program, February 1991

DOE Order 5480.1B, Environmental Protection, Safety, and Health Program for Department of Energy Operations, September 1986

DOE Order 5480.3, Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Waste, July 1985

DOE Order 5480.4, Environmental Protection, Safety, and Health Protection Standards, May 1984

DOE Order 5480.5, Safety of Nuclear Facilities, September 1986

DOE Order 5480.9, Construction Safety and Health Program, November 1987

DOE Order 5480.10, Contractor Industrial Hygiene Program, June 1985

DOE Order 5482.1B, Environmental Protection, Safety, and Health Protection Appraisal Program, September 1986

DOE Order 5483.1A, Occupational Safety and Health Program for DOE Contractor Employees at Government-Owned Contractor-Operated Facilities, June 1983

DOE Order 6430.1A, Draft General Design Criteria, December 1987

DOE Order 5820.2A, Radioactive Waste Management, September 1988

DOE Order 5480.11, Radiation Protection for Occupational Workers, July 1989

1.1 BACKGROUND

Building 232-Z is an element of the Plutonium Finishing Plant (PFP) located in the 200 West Area of the Hanford Site. From 1961 until 1972, plutonium-bearing combustible materials were incinerated in the building. Between 1972 and 1983, following shutdown of the incinerator, the facility was used for waste segregation activities. The facility was placed in retired inactive status in 1984 and classified as a Limited Control Facility pursuant to DOE Order 5480.5, Safety of Nuclear Facilities, and 6430.1A, General Design Criteria. The current plutonium inventory within the building is estimated to be approximately 848 grams, the majority of which is retained within the process hood ventilation system. As a contaminated retired facility, Building 232-Z is included in the DOE Surplus Facility Management Program (SFMP).

The building is being maintained in safe storage with controlled access and negative pressure. However, the 1990 PFP draft Final Safety Analysis Report (FSAR), which included a seismic analysis of the building, revealed that potential on-site consequences of continued safe storage exceed Westinghouse Hanford Company (WHC) risk-acceptance guidelines (WHC-SD-CP-SAR-021 1990a).

The Hanford Site, comprising 1450 km^2 (560 mi^2), is located in south-central Washington State. The climate of the area is semiarid. Building 232-Z is approximately six miles from the Columbia River, the nearest natural watercourse, and is outside the projected 100-year and 500-year floodplain. Figures 1.1, 1.2, and 1.3 provide a general location of Building 232-Z.

1.2 OBJECTIVES

The objective of the DOE Richland Field Office (DOE-RL) environmental protection program is a commitment to environmental management. This objective is manifested in environmental protection programs designed to correct existing environmental concerns, minimize risks to the environment or public health, and address potential environmental concerns before they pose a threat to the quality of the environment or the public welfare.

The objective of this D&D assessment is to remove Building 232-Z, thereby eliminating the radiological and environmental hazards associated with the plutonium inventory within the structure.

1.2.1 Project

The steps to accomplish the plan objectives are: (1) Identifying the locations of the most significant amounts of plutonium, (2) removing residual plutonium, (3) removing and decontaminating remaining building equipment, (4) dismantling the remaining structure, and (5) closing out the project.

1.2.2 D&D Program Management

About 115 chemically and radioactively contaminated structures, including surplus production reactors, chemical-process building and structures, and support-operation facilities, are included within the scope of the SFMP. Program management will increase commensurately with the size and numbers of structures that undergo D&D. Program management will support D&D projects in accordance with DOE orders including program management, planning and scheduling, quality assurance, and records and data management.

1.3 SCOPE

This plan addresses the D&D of Building 232-Z and the waste transfer line extending 2.8 meters (6 feet) from the building. All utilities would remain connected during the residual plutonium removal phase, and the decontamination and removal of the building equipment phase. During the decommissioning phase, all utilities would be disconnected and the building and its foundation dismantled.

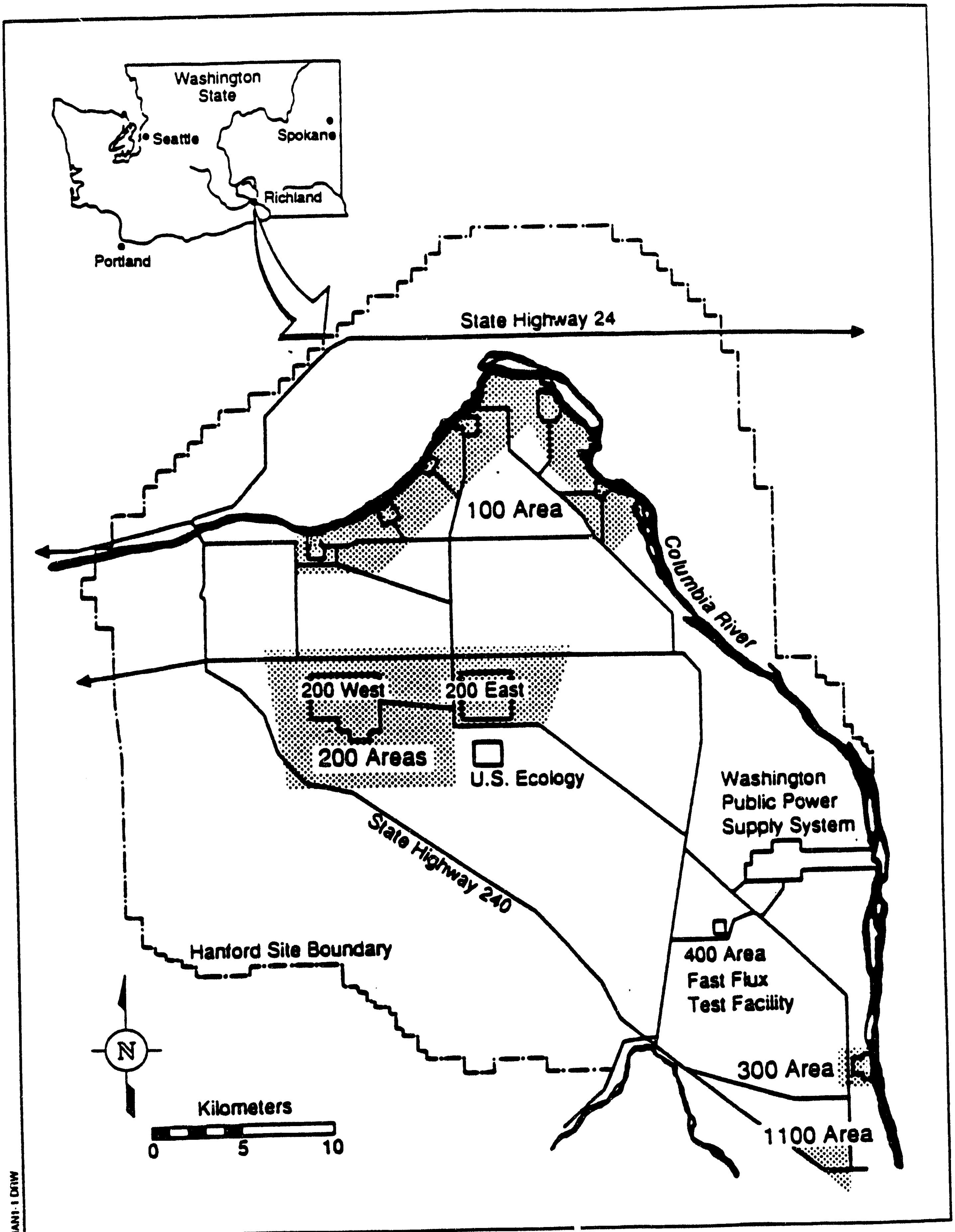

FIGURE 1.1. AREAS 200 EAST AND 200 WEST AT THE HANFORD SITE

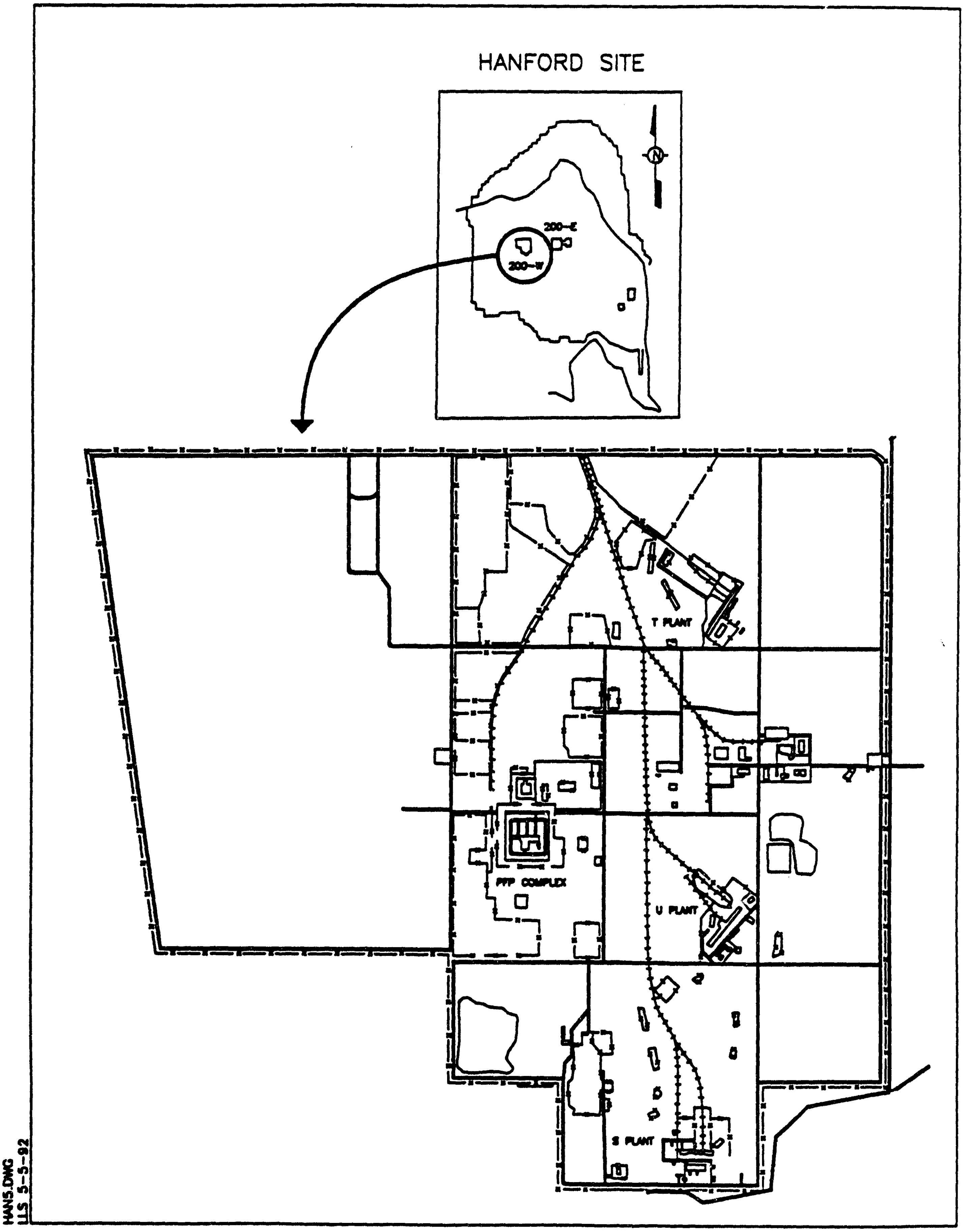

FIGURE 1.2. 200 WEST AREA

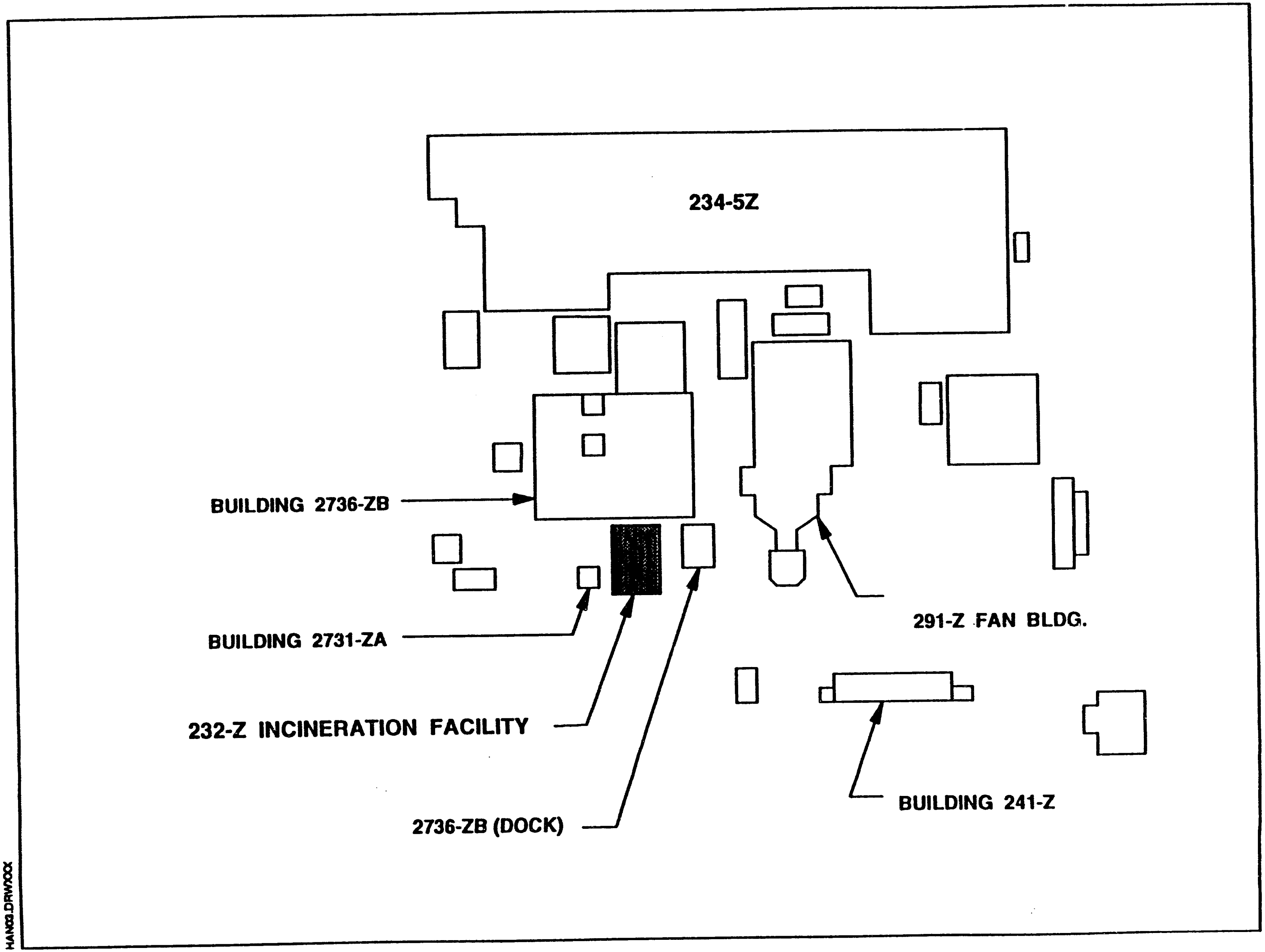

FIGURE 1.3. 232-Z INCINERATION FACILITY IN THE 200-WEST AREA

2.0 FACILITY INFORMATION

2.1 PHYSICAL DESCRIPTION

Building 232-Z, located about 200 feet south of the main portion of Building 234-5Z, is approximately 37 feet wide by 57 feet long. Building 232-Z currently houses the incinerator that was used to recover plutonium from combustible waste. The building is divided into various functional areas including the process room and chemical preparation rooms, and the storage, change, ventilation, and electrical equipment rooms. Except for ventilation supply and exhaust filtration, the building uses services (electricity, etc.) supplied from the 234-5Z and 291-Z buildings.

The building is single-storied over the process and storage areas and two-storied over the service areas at the north end. The respective roofs are about 15 feet and 19 feet above grade, consisting of concrete over metal decking with insulation and built-up, asphalt-gravel covering.

2.1.1 Ventilation

Building 232-Z was designed to ensure confinement of radioactive materials. The building ventilation exhaust air was originally exhausted by the 291-Z Building ventilation exhaust system and discharged to the atmosphere through the 291-Z-1 exhaust stack. The original exhaust duct leading to Building 291-Z was isolated from the 291-Z system and a new, independent 232-Z exhaust system was installed in 1990 (see Figure 2.1 and 2.2) (Morton 1990).

Ventilation air is drawn in through the original ventilation supply system and distributed to the process area via the negative pressure created by the building exhaust fan. Air is drawn from the cleaner non-process areas into the process area and through any of the high-efficiency particulate air (HEPA) filter floor ducts, scrubber hook, or incinerator hood. Finally, air is routed through either of two parallel filter boxes equipped with HEPA filters. The combined airflows are routed to the new ventilation exhaust system and discharged to the atmosphere.

The new exhaust system (296-Z-14) consists of three parallel sets of two HEPA filters, two exhaust fans with one fan operating and the other on standby, and an exhaust stack. Each fan is separately controlled. Low flow in the operating fan exhaust duct will cause the standby fan to start triggering an alarm on the local control panel and a trouble alarm in multiple locations at the Plutonium Finishing Plant (PFP) complex.

2.1.1.1 Electrical power

Electrical power for the ventilation system is provided by the emergency power bus through an electrical circuit breaker attached to the motor control center's electrical panel Number 1 (MCC-EP-1) in Building 2736-ZB. A local panel in Building 232-Z distributes the power for fan controls, instrumentation, and stack monitoring. The Hanford Site grid normally supplies power to the emergency power bus. Upon loss of bus voltage, the three diesel generators that provide back-up power to PFP would start automatically providing power. There would be a delay of 10 to 20 seconds to allow the generators to start, with the load added to the generators once they stabilized at speed.

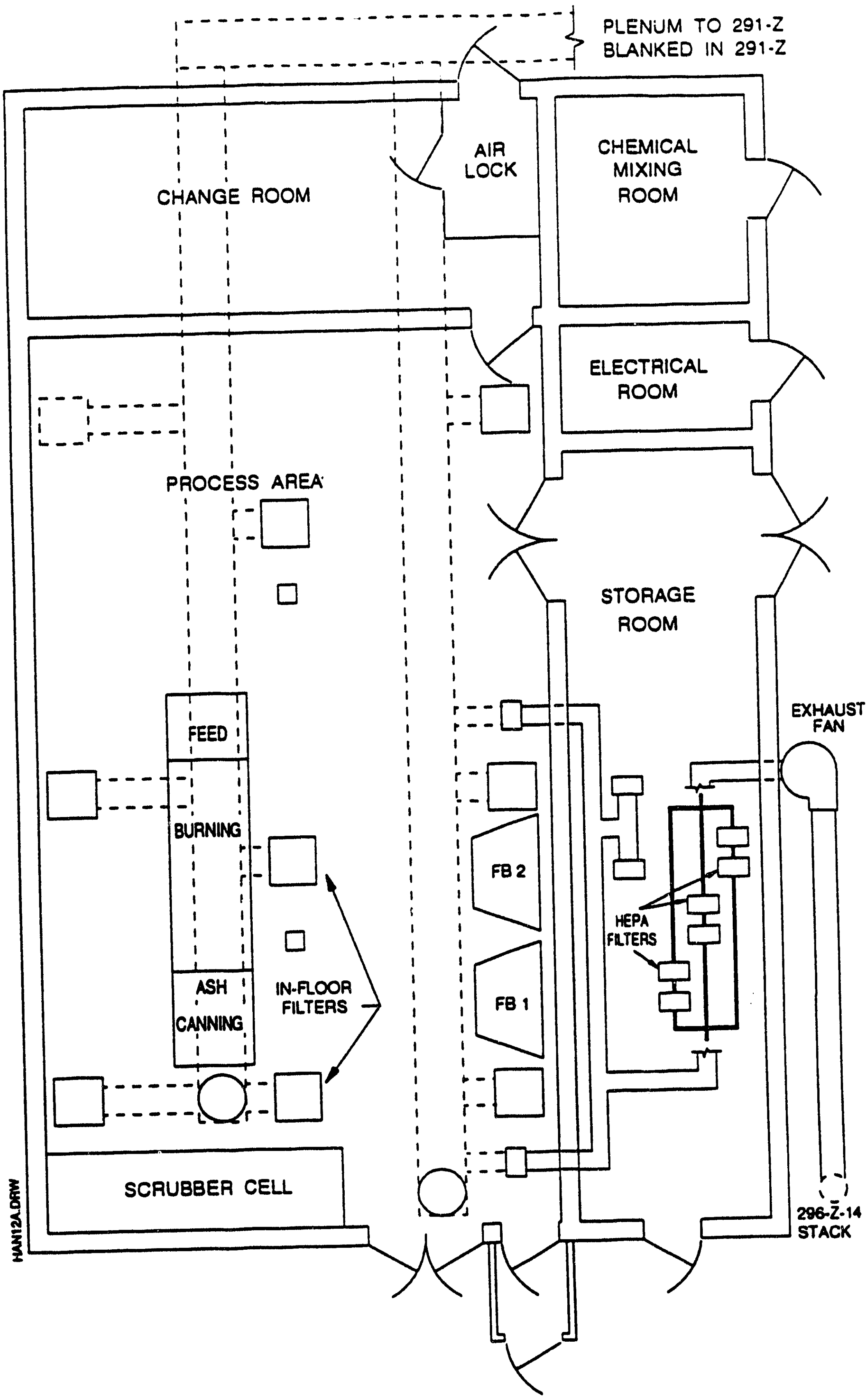

FIGURE 2.1. BUILDING 232-Z LAYOUT AND VENTILATION

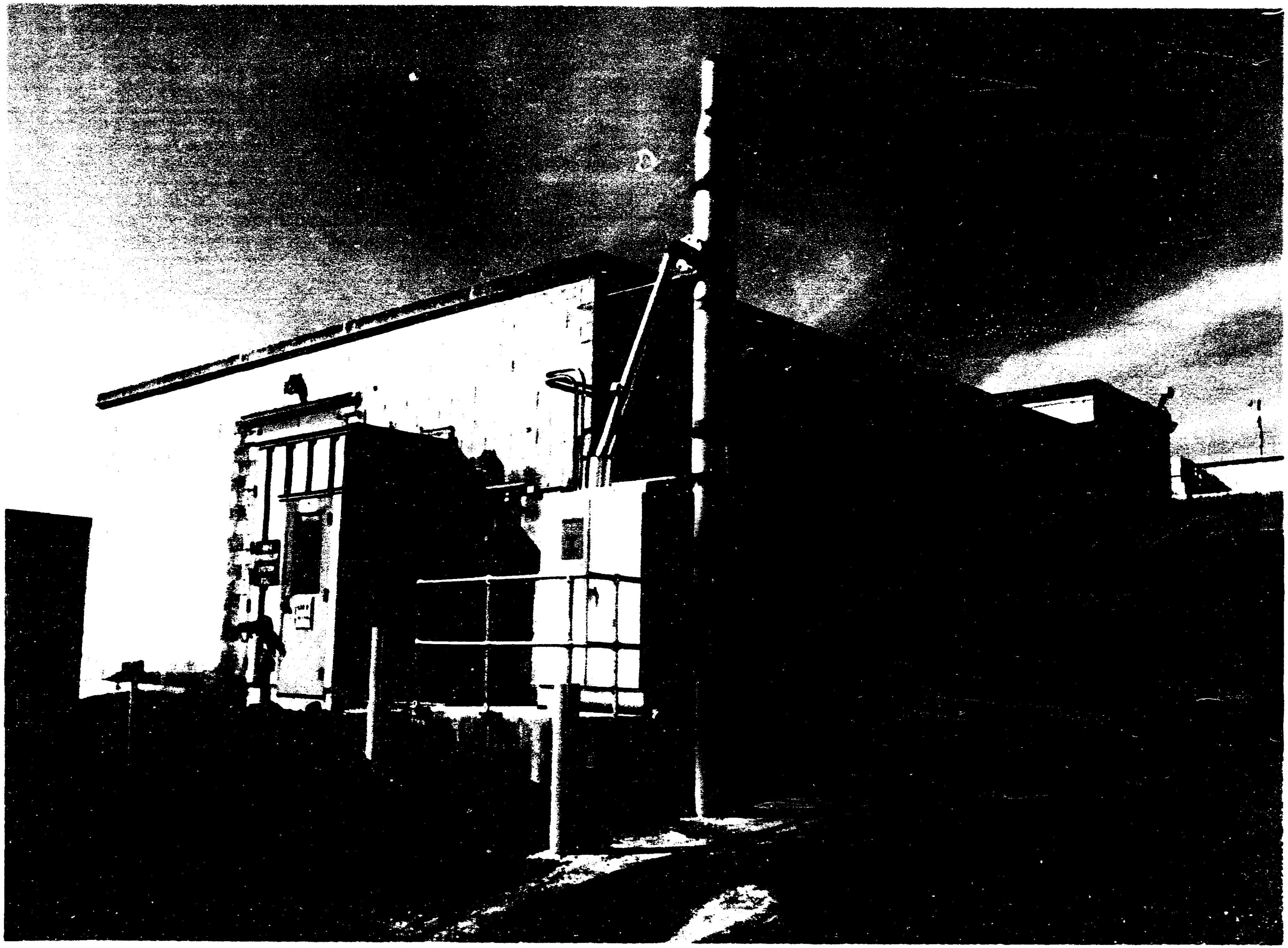

FIGURE 2.2. BUILDING 232-Z WITH NEW VENTILATION SYSTEM INSTALLED

2.1.1.2 Off-gas duct work

Two sections of off-gas duct work are located in Building 232-Z. One section, the leach hood off-gas line, runs from midroom through the process room wall to the scrubber cell. A portion of the leach hood off-gas line and two leach hoods were removed as part of the decommissioning work begun in the early 1980s. The end of the disconnected off-gas line is wrapped in a plastic bag. The other section runs from the incinerator glove box through the scrubber room wall, where it joins with the off-gas line from the leach hood in a common header to the scrubber. During operation of the facility, this line carried the incinerator off-gas from the off-gas/ash cyclone separators to the scrubber column where it was treated before exiting through the E-4 ventilation system. Both sections are covered with asbestos insulation and located 2.4 to 3 meters (8 to 10 feet) above floor level.

2.2 HISTORY

The PFP conducts diverse plutonium processing, handling, and storage operations. The principal PFP structure is Building 234-5Z, completed in 1949. Functions performed within this building included purifying plutonium nitrate solutions, reducing the nitrate to metal, and fabricating plutonium metal parts. In the original design of the PFP, all operations were to occur within Building 234-5Z. However, increases in production capacity and associated storage and scrap-recovery requirements led to the construction of Building 232-Z.

From 1961 to 1972, the 232-Z incinerator building was operated for the incineration of plutonium-bearing combustible materials and the subsequent recovery of plutonium from ash. As a result of several facility-design deficiencies and contamination accidents, further operation of the incineration process was deemed imprudent. For 11 years, following shutdown of the incinerator, the facility was utilized for waste segregation activities. Two attempts to change HEPA filters in 1979 and 1980 resulted in minor stack releases of 144 μCi and 200 μCi of plutonium, respectively. In June 1983, a PFP source reduction program was initiated in Building 232-Z. The program included the removal of approximately 50 percent of the 232-Z glove boxes, and removal of approximately 66 percent of the radioactive acid digestion test unit glove boxes (WHC 1989).

2.3 RADIOLOGICAL CHARACTERIZATION

The purpose of a radiological characterization is to determine the radiological conditions that would be encountered during the decontamination and decommissioning project, and to establish the radiological inventory in the facility. A draft "Work Plan for 232-Z Inventory Reduction" was prepared in 1989 but never implemented (WHC-SD-DD-WP-001 1990). The purpose of the reduction plan was to reduce the plutonium inventory from approximately 848 grams to below 320 grams; a level where the on site consequences of a seismic event would be within risk-acceptance guidelines.

Currently, the building is assumed to contain 848 grams of plutonium (733 grams in the process piping and duct work, 23 grams in the feed glove box, 20 grams in the burning glove box, 52 grams in the ash/canning glove box, and 20 grams in the scrubber cell) as determined by non-destructive analysis (NDA), which is 86, 3, 2, 6, and 2 percent, respectively. Dose rates in the area of the off-gas duct work are approximately 5-10 mrem/hr. The chemical form of the material is probably plutonium oxide (PuO_2). No information is available regarding the gross physical form of the material. Given its relatively long-term retention in active ventilation ducts, it is reasonable to assume the material exists as agglomerated particles bound to duct surfaces.

Initially, the principal tasks to be completed include the removal of residual plutonium from the ventilation piping, glove boxes, and filter boxes, followed by decontamination and removal of the process equipment itself. The final step would be the dismantling of Building 232-Z and associated structures. All activities, including administration, D&D work, and close out, would be in accordance with approved written procedures and detailed work plans. Appendix A provides a general guideline for the sampling and analyses for chemical and radiological contaminants within the Building 232-Z.

2.4 CHEMICAL CHARACTERIZATION

The 232-Z Isolation Safety Analysis Report (SAR), dated February 1990, indicate that no toxic materials are present within Building 232-Z; however, historical PFP processing information indicates that leaded rubber gloves and other assorted metal pieces were incinerated in Building 232-Z. This suggests that oxides of the incinerated metals may be present in the resultant ash (SD-HS-SAR-007 1990). Consequently, a preapproved plan to characterize the incinerator ash should include toxicity characteristic leaching procedure (TCLP) analyses for leachable lead, chromium, and nickel in accordance with applicable federal regulations. The final determination of contamination for waste disposal purposes will be made following sampling and analyses.

The possible presence of hazardous materials associated with structural and functional components of the building (e.g., lead-based paints and asbestos) should be investigated. Paint chip samples from concrete, structural steel, and glove boxes should be analyzed for TCLP metals and anions and asbestos should be analyzed for friable fibers.

3.0 CRITERIA

3.1 RADIOLOGICAL PROTECTION AND ALARA

All radiological work shall be performed in accordance with DOE Order 5480.4, Environmental Protection, Safety, and Health Protection Standards, May 1984; and DOE Order 5480.11, Radiation Protection for Occupational Workers, December 1988. Radiation Work Permits (RWP) and Decommissioning Work Plans (DWPs) will be written to achieve practices that are "as low as reasonably achievable" (ALARA) exposures, and will be written to conform to the requirements of, and address the guidance contained in, DOE Order 5480.10, Contractor Industrial Hygiene Program, and DOE Order 5480.11. External dose rates are not expected to be of primary concern during equipment-removal work. However, extensive alpha contamination in the off-gas duct work poses a potential inhalation risk to personnel and a risk of environmental contamination. The decontamination and decommissioning (D&D) of Building 232-Z will be planned and carried out according to the general guidelines outlined below from the ALARA Management Work sheet (Figure 3.1) or a similar work sheet.

- Piping and equipment-removal work will be performed within the building. The segmentation of the piping and equipment for decontamination will be done within the building in the staging area.

- Plutonium removal from piping and duct work segments will be carried out within a glove box located in Building 234-5Z. Standard contamination control precautions will be observed during the transfer of this piping/duct work between buildings.

- As much as possible, time-saving devices and equipment will be designed into the removal processes. Contamination controls will dictate the speed of some more critical aspects of the project.

- Greenhouses and glove bags will be used extensively to control the spread of contamination. Decontamination of the piping and equipment to low-level radioactive waste (LLRW) criteria will involve a short-term increase in the risk of exposure; however, eliminating the majority of the transuranic (TRU) waste and solidifying what remains, will minimize the future risk of contamination or release.

- Additional shielding is not expected to appreciably lower dose rates. General area dose rates in the off-gas duct work were approximately 5 to 10 mrem/hr. Specific shielding criteria will be evaluated on a case-by-case basis during the project.

- Additional hazards will be addressed through the Safety Evaluation, Criticality Safety Analysis Report, and the Area Emergency Plan. These documents will be referenced in or implemented through the DWP and job safety analysis (JSA) for a given task.

- The number of personnel entering the radiologically controlled area will be kept to a minimum.

- Both respiratory protection and special ventilation will be required to protect workers from unacceptably high levels of contamination. It is anticipated that throughout the decommissioning, the process area will remain under a negative pressure. During dismantling, airflow in the area will be maintained at negative pressure to control the sources of airborne contamination.

Attach to RWP	ALARA MANAGEMENT WORKSHEET (AMW)

PART I PRE-JOB INFORMATION

RWP No.	Work Pkg. No. or Equivalent	Area/Facility/Location

Job Title/Occupation	ALARA Review Required ☐ Yes If yes, then complete Section II of this form ☐ No If no, then sign in Section III of this form

PART II ALARA REVIEW

PART IIA ESTIMATED COLLECTIVE DOSE ________ Person-rem

PART III PROTECTIVE MEASURES

	YES	NO	
A. Can work be moved to a lower exposure rate area ?			
B. Can time-saving techniques be employed to reduce costs ?			
C. Can decontamination be done to reduce risks ?			
D. Can additional shielding be employed to reduce dose rates ?			
E. Can additional nonradiological hazards be identified and planned for ?			
F. Can other contingencies (i.e. off-normal events, accidents, etc.) be planned for ?			
G. Can the number of personnel entering the radiologically controlled area be reduced ?			
H. Can other adverse work conditions (e.g. heat stress, noise, physical restrictions, etc.) be planned for ?			
I. Can special ventilation systems be used in lieu of respiratory protection ?			
J. Can additional special tools or equipment be utilized to reduce exposures ?			
K. Can additional provisions for waste removal, segregation, or minimization be accomplished ?			
L. Can additional efforts be made to reduce FUTURE doses ?			
M. Describe any other methods which were used to reduce exposures or risks ?			

PART IIC ESTIMATED COLLECTIVE DOSE (corrected) ________ Person-rem

PART III PRE-JOB APPROVAL

Signature of AMW preparer ______________________ Date ________

DISTRIBUTION: Original - RWP Work Package ALARA Program Office ALARA Team Chairperson

PART IV LESSONS LEARNED

In the course of performing any job covered by this AMW, document any lessons learned and send copy to ALARA Team Chairperson or Point of Contact.

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FIGURE 3.1. ALARA MANAGEMENT WORKSHEET

- The cutting tools selected will be of such type as to limit the possibility of a tear or cut in a worker's protective clothing. The tools also will be as light as possible to minimize worker fatigue. Limiting worker fatigue is a means to implement ALARA practices because less fatigue means better attention, thus lowering the risk of mistakes.

- After recovery of residual plutonium from the removed piping, the sections of removed pipe will be classified as TRU or low level waste (LLW), depending upon the results of a final NDA, and will be packaged and disposed of accordingly. Protective equipment and other secondary wastes may not require decontamination to meet LLRW criteria. However, each waste drum will be assayed before decontamination to determine if decontamination is required to meet the LLRW criteria.

3.2 WASTE MINIMIZATION

D&D of a large radiologically contaminated facility is expected to generate a significant volume of waste. One of the goals of any such project is not only to minimize waste, but to consider and minimize the hazard classifications of the waste generated. This D&D assessment was developed with the mininization of TRU waste as a primary goal. When D&D alternatives are thoroughly screened with regard to implementability, constructability, effectiveness, and cost, then the goals of TRU waste minimization can be achieved.

The removal of recoverable plutonium will help to minimize the amount of TRU waste generated. Although the applicable limit for plutonium-removal operations will be the established economic discard limit (EDL), removal to below this limit will be achieved to the extent practicable. The EDL is that limit at which the costs to recover a product outweigh the benefits of recovery.

The process recommended to decontaminate TRU waste will generate two waste streams: a LLRW stream of similar volume to the original TRU stream estimated to be 213 ft^3, and a smaller volume of concentrated liquid TRU waste estimated to be 22 ft^3. Once solidified, this is estimated to increase to 33 ft^3 of solid, stabilized waste. As mentioned previously, the TRU waste decontamination effort is designed to reduce future risk by placing the piping and equipment in a LLRW category that would allow its immediate and permanent disposal. The remaining TRU liquid waste will require stabilization by an approved technology. Once stabilized and packaged, the TRU waste will not have to be contact-handled (ch) again. The method for solidification of TRU-waste liquid or sludge has traditionally been to add a grouting mixture or concrete.

Other waste minimization techniques designed into the D&D project are listed below:

- Negative pressure/controlled ventilation flows will be maintained on Building 232-Z throughout the project.

- An option under consideration is to enclose Building 232-Z in a tertiary confinement building as a last barrier to an environmental release. This confinement structure would have its own ventilation system, and would be constructed with reuse and easy decontamination in mind.

- The ventilation system and work plan will be specifically prepared to prevent contaminating the confinement building structure.

- Building 232-Z will be dismantled (taken apart), instead of demolished (broken apart), thereby eliminating the waste volume expansion associated with broken concrete and its associated void spaces.

Gross quantities of residual plutonium will first be removed from process piping, filter and glove boxes, and duct work. Remaining piping and equipment will be removed in order of its level of contamination beginning with the least radiologically contaminated to the most radiologically contaminated. This will prevent the contamination of "conditionally clean" and LLRW components that could become cross-contaminated by and from the disturbance of more contaminated components.

3.3 RESIDUAL RADIOLOGICAL LIMITS

At the end of the D&D project, the area will meet the following radiological conditions:

- There shall be no loose surface soil contamination nor shall there be any soil contamination within one foot of final grade greater than that allowed by DOE Order 5820.2A, Radioactive Waste Management, February 1984.

- If any soil contamination remains that is greater than allowed under DOE Order 5820.2A standards, it is to remain below one foot from final grade. The level and extent of the remaining contamination shall be documented in the final report for the decommissioning project and filed with Operable Unit 200-ZP-1 records.

- The average annual dose from any residual contamination shall be reduced to ALARA levels, as verified by appropriate modeling techniques, but in no case shall exceed allowable levels as per applicable DOE Orders or other federal or state regulations. If, based on analytical data, it is determined that this level is unachievable in a cost-effective manner, a higher limit will be negotiated with the Department of Energy, Richland Operations Office (DOE-RL).

3.4 PHYSICAL CONDITION

At the end of the D&D project, the area is expected to meet the following criteria with respect to physical condition:

- The Building 232-Z and its foundation will have been removed.

- The subsurface and surface soils will meet the conditions set forth in Section 3.3 of this document. The surface will be covered with gravel, crushed stone, or other material as necessary to prevent soil erosion.

- The interconnecting 7.62-centimeter (3-inch) waste transfer pipe between 232-Z and 241-Z will be cut 2.8 meters (6 feet) south of the building and capped.

4.0 DECOMMISSIONING PLAN

The work described under this plan is divided into three major tasks and discussed separately. These major tasks are: Residual Plutonium Removal, discussed in Section 4.1; Piping and Equipment Removal and Disposal, discussed in Section 4.2; and Building Decommissioning, discussed in Section 4.3. Section 4.1 discusses the removal of recoverable plutonium from process piping/duct work, filter boxes, and glove boxes. Section 4.2 discusses removal of all equipment from the interior of Building 232-Z, decontamination, and disposal of all related wastes. Section 4.3 describes removal of the Building 232-Z shell and disposal of related wastes. Section 4.4, Decommissioning Constraints, discusses the option of using a confinement building during decontamination and decommissioning (D&D) work on Building 232-Z, and presents a program-flow chart. If a confinement building is chosen, it would be constructed prior to the dismantlement of the Building 232-Z shell. Section 4.5 describes the work required to complete each of the major phases of this D&D program.

A number of considerations must be made in the overall analysis of options available for D&D of Building 232-Z. Specifically, methods used to remove contaminated equipment from Building 232-Z must be designed to contain the contamination sufficiently to prevent an unacceptable release to the environment. Adequate containment is necessary to prevent such a release. Cost considerations are also important, and an estimated cost for each option must be determined. In consideration of cost and environmental responsibility, waste reduction techniques will be employed to minimize the amount of disposed waste and the toxicity of the waste generated will be minimized where possible. Efforts also should be made to keep secondary wastes to a minimum. Secondary wastes are those wastes generated as a by-product of D&D efforts or during D&D activities, such as discarded gloves, shoe covers, or plastic material. There is possible future liability related to the disposal of hazardous wastes, even those disposed of in accordance with currently applicable regulations (i.e., the responsibility for a hazardous waste does not end with the underground disposal of that waste). If the repository of that waste leaks or results in ground or water contamination at some point in the future, the generator of that waste may be held accountable to correct and/or remediate that contamination. This possible liability makes it necessary to consider all reasonable options for the reduction of volume and toxicity of wastes.

4.1 RESIDUAL PLUTONIUM REMOVAL

The process-room equipment in Building 232-Z (Figure 4.1) was used to incinerate plutonium-contaminated waste material that was size-reduced prior to incineration. The ash was collected and placed in ash cans within the ash-canning hood for removal to another facility. Plutonium was then chemically extracted (leached) from the ash. Combustion gases produced in the incinerator were routed to the scrubber cell, where solid particles of plutonium oxide and other metal oxides were captured. Any acids present were neutralized. Non-destructive analysis (NDA) results indicate the presence of 848 grams of plutonium throughout the process duct work, scrubber cell, incinerator feed, burning and ash hoods, the filter hoods (Figure 4.2). Most of this plutonium appears to be concentrated within the process exhaust ducts exiting the incinerator and leaching glove boxes, and in the high-efficiency particulate air (HEPA) filters and filter boxes.

Section 4.2.1 presents four options for the disposition of Building 232-Z. Options (2) and (3) involve plutonium removal. For these options, residual plutonium will be removed prior to decontamination of building and equipment surfaces and disassembly of the building and its components. There are several reasons for removal of excess residual plutonium prior to decontamination and disassembly. One is to reduce the potential for release of airborne radioactivity during the disassembly process. Another is the

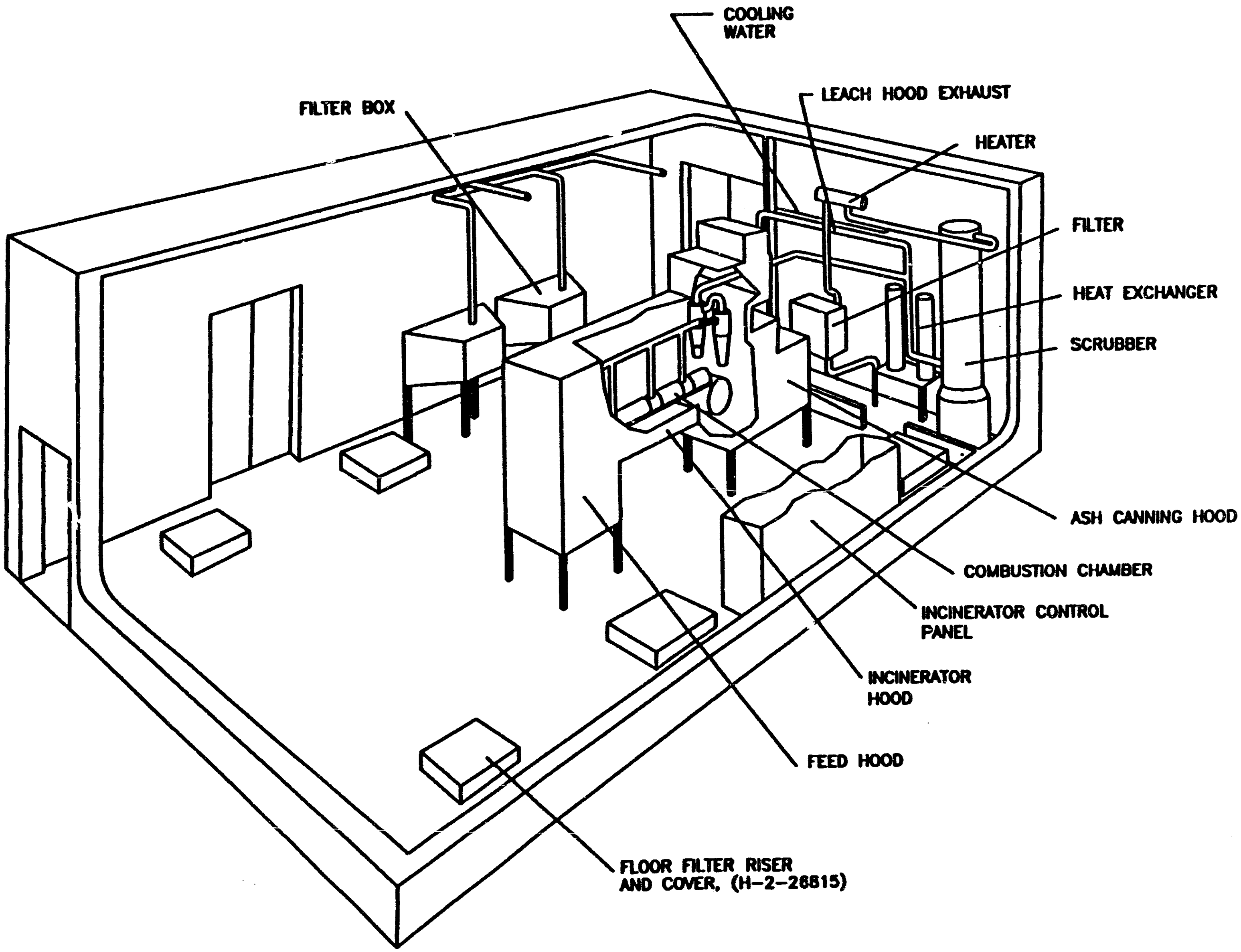

FIGURE 4.1. BUILDING 232-Z PROCESS ROOM EQUIPMENT

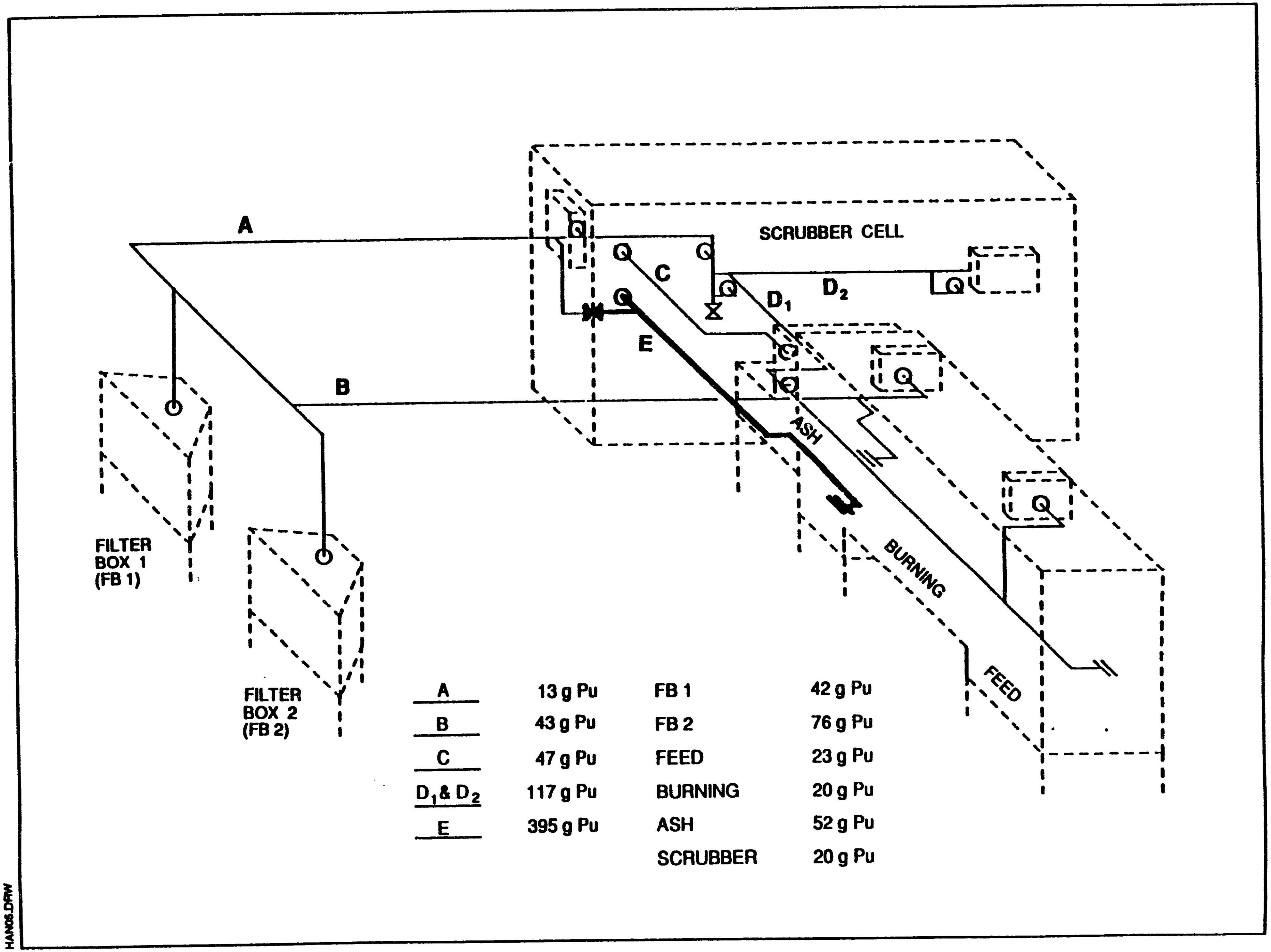

FIGURE 4.2. LOCATION OF PLUTONIUM IN BUILDING 232-Z

economic value of the recovered plutonium. The removal process will continue until the inventory of plutonium has been reduced as low as practicable but at least to a level below the established economic discard limit (EDL). A third reason is to reduce the potential of a criticality accident. Finally, the reduction of some waste from transuranic (TRU) to low level radioactive waste (LLRW) criteria will result in a cost savings for disposal.

For purposes of describing the plutonium-removal process, the plutonium containing components within Building 232-Z can be grouped into four categories: (1) process piping and duct work, (2) filters and associated filter boxes, (3) firebrick and other glove box components, and (4) glove boxes themselves. Specific procedures for removal of plutonium from each of these categories will vary, but certain considerations and operations are common to all four and are discussed below.

Prior to commencing recovery operations, the appropriate documentation will be prepared. A safety assessment document (SAD) will be prepared in accordance with the requirements of WHC-CM-4-46, Non-Reactor Facility Safety Analyses Manual. An Environmental Assessment (EA) will be prepared per the requirement of the National Environmental Policy Act (NEPA) that evaluates each of the D&D alternatives presented in this document and recommends a preferred alternative based upon the anticipated environmental impacts. The required planning and control documents, including a job safety analysis, "as low as reasonably achievable" (ALARA) review and required permits, will be prepared in accordance with applicable procedures. Radiation Work Permits (RWPs), both general and specific, will be prepared for each operation and approved by the appropriate authorized individuals. A criticality procedure will be developed and instituted prior to commencing operation.

A prejob characterization survey of the current radiological conditions will be performed to identify the areas of highest loose surface contamination and dose rates. This information will be used to prepare the RWPs. Prior to commencing actual removal operations, involved personnel will receive facility specific and criticality worker training and will participate in mock-up training for the operations that will be performed. A comprehensive prejob briefing will also be held for each operation and the structure established for daily briefings as work progresses. Periodic updates will occur as the major work tasks proceed.

Prior to beginning actual operations, a readiness review (RR) will be scheduled to ensure appropriate physical, administrative, and procedural requirements for safe and proficient operations are met. The review includes a check of facility readiness and ensures that the appropriate hardware and personnel are available to support the work. In addition, a review to ensure compliance with DOE Environmental Safety and Health Orders is included.

Personnel protective clothing appropriate to the particular operation, as specified in the relevant RWP, will be worn by each D&D worker, including respiratory protection. When required, respirators will be capable of preventing inhalation of airborne asbestos or asbestos-containing material (ACM) as well as airborne radioactive materials.

Contamination control will be maintained by the appropriate combination of greenhouses and glove bags necessary for the particular operation. Greenhouses will be maintained at a negative air pressure with respect to the remainder of the building and the outside environment to minimize the escape of airborne radioactivity. Continuous air monitors (CAM) will be used to monitor the levels of airborne radioactivity and to alert personnel to any release of airborne radioactivity from within greenhouse enclosures.

During removal operations, frequent use of NDA will be made to track the amount of plutonium removed. This will be done for safety and accountability purposes.

All items removed from Building 232-Z during plutonium-removal operations, including the plutonium itself, will be prepared and packaged for storage, transportation to a disposal facility, or further processing, as appropriate. All waste handling and packaging will be in accordance with the criteria established in Title 49, parts 100-177 of the Code of Federal Regulations, Washington Administrative Code (WAC-173-303), the Westinghouse Hanford Company (WHC) Hazardous Waste Management Manual, the latest revisions of the Plutonium Finishing Plant (PFP) TRU and LLRW certification plans, and the Hanford Site Radioactive Solid Waste Acceptance Criteria (WHC-EP-0063-2). Any item to be released from a surface contamination area or a radiological control area will be surveyed to ensure that surface contamination levels are below the relevant release limits. Sections of pipe or duct, equipment, and glove box components or contents will, as a minimum, be double- bagged with all sharp edges capped to prevent tears to the bag. Recovered plutonium will be placed into poly jars for storage until the plutonium can be reprocessed for further use.

4.1.1 Process Piping and Duct Work

The process exhaust duct work is estimated to contain the majority of the plutonium inventory (Figure 4.2). Removal of plutonium from this duct work and associated process piping will proceed in a stepwise manner. First, a greenhouse will be erected around the location where the duct work removal will take place. Any asbestos insulation covering the piping will be removed and all piping within the greenhouse will be wrapped to minimize the spread of contamination. A glove bag will then be placed around the section of piping/duct work to be cut. The duct work will be supported to allow cutting and capping of both ends of the pipe section before removing the glove bag. The glove bag will then be removed and the pipe section transferred to the floor where an NDA survey will be performed. NDA survey results will determine the requirements for criticality control, and for accountability purposes. Piping will be cut to sections of appropriate length for the most feasible storage and transportation containers. The section will then be covered by at least two layers of plastic bagging, surveyed for external contamination, and certified for release from Building 232-Z. The next section of piping will be removed in like manner and the process continued until all piping/duct work containing plutonium in excess of the EDL has been removed. Temporary sections of piping/duct work will be added to replace those removed for plutonium recovery where deemed necessary to maintain stable airflow and ventilation required for an adequate negative pressure gradient.

After removal, pipe sections will be placed on special carts modified for easy securability and transported to an adjacent building, Building 234-5Z. There, an NDA survey will be performed and pipe sections will be loaded into a glove box, where plutonium removal will take place. Plutonium removal is anticipated to be accomplished mainly through mechanical means, such as brushing and scouring. However, should these methods fail to remove plutonium to below the EDL, other more aggressive means would be employed. After removal of the residual plutonium, the pipe sections will be given final NDA surveys to verify that they should be disposed of as TRU waste.

An alternative procedure would be to cut and bag out the asbestos insulation with the piping, with the insulation to be removed within the plutonium-removal glove box. The particular procedure to be used will depend upon the results of specific prejob assessments and experience gained as the work progresses.

4.1.2 Filters and Filter Boxes

The results of the initial NDA survey showed an appreciable quantity of plutonium contained within filter boxes FB-1 and FB-2 (Figure 4.2). Recoverable plutonium will be removed from these filters/filter boxes prior to proceeding with the D&D process. To accomplish this, a greenhouse will be installed around the opening of the filter box. The filter will then be carefully removed and placed into a plastic envelope for contamination control. An NDA survey will then be performed on the filter. If residual plutonium remaining on or within the filter exceeds the EDL, the filter will be transferred to the plutonium-removal glove box in Building 234-5 Z for recovery of the excess plutonium by mechanical means. Any loose plutonium remaining in the filter box will be removed and placed in poly jars for storage. This will likely be done using a combination of mechanical removal techniques and vacuuming of the interior surface of the filter box. As much of the residual plutonium as is reasonably feasible will be removed; however, removal operations will be discontinued when the amount has been reduced to below the EDL as verified by NDA.

4.1.3 Incinerator and Scrubber Cell

The incinerator and scrubber cell are the only remaining pieces of process equipment in the process room after the previous partial decontamination and decommissioning. The incinerator consists of a feed conveyor, combustion chamber, and ash canning glove box. Based on the initial NDA survey, approximately 95 grams of plutonium remains within the incinerator, although this estimate is subject to significant uncertainty. This is because plutonium may exist within the combustion chamber and may not be detected due to a combination of shielding from firebrick and/or asbestos brick present and somewhat poor geometry for the NDA survey.

A specific work plan to include criticality specifications will be developed for the removal of residual plutonium from the incinerator. This work plan may need to be modified as work progresses. A greenhouse will be constructed to enclose the top and side(s) of the combustion chamber portion of the incinerator. A slight negative pressure will be maintained during the firebrick removal. Excess plutonium on the firebrick that can be easily removed will be dislodged by mechanical means. Radioactive debris will be removed as bricks are transferred out of the combustion chamber. This may be accomplished by using a HEPA-filtered containment vacuum or equivalent means. After the operation, the HEPA filter from such a containment vacuum can be sealed with a cap plug to render it safe for further handling or storage. Brick removal will begin from the top, where access to half of the bricks is expected, and will shift to the sides to complete the operation. As bricks are removed, they will be surveyed for remaining plutonium contamination and packaged for disposal as TRU or low-level waste (LLW), as appropriate. After removal of the brick is complete, any remaining loose plutonium will be removed from the walls and floor of the combustion chamber glove box using a combination of mechanical removal techniques and vacuuming. A final NDA survey of the incinerator will then be performed to document any remaining residual contamination.

Results of the initial NDA survey showed an estimated 20 g of plutonium remaining within the scrubber cell. It is not anticipated that it will be feasible to recover this amount. However, should more accurate NDA surveys performed during process line dismantling operations indicate the presence of recoverable amounts, a specific work plan would be developed and the recoverable plutonium would be removed before continuing the dismantling operations. As with the previously described removal operations, appropriate contamination control procedures would be employed, including use of greenhouses and appropriate worker protection measures.

4.2 PIPING AND EQUIPMENT REMOVAL AND DISPOSAL

Following residual plutonium recovery operations, the planned D&D activities for Building 232-Z may begin. Radiological survey information indicates the presence of fixed and transferable contamination on the floor, walls, and process equipment inside the process area. Fixed contamination on surfaces in the scrubber cell are reported to be as high as 1 x 10^6 disintegrations per minute (dpm) (A.L. Ehlert, Internal Memo PFP/LAB H&S 33920-92-034, May 1992). Material containing transuranic radioisotopes with concentrations in excess of 100 nCi/g of material is classified as TRU waste. Floor and wall surfaces within Building 232-Z above this established limit are categorized as TRU waste.

Criteria used to judge the options or alternatives discussed within this section include: (1) adherence to federal, state, and local regulatory requirements; (2) economic justification; and (3) minimization of injury or radiation exposure risks to personnel.

4.2.1 Piping and Equipment Removal

This section discusses the contents of Building 232-Z and its expected radiological status. Types of equipment required to D&D the building equipment are discussed. Also, methods and equipment are suggested for carrying out the Building 232-Z D&D. Four options are examined for dealing with the contents of Building 232-Z: (1) remove equipment and dispose of contents without efforts to decontaminate TRU waste or recover radioactive materials; (2) remove equipment and the radioactive material, (3) remove and section equipment and decontaminate TRU waste to LLRW or clean status; and (4) no action.

4.2.1.1 General conditions at Building 232-Z

A limited source reduction operation was performed at Building 232-Z in the mid 1980s. This operation resulted in the removal of the chop hood (used to shred waste into small pieces prior to incineration), and removal of the leach hood (used to extract plutonium from the ash produced in the incinerator hood). At that time, process room HEPA filters were also replaced. The incinerator hood, scrubber cell, filter hoods, and associated piping remain in the Building 232-Z process room.

In 1991 the original Building 232-Z ventilation system in use was blanked off in the 291-Z Fan Building and a temporary 232-Z ventilation system was made operational to service only the 232-Z facility. This ventilation system's power is supplied through the emergency power electrical bus from MCC-EP-1 in Building 2736-ZB. A local control panel, located on a concrete pad outside Building 232-Z, distributes power for fan controls, instrumentation, and monitoring of the 296-Z-14 stack discharging filtered exhaust from the 232-Z facility. The benefit of the independent power supply for the Building 232-Z ventilation system is that the current ventilation system may remain in operation even after all other power in 232-Z is turned off to allow D&D of electrical systems and equipment within Building 232-Z. This is significant because a self-sufficient ventilation system may eliminate the need for a secondary confinement building. If a confinement structure is built, measures must be taken to protect the temporary fans and the control panel from damage during construction because this could cause the loss of ventilation to Building 232-Z.

While electrical power would remain for as long as possible, the power supply must eventually be turned off to allow removal of electrical equipment, conduit, and wiring. Temporary power will be supplied by extension cords to electrical devices needed during the remaining D&D work. Temporary free-standing work lights will be needed to direct lighting to the areas required.

Waste materials present in the facility fall into a number of different waste categories. Piping and equipment within the process hoods which are contaminated with plutonium (presumably as plutonium oxide); and other non-radioactive heavy metals, which were present in the incinerator feed materials. It is suspected that these heavy metals include chromium, lead, and nickel. These materials, along with the process hoods and some areas on the floor and walls, may have to be classified as TRU wastes unless decontamination efforts are able to reduce contamination levels. In addition, the presence of heavy metals must be ascertained because their presence (above the established threshold for each of these metals) would require that Resource Conservation and Recovery Act (RCRA) disposal guidelines be followed in addition to federal guidelines for disposal of radioactive wastes (RCRA 1976).

Materials classified as LLRW may include some incinerator hood construction materials, scrubber cell construction materials, support equipment outside process hoods, an incinerator electrical control panel, electrical conduit and wiring outside process hoods, lighting fixtures, and other miscellaneous support equipment. Materials outside the processing area are expected to be classified as conditionally clean. A thorough radiological survey will be required prior to start of D&D work to identify contamination levels (where possible) so appropriate disposal plans can be made.

Asbestos, used as insulation, is also present around much of the incinerator exhaust handling duct work and within the incinerator hood and the scrubber cell. This material will likely be classified as LLRW or TRU waste. Appropriate measures must be taken to ensure that removal, packaging, and disposal of asbestos meets federal regulatory requirements.

Chemicals used in the process of scrubbing exhaust gases or for chemical extraction in the leach hood may still be present within process equipment or piping. A thorough investigation must be made upon initiation of the D&D process to determine the presence or absence of these materials. A plan for collection and disposal will be prepared.

A variety of construction materials was used in Building 232-Z. The physical nature of these items, along with contamination levels, will greatly affect the methods used to remove them from the building once the D&D process starts. These materials include:

- electrical conduit and associated electrical wiring,
- 0.187-in.-thick sheet metal used in hood construction,
- angle iron ranging up to 4 inch x 6 inch (nominal),
- carbon steel piping up to 6.5-in. outside diameter (OD),
- smaller-diameter stainless steel process piping,
- 5-in. OD (nominal) stainless steel piping (used as incinerator primary and secondary combustion chambers),
- polycarbonate material used for windows (typically 3 x 3 feet),
- refractory brick in the incinerator hood,
- aluminum jacketed asbestos insulation material,
- scrubber and heat exchanger vessels,
- pumps within the scrubber hood,
- instrumentation inside incinerator hood and scrubber cell,
- blower fan and motor under incinerator hood,
- incinerator conveyor mechanism,
- incinerator ash canning equipment,
- lighting fixtures,
- heating and ventilation duct and equipment,

- contaminated floor and wall surfaces,
- Motor Control Center electrical equipment, and
- channel and I-beam members (parts of a trolley system over the incinerator hood).

This list is not intended to be all inclusive, but rather to present a sampling of the types of materials and equipment that must be considered when selecting tools to remove materials from service.

4.2.1.2 Dismantling equipment

Because such a wide variety of materials will be removed during the Building 232-Z D&D, an evaluation of options must be performed to select tools that are capable of performing this work and that can meet certain other requirements. Criteria for judging tools are:

1. capability of the tool to perform the required type of work,
2. operator safety considerations,
3. ease of use,
4. operator comfort during use,
5. cost of tool,
6. operating, and maintenance expenses.

Inspection of the list of materials to be removed reveals that no single type of tool will be suitable for removal of all materials. Cutting tools will be needed for sectioning long, unmanageable members; a set of hand tools will be needed to disassemble equipment that is bolted together; cutting or grinding tools may be needed to cut welds or damaged bolt heads; brushing and scouring tools will be needed for the mechanical removal of residual plutonium; and abrasive particle blasters or scarifiers may be needed to remove surface contamination from floor and wall surfaces. Tool selection will depend, in part, on the extent of decontamination necessary. Power cutting tools will be required regardless of the extent of decontamination, but the number and types of tools depends on the extent of decontamination undertaken. It is important to note that, because the process duct and process hoods contain plutonium oxides, a worker receiving a cut or abrasion in this type of environment could become contaminated with plutonium.

4.2.1.3 Metal burning tools

Metal burning tools are among the most versatile tools available for cutting metal components. There are two types applicable for this work: oxygen/acetylene torches and plasma arc torches. The oxygen/acetylene torch burns a mixture of oxygen and acetylene gas to produce a high temperature flame capable of cutting metals. The plasma arc torch uses electrical current (similar to an arc welder) to melt the metal while a pressurized gas (nitrogen) forces molten metal out of the kerf (melted) area. The oxygen/acetylene torch and the plasma arc torch are both lightweight and capable of cutting through metal components rapidly. The drawback for these devices is the high temperature operation or use of an open flame, which could result in burning through plastic protective barriers or personnel protective clothing. Worse yet, a fire accident in the building or burn injury to workers could result from the use of these tools.

4.2.1.4 Grinders and abrasive cutters

Abrasive cutting tools include disc grinders, chop saws, and bench-mounted chop saws. All use abrasive discs for cutting media; cutting speeds are moderate to fast. They are capable of cutting various grades of carbon or stainless steel. The hand-held portable chop saws offer high mobility and versatility, but these tools may weigh over 20 pounds, so operator fatigue is a concern especially if over-head or extended arm work is planned. Another concern is the generation of a continuous stream of sparks from the cutting action of the abrasive blade. For a fixed-position, bench-type chop saw, a protective barrier can be provided to prevent sparks from landing on and igniting any combustible materials. For hand-held grinders or chop saws, caution is advised to minimize the spread of debris (possibly contaminated). Removal or protection of combustible materials in the pathway of the spark stream is strongly recommended. The main disadvantage of abrasive cutting tools is the uncontrolled generation and spreading of dust and debris while the tool is in use. This dust can be reduced by using a wetting agent. However, this requires that collection, containment, and disposal of that wetting agent is also considered.

4.2.1.5 Portable, reciprocating, and fixed-position saws

A range of portable and fixed-position saws also are available. Portable band saws (Figure 4.3) offer the ability to cut materials anywhere the saw will fit. Features include moderate cutting speeds and the ability to cut pipe up to 4.75 in. in diameter with a single pass without rotating the stock or the saw. Another saw, the reciprocating saw (Figure 4.4), is capable of cutting a larger pipe or angle iron than the portable band saw, and is generally smaller and lighter. Drawbacks to both types of saws are prohibitive tool weight for extended arm cutting and the necessity for frequent blade changing if harder grades of steel (or stainless steel) are encountered. Fixed-position saws include the horizontal-vertical band saw and the power hack saw. The horizontal-vertical band saw (Figure 4.5) operates as a horizontal cut-off saw for reducing stock lengths or as a vertical saw for cutting flat sheet stock. The power hack saw is a reciprocating type of saw used primarily for reducing stock length. Both saws offer many advantages at a set location, and would be particularly useful if an extensive decontamination program is established. Cutting speeds are moderate; the machines are semiautomatic (i.e., they cut through the stock and shut themselves off when the cut is complete); spread of dust and debris is minimal; and the machines offer almost no possibility of producing a fire. Of the two fixed-position saws, the horizontal-vertical band saw is the most capable since it can cut long pipe, angle members, or flat sheet metal.

4.2.1.6 Nibblers and shears

Portable nibblers take a continuous series of small bites out of sheet material until a path has been nibbled through the material (Figure 4.6). They are capable of cutting through steel sheet up to 0.25-in. thick or aluminum sheet up to 0.375 in. thick. Portable sheers operate by cutting through material using a scissor action. Portable shears, having slightly less capacity, are capable of slicing through steel sheet up to 0.187 in. thick (Figure 4.7). Both are available as electrically operated, each requiring a 110-115 volt power source.

4.2.1.7 Glove bags and greenhouses

To prevent the unintentional spread of contamination throughout the processing area, contamination containment facilities will be provided within the process area during removal of piping and equipment. When removing pipe sections containing known or suspected transferable contaminants, a greenhouse (Figure 4.8) and glove bags will be provided for contamination containment. Construction methods for greenhouses will follow established procedures. These structures must be used whenever there is a risk of releasing high levels of unfixed contaminants into the general work area outside process hoods. They will be required for the handling of radioactive contaminants and for asbestos removal.

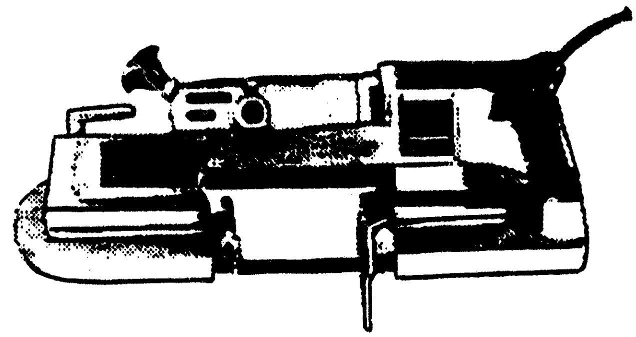

FIGURE 4.3. PORTABLE BANDSAW

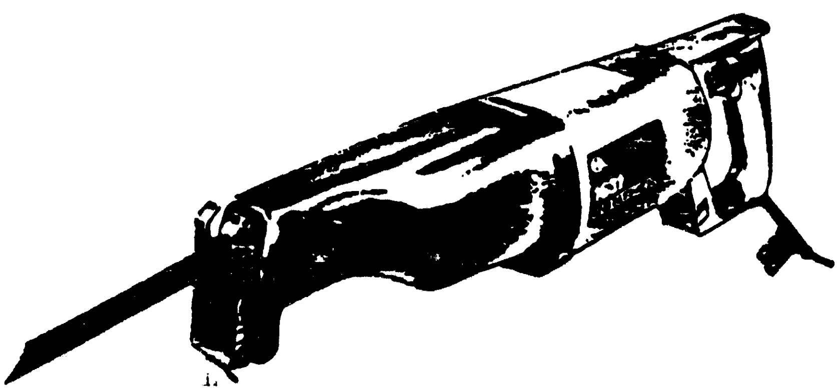

FIGURE 4.4. RECIPROCATING SAW

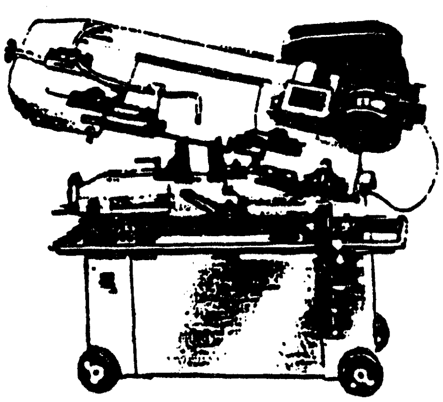

FIGURE 4.5. HORIZONTAL - VERTICAL BANDSAW

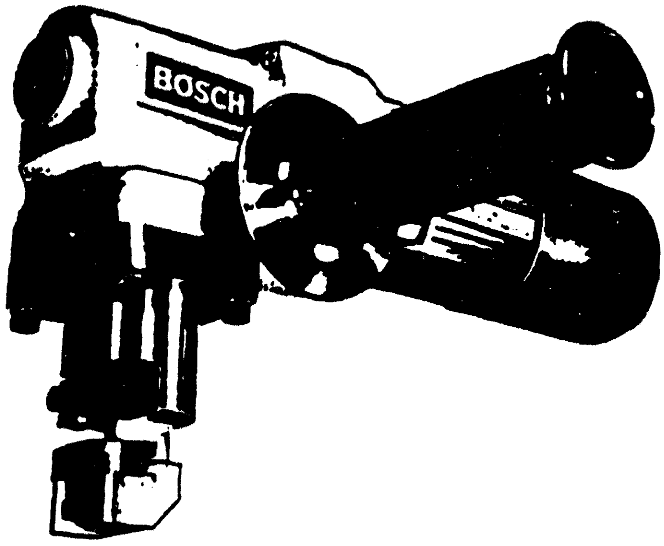

FIGURE 4.6. PORTABLE NIBBLERS

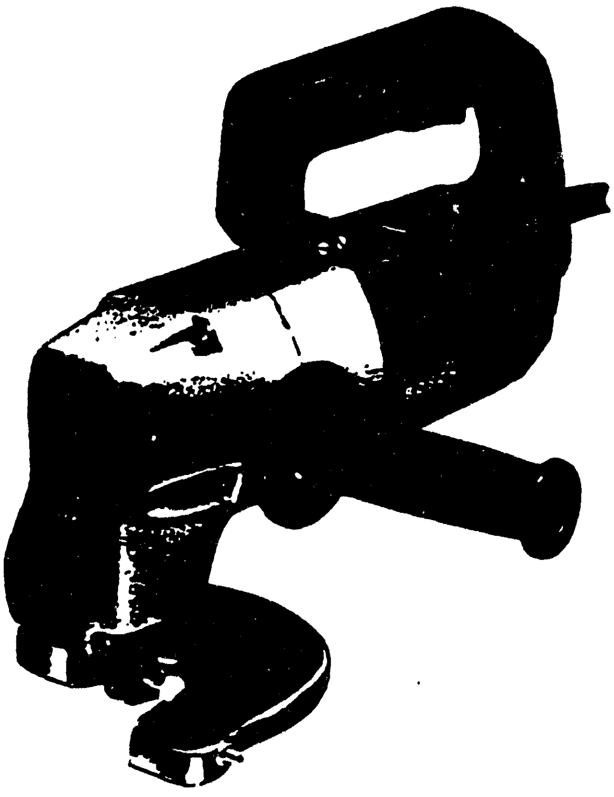

FIGURE 4.7. PORTABLE SHEARS

FIGURE 4.8. WORKERS INSIDE A TYPICAL GREENHOUSE AT HANFORD SITE

4.2.1.8 Packaging and disposal

Various containers are available for the containment of wastes including 55-gallon drums and waste boxes. Either of these containers can be utilized to package LLRW waste; however, only 55-gallon drums will be used to package TRU waste. Empty 55-gallon drums offer the convenience of easy movement and they are still reasonably easy to move after being filled (if drum handling tools are made available). The drums also are well suited for limited-space areas, to service small components, or for easily compactable waste. Selection of waste containers must be based upon waste storage location, waste radioactivity status (or asbestos content), and the size and nature of the components that will be placed in the containers. If materials are sectioned into small pieces (i.e., less than 30 in.) for decontamination purposes, then 55-gallon drums may be acceptable for containment of these LLRW or TRU waste materials.

4.2.1.9 Summary

The portable band saw and the portable reciprocating saws seem to be the best choice for portable cutting tools (of the many tools considered) for use in the Building 232-Z D&D. (See Table 4.1 for a tabular analysis of various types of tools.) For fixed-position cutting capability, the horizontal-vertical band saw offers the best capability. However, where flat metal sheet must be cut using a completely portable tool, nibblers or shears are well suited.

Each of these tools:

- is relatively safe to operate,
- minimizes contamination spread,
- is fairly easy to operate, and
- is relatively inexpensive.

Contamination control facilities (greenhouses and glove bags) must be used during this proposed work to prevent the spread of asbestos or radioactive contamination. Waste container selection will have to be made based on the contamination status of the waste, the availability and means of temporarily storing the waste, and the size of the waste components being disposed of.

4.2.2 TRU Waste Disposal Option

The first option considered for disposing Building 232-Z equipment and materials is to dispose of all materials without decontamination or volume reduction. This would entail a thorough NDA of all materials in the building and a classification of the radiological status of all materials present on the floor and wall surfaces. Equipment would then be dismantled for disposal in order of least contaminated to most contaminated. This method is recommended for two reasons. First, it allows removal and disposal of less contaminated materials prior to subjecting them to the risk of additional contamination posed during removal of more highly contaminated materials. Secondly, it allows experience to be gained in equipment removal at a much lower risk to personnel than if removal operations were to start with TRU materials first. The experience gained can later be used to help removal operations for more highly contaminated materials proceed more safely and efficiently.

After monitoring to ensure they are below release limits, all clean fixtures, equipment, and materials would be disposed of at a sanitary landfill, and all LLRW would be collected and disposed of at the Hanford 200 Area LLRW Burial Ground. TRU waste would be packaged and placed in monitored retrievable storage at the Transuranic Storage Assay Facility (TRUSAF) until eventual relocation to the Waste Isolation Pilot

Table 4.1. Tool Alternatives Comparison Table

Tool Description	Purpose	Tool Capability 1=low, 5=high	Tool Safety 1=low, 5=high	Ease of Use 1=low, 5=high	Tool Cost* 1=high, 5=low	Average Rating
Oxygen/Acetylene Torch	cutting and sectioning pipe and angle	5	2	5	5	4.25
Plasma Arc Torch	cutting and sectioning pipe and angle	5	2	5	3	3.75
Portable Band Saw	cutting pipe and angle	4	4	4	5	4.25
Portable Reciprocating Saw	cutting pipe and angle	4	4	5	5	4.5
Horizontal-Vertical Band Saw	sectioning pipe and angle	5	4	5	4	4.5
Power Hack Saw	sectioning pipe and angle	5	4	5	3	4.25
Nibblers	cutting sheet metal	5	5	5	4	4.75
Shears	cutting sheet metal	5	5	4	4	4.5
Disc Grinders	grinding welds	5	3	5	5	4.5
Chop Saws	cutting pipe and angle	4	3	3	5	3.75
Bench-Mounted Chop Saw	sectioning pipe and angle	3	4	4	4	3.75

Key
Tool Cost: 5 = < $1,000; 4 = $1,000 – 2,000; 3 = $5,000; 2 = $5,000 – 20,000; 1 = $20,000 – 50,000

Note: Shaded areas are the Preferred Tool Alternatives

Plant (WIPP) facility, provided WIPP does eventually become operational. The criteria used to judge this option include estimated cost of disposal, safety of personnel involved in the removal work, and possible future legal and financial liability associated with this type of disposal.

4.2.2.1 Disposal costs

The currently accepted cost for disposal of TRU waste in monitored retrievable storage on the Hanford Site is $291 per cubic foot (/ft^3) of waste. This current estimate is for the cost of maintaining the waste at the site until it is eventually retrieved and relocated to WIPP or some other long-term storage location. WIPP is intended to provide long-term storage for the waste. Because relocating this waste from the Hanford Site to another site is planned, it is reasonable to include estimated costs for TRU waste retrieval, relocation, and re-entombment at its anticipated future location. These costs were estimated to be about $664/ft^3 for WIPP [DOE, *Contact Handled (CH) TRU Waste Management Costs,* (DOE 1990)]. (This $644/ft^3 is an anticipated cost to DOE for WIPP operation. Program costs would not include this value, but it should be considered for comparisons from a waste minimization standpoint.) However, there are concerns that WIPP may not become operational. Also, the $644/ft^3 WIPP operational cost estimate was made in 1990 and may be low by the time WIPP becomes operational. Thus, recognizing that estimated TRU waste disposal costs may be low, and that the future of WIPP is uncertain, a figure that will be used for estimating TRU waste disposal is $935/ft^3 ($291/ft^3 + $644/ft^3).

4.2.2.2 Disposal without decontamination or volume reduction

TRU waste volume for Building 232-Z is estimated to be about 590 ft^3 of packaged waste (Table 4.2). This estimate takes into account the inefficiency of packaging irregular metallic shapes by assigning a factor of 150 percent to the estimated actual volume. At the rate of $291/ft^3, the cost for TRU waste disposal would be about $171,690. Labor and programmatic costs for collection and packaging of these materials are not considered since a D&D program will require that equipment be disassembled regardless of whether volume reduction or decontamination is pursued. However, adding in the anticipated WIPP operational expense of $644/ft^3, the total then becomes about $551,650 for disposal of TRU waste without volume reduction or decontamination.

Table 4.2. Estimated TRU Waste Volumes Generated During 232-Z D&D Process

Transuranic Waste			
Area	**Est'd Volume (ft^3)**	**Packing Factor**	**Waste Volume (ft^3)**
Incinerator Hood	168	1.5	252
Scrubber Hood	135	1.5	203
Filter Hoods	48	1.5	72
Process Exhaust Duct	42	1.5	63
Totals	393	N/A	590

4.2.2.3 Summary

The cost of disposing TRU waste at Building 232-Z without volume reduction or decontamination is estimated to be about $551,650. With general and administrative (G&A) costs, common support pool (CSP) costs, and contingency costs added, this figure increases to $992,722. This cost figure could increase if WIPP facility operational costs rise. Also, if WIPP does not become operational and a new facility is constructed to replace WIPP, TRU waste disposal costs at that new facility may be higher than estimated WIPP disposal costs.

4.2.3 Equipment and Materials Decontamination

This section addresses decontamination of the equipment that will be removed from Building 232-Z. Economic justification and waste minimization needs are considered. Criteria for selection of proposed decontamination processes are:

1. process capability,
2. manpower requirements,
3. operator safety/radiation exposure,
4. decontamination system cost,
5. secondary waste generation, and
6. equipment availability.

4.2.3.1 Economic justification for decontamination

Using a value of $935/ft^3$ for TRU waste disposal, and $54/ft^3$ for LLRW disposal, there may be justification for use of decontamination equipment such as the vibratory decontamination unit (VDU). If decontamination efforts were pursued and waste classification could be reduced from TRU status to LLRW status, then significant savings could be realized due to the difference in disposal costs between TRU disposal and LLRW disposal. This difference amounts to approximately $900/ft^3$ of waste disposed. Therefore, up to $900/ft^3$ could be spent on decontamination efforts before a break-even point would be reached, based on estimated disposal costs alone.

4.2.3.2 Toxicity and volume reduction

Regardless of the outcome of economic justifications for the removal of residual plutonium, and decontamination of equipment, the D&D program would reduce the amount of TRU waste requiring disposal by reducing the concentration of some TRU waste to LLRW levels. From the standpoint of TRU waste management, the D&D of Building 232-Z would help reduce the amount of TRU waste at TRUSAF requiring management and eventual relocation to WIPP.

4.2.3.3 Manual wiping and scrubbing

One method commonly used for small-scale decontamination programs is to manually wipe or scrub materials to reduce contamination to a level less than 100 nCi/g. This method has the following disadvantages.

- It is labor intensive, difficult work due to the amount of scrubbing required.

- It exposes decontamination personnel to radiation and the possibility of injuries such as puncture wounds or lacerations from the items being decontaminated.

- Often many iterations are required before contamination is reduced to acceptable levels.

For these reasons, manual decontamination should be restricted to small tasks with low-hazard potential and low-radiation exposure rates. It is generally not suitable for the Building 232-Z D&D Program.

4.2.3.4 Abrasive blasting

Abrasive blasting is the high speed impingement of particles on an object with the purpose of abrading away surface material. These blasters use a variety of abrasive media including various grades of sand, aluminum oxide particles, or solid carbon dioxide (CO_2). One problem with these types of devices is the containment of the abrasive media and radioactive dust and debris generated during the blasting process. However, when the blaster is equipped with a vacuum collection/containment system, contamination spread can be minimized. When equipped with a collection system, the CO_2 system allows the collection and containment of contaminated debris and also allows the separation of debris from the abrasive media, thereby reducing the amount of secondary waste requiring disposal. Because the materials being decontaminated contain significant amounts of plutonium, the abrasive debris generated during blasting may be TRU waste. However, for abrasive blasting to be effective, piping and vessels would have to be sectioned lengthwise to allow direct impingement of the abrasive particles on the contaminated surfaces.

4.2.3.5 Vibratory decontamination unit

Use of a VDU (Figure 4.9) is a possible option for decontaminating materials to be removed from Building 232-Z. The VDU is a vibrating tub of metal beads that act to abrade particles, rust, debris, etc. from the surfaces being cleaned or decontaminated. A liquid flushing system is used to wash debris off of the decontaminated item prior to the item exiting the VDU exit chute. A rinse tank is incorporated to give the item a final rinse to complete the decontamination process. Use of a VDU as a viable option will be based upon an assessment of equipment availability and adequate space for its operation.

The VDU is batch-fed with a cycle time of about 1 hour. Batch size is somewhat dependent on the size of the components being decontaminated, but is generally about 3 ft^3 or less. Material fed into the VDU must be sectioned so that the piece will fit within a 30.5-cm (12-in.) circle, to prevent jamming in the unit's exit chute. Optimum unit loading capacity occurs when materials are cut to fit within a circle 20.32 cm to 25.4 cm (8 in. to 10 in.) in diameter. This would entail setting up tools and operations within the Building 232-Z so that materials could be sectioned into small pieces. One side benefit of sectioning materials prior to decontamination is that the sectioned volume would be over 100 ft^3 less than the volume of material prior to sectioning. Another benefit would be increased packaging efficiency because smaller pieces fit together more closely than do larger, irregular-shaped pieces. This would further reduce the packaged waste volume. Table 4.3 shows the volumes of TRU wastes to be decontaminated to LLRW status during this program. Table 4.4 shows combined clean and LLRW wastes expected from the Building 232-Z D&D program. (The actual breakdown of clean and LLRW will be determined following a thorough radiological survey.) In both Tables 4.3 and 4.4, a factor of 1.5 was used to account for the inefficiency of packaging odd-shaped metal components into a fixed-shape container.

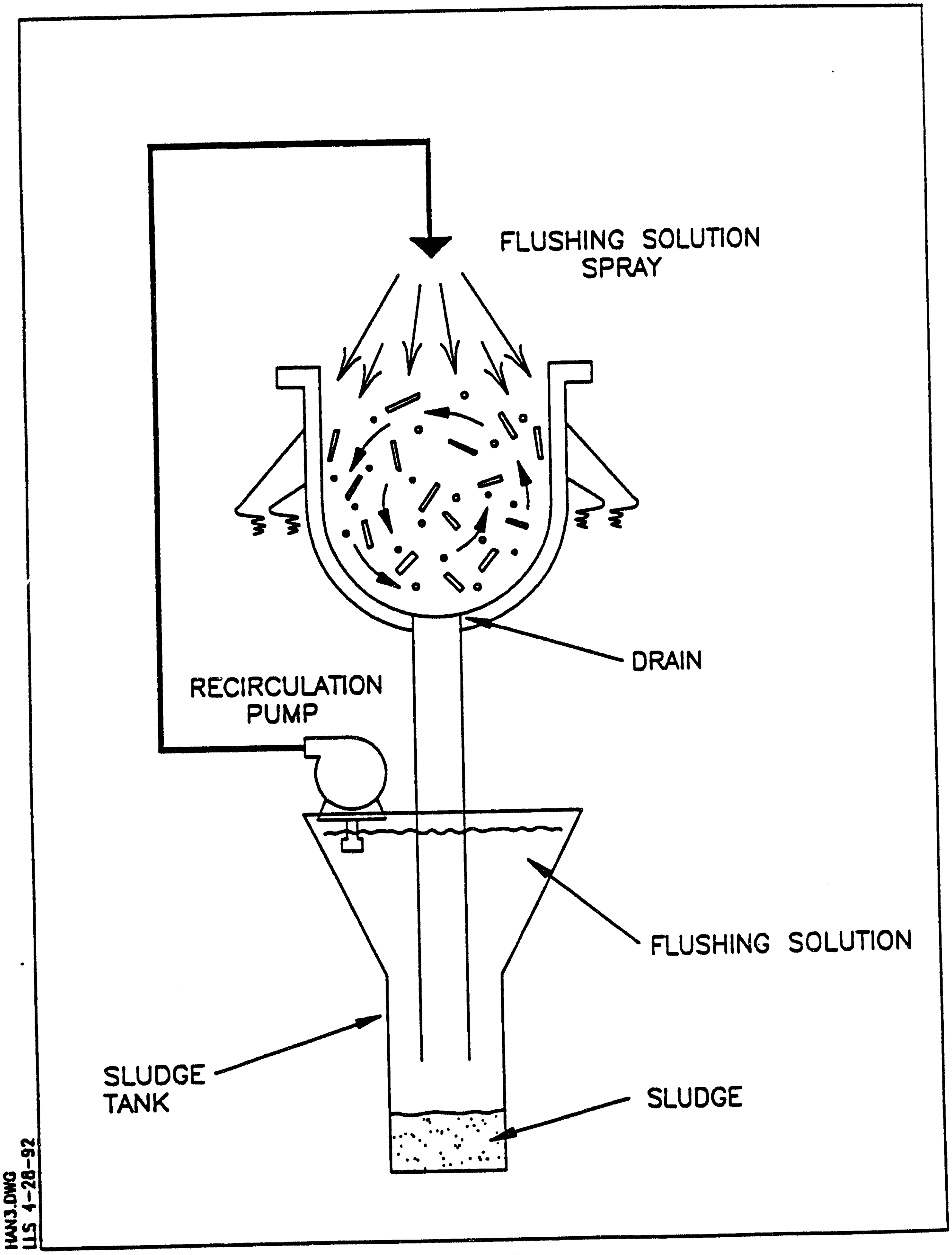

FIGURE 4.9. SCHEMATIC DRAWING OF THE VIBRATORY DECONTAMINATION UNIT (VDU)

Table 4.3. Building 232-Z Waste Volumes Before and After Decontamination

Source of Waste	Transuranic Waste (Before Decontamination)			Low Level Radioactive Waste (After Sectioning and Decontamination)		
	Est'd Volume (ft^3)	Packing Factor	Packed Volume (ft^3)	Sectioned Volume (ft^3)	Packing Factor	Packed Volume (ft^3)
Incinerator Hood	168	1.5	252	120	1.5	180
Scrubber Hood	135	1.5	203	84	1.5	126
Filter Hoods	48	1.5	72	9	1.5	14
Totals	351	N/A	527	213	1.5	320

Table 4.4. 232-Z Low Level Radioactive Waste Volume Estimates

Source of Waste	Estimated Volume (ft^3)	Packaging Factor	Waste Volume (ft^3)
Misc. Building Hardware	200	1.5	300
Secondary Wastes	132	1.0	132
Non-Process Process	600	1.0	600
Decontaminated Materials from Vibratory Decontamination Unit	192	1.5	288
Total	1124	N/A	1320

The assumption is made that wastes classified as LLRW would be disposed without any decontamination and that no further effort would be made once TRU waste was decontaminated to LLRW status.

The waste stream from the VDU will consist of decontaminated materials and the liquid waste from the vibratory and final rinse tanks. Decontaminated materials are expected to be designated as LLRW. The volume of decontaminated material waste will be the same as the volume of input materials since negligible volume reduction will occur in the VDU.

The abrasive media in the VDU remain part of the system and do not require disposal. A very small amount of the volume of the abrasive media will be lost as sludge sediment during decontamination operations. Liquid in the vibratory tank along with the sludge sediment constitute the liquid waste stream from the VDU. Liquid removed from the vibratory tank is replaced with liquid from the final rinse tank, and the final rinse tank is refilled with fresh water. It was assumed that 1 ft^3 of liquid waste would be generated for every 10 ft^3 of material decontaminated. This liquid waste is expected to be designated as TRU waste. Based on this assumption, approximately 22 ft^3 of liquid waste will be produced from VDU operations. This liquid waste will require solidification and stabilization by an approved method.

4.2.3.6 Chemical flushing

Chemical flushing is used to dissolve away surface contamination from materials. A variety of chemicals are available for decontamination purposes. Chemical flushing for Building 232-Z materials would entail sectioning materials to the appropriate size and placing them into a flushing tank. Disadvantages of this type of system include hazards from the corrosive flushing materials and the necessity for disposal of the large volumes of liquid waste generated during this process.

4.2.3.7 Electropolish

Electropolishing is similar to chemical flushing except that an electrical charge is applied to the items being decontaminated to create an accelerated corrosion reaction. This reaction results in the removal of surface material from metallic items along with the contaminants on their surfaces. As with chemical flushing, a corrosive liquid is used as the electropolishing medium and large amounts of liquid waste are generated. Another disadvantage is that only metallic items may be decontaminated by this method. Non-metallic or non-conductive items such as plastic, rubber, or polycarbonate materials would have to be decontaminated by another method (Allen 1978).

4.2.3.8 Ultrasonic

Ultrasonic decontamination is performed by transmitting high-frequency impulses through a liquid medium to the surface of a contaminated object. These impulses cause the formation and subsequent implosion of tiny bubbles on the surface of the contaminated item. This action cleanses the surface of the item. Items must be sectioned to fit into the ultrasonic cleansing tank. The liquid used in the tank must then be disposed of as a secondary waste generated by the ultrasonic unit.

4.2.3.9 High pressure water lance

This unit employs a high-pressure water spray designed to wash contamination from the surface of the item being decontaminated. A disadvantage of this system is the large volume of waste water generated by this process.

4.2.3.10 Concrete and block surface contamination

Currently, there are spots of fixed contamination on the floor and walls within the Building 232-Z process area, especially the scrubber cell, with high contamination. Areas with specific activity equal to or greater than 100 nCi/g are classified as TRU waste. Therefore, these areas of fixed contamination must be decontaminated or they will have to be disposed of as TRU waste.

4.2.3.11 Scarifier

One method that has been used successfully to remove contamination from concrete surfaces is the scarifier process. This process chips away surface material from the item being decontaminated. Any surface contamination greater than or equal to regulatory guidelines would be decontaminated to LLRW or releasable status. High-efficiency collection systems are available to vacuum up the dust, debris, and radioactive particles generated during this process (Figures 4.10 and 4.11).

4.2.3.12 High-temperature water spray system

A high-temperature water spray system could be used coupled with a vacuum system. This provides a cleansing spray and a vacuum collection system to recover the spray and contaminants washed free of the surface. This system is well suited for removing loose paint or loose contamination on exposed surfaces. However, the floor and wall surfaces requiring decontamination at Building 232-Z have hard, smooth painted surfaces and are unlikely to be completely decontaminated by this process unless paint and perhaps

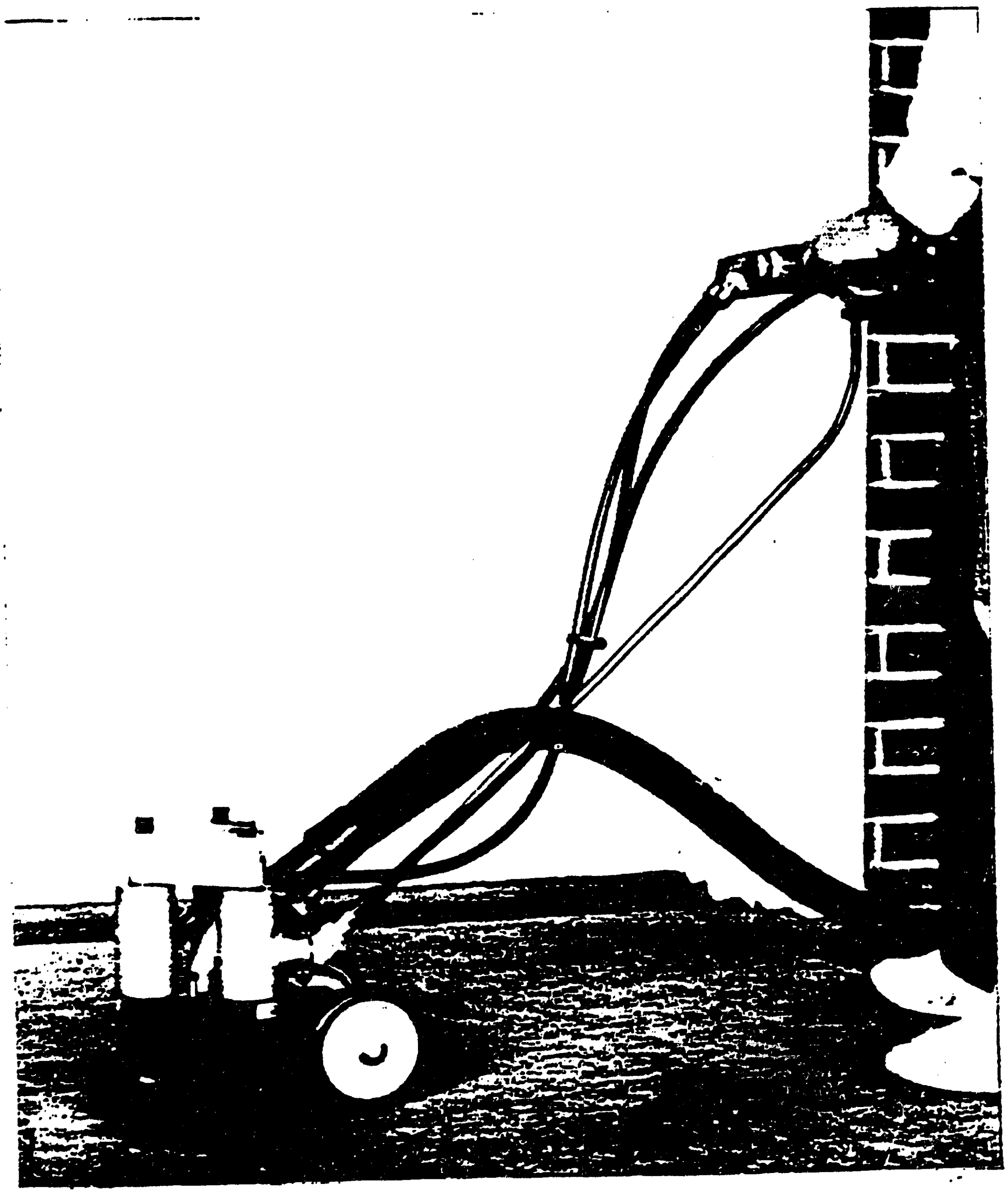

FIGURE 4.10. FLOOR SCARIFIER UNIT

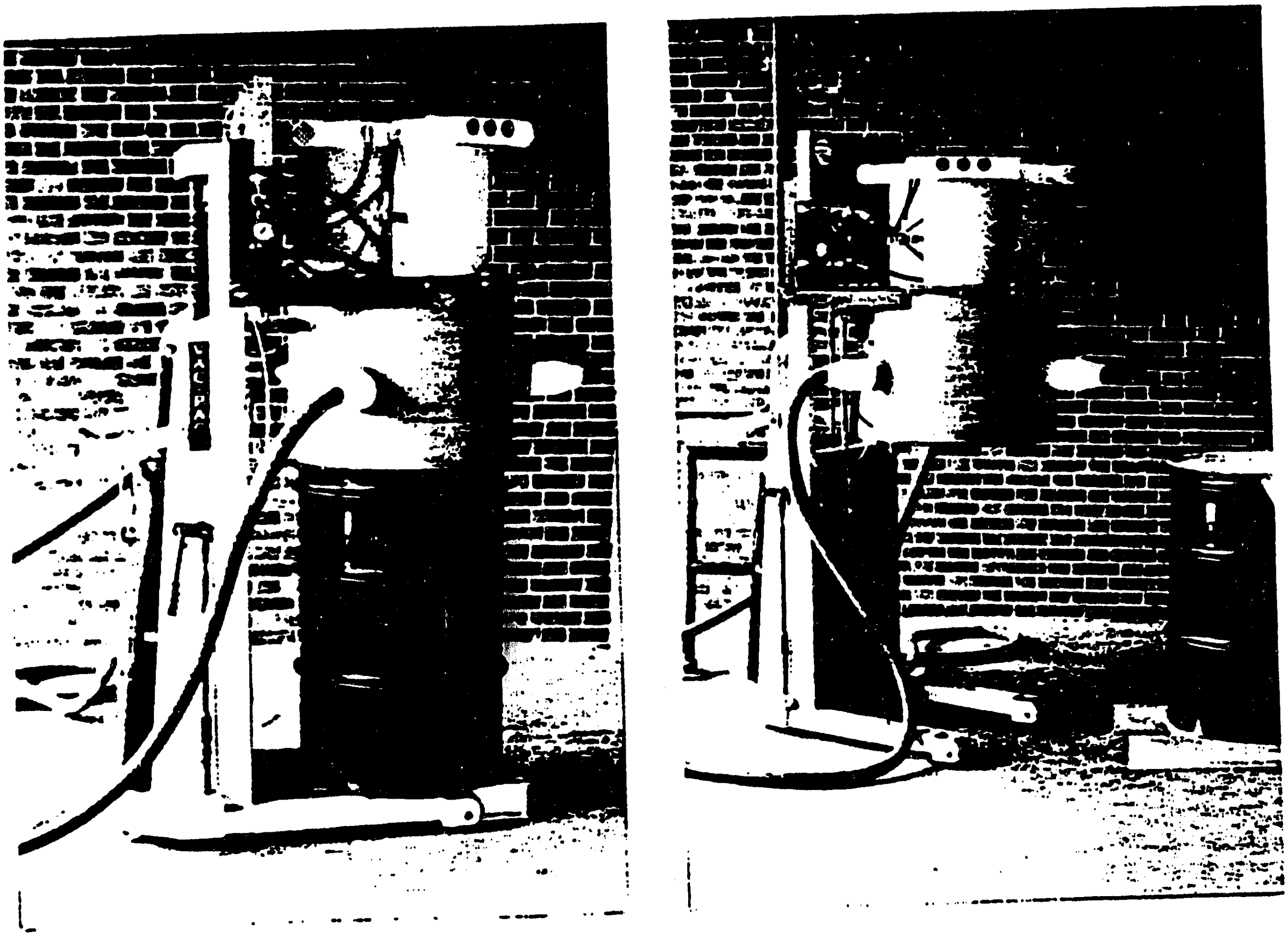

FIGURE 4.11. SCARIFIER DUST COLLECTOR SYSTEM

floor or wall surface are first abraded away. Therefore, a high-temperature water spray system will not be further considered for floor and wall decontamination.

4.2.3.13 Areas exempted from decontamination

Several underground pipelines enter Building 232-Z. These lines include two radioactive waste lines that were used to transfer liquid waste from Building 232-Z to the D-4 waste holding tank via the D-6 tank (Figure 4.12). Also, the duct work previously used to route building ventilation exhaust to Building 291-Z is still attached to Building 232-Z. Finally, there is a sanitary sewer line exiting Building 232-Z. These lines will have to be disconnected carefully and inspected for contamination. They will have to be cut and capped at some agreed upon location. Extra care will have to be taken during demolition of the building floor to prevent breakage of the radioactive waste line because it is likely to be highly contaminated. It might be appropriate to cut the floor and remove the lines prior to floor dismantling. This can better be determined upon field inspection. In either case, care should be taken while removing or working in areas near the sanitary waste line, the steam condensate line, and the building ventilation exhaust line. These measures will reduce the risk of spreading contamination.

4.2.3.14 Summary

Based on the comparison of available decontamination methods (Table 4.5), the VDU appears best suited as the primary method of decontamination for this program. The VDU process has proven capable, and secondary waste generation is relatively low. No capital expenditure would be needed to obtain the unit. Personnel exposure during the VDU decontamination process would be among the lowest received from any of the decontamination methods examined. Although use of the VDU requires additional handling of TRU materials for size reduction, the actual size reduction and decontamination operations can be automated to help minimize exposures. The use of semi automatic size reduction and decontamination equipment, in addition to reducing personnel exposures, will eliminate the requirement for an operator to be assigned full time to those operations. Of the methods examined for floor and wall decontamination, the scarifier is the most capable and generates the least amount of secondary waste.

4.2.4 No Action

The no action alternative is one option for Building 232-Z. The facility would be left intact with its current inventory of radioactive material and only routine maintenance would be performed to maintain the current state of facility repair and to maintain containment systems.

In Building 232-Z there are currently 848 grams of plutonium mixture. Facility collapse could occur as a result of an earthquake. An analysis of the consequences of the collapse of Building 232-Z concluded that the radioactive material inventory must be less than 320 grams to prevent release in excess of the risk acceptance criteria (RAC) (WHC 1990a). Therefore, the radioactive material inventory in Building 232-Z is unacceptably high to justify a no action option.

4.2.5 Recommended Techniques for Equipment Removal, Decontamination, and Disposal

The following sections present a summary of the recommended tools and techniques suggested for the removal, decontamination, and disposal of the equipment in Building 232-Z. A suggested equipment layout for 232-Z during the D&D program is also supplied.

4.2.5.1 Required tools and equipment

Several types of tools are required to perform the range of dismantling work on Building 232-Z. Portable band saws and reciprocating saws are recommended for cutting into pipe runs or cutting long sections of angle iron. Hand tools will be needed to unbolt fixtures from walls or unbolt equipment sections from one another. The fixed position horizontal-vertical band saw is recommended for sectioning longer pieces,

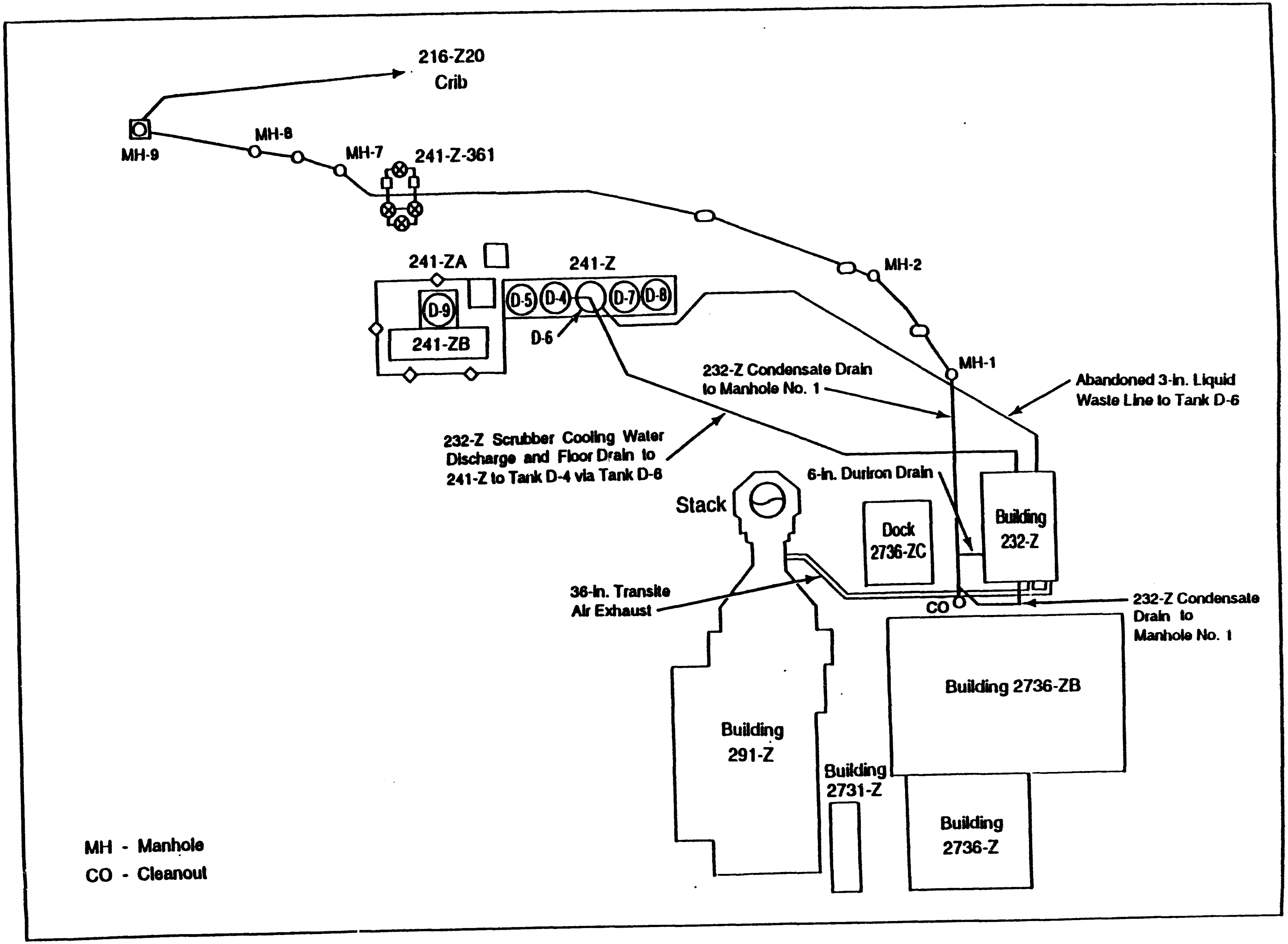

FIGURE 4.12. LIQUID WASTE LINES AND EXHAUST DUCT EXITING BUILDING 232-Z

Table 4.5. Evaluation of Decontamination Methods

Decontamination Method	Process Capability 1=low, 5=high	Operator Safety 1=low, 5=high	System Purchase Price* 1=high, 5=low	Secondary Waste Generation 1=high, 5=low	Average Rating
TRU-Contaminated Process Piping and Equipment					
Manual Wiping and Scrubbing	1	1	5	1	2
Abrasive Blasting	5	4	4	3	4
Vibratory Decontamination Unit	5	5	5	5	5
Chemical Flushing	4	4	3	1	3
Electropolishing	4	5	1	3	3.25
Ultrasonic	4	5	2	3	3.5
High Pressure Water Lance	4	3	4	4	3.75
TRU-Contaminated Floor and Wall Surfaces					
Scarifier	5	5	3	5	4.5
High Temperature Water Spray	3	5	3	3	3.5

Key
* System Cost: 1 = > $100,000; 2 = $50,000 – $100,000; 3 = $25,000 – $50,000; 4 = $1000 – $25,000; 5 = <$1000
Note: Shaded areas indicate preferred decontamination method.

especially for cutting pieces to proper size for decontamination operations. Two assay systems will be used to determine radiological status. One system will be used to assay heavily contaminated materials; the other system will assay lightly contaminated materials, thereby allowing it to remain fairly clean and able to certify clean status. Non-destructive analyses will be performed for all materials prior to dismantling operations to determine radiological status and again prior to disposal to confirm clean, LLRW, or TRU status. Clean or LLRW materials will be disposed of without further decontamination efforts. Where feasible, TRU material will be decontaminated until LLRW or clean status is obtained. Materials will be assayed following decontamination to confirm clean or LLRW status prior to disposal.

4.2.5.2 Decontamination

The VDU is recommended for use as the primary decontamination device. The device, currently located in Building 231-Z, is set up inside a process hood containing the vibratory unit and the liquid recirculation system. This process hood would need to be relocated to Building 232-Z if the decontamination is to be performed there. It is expected that use of the VDU will allow most waste currently classified as TRU to be decontaminated to the LLRW level. During sectioning of waste materials prior to decontamination, the TRU waste volume is expected to be reduced from 351 ft^3 to about 213 ft^3 (Table 4.3). Following equipment decontamination, a scarifier would be used to decontaminate floor and wall surfaces.

When TRU-material removal procedures are begun, material would be cut into pieces that could be easily handled by two people. These sections would be bagged and relocated to the sectioning greenhouse within the Building 232-Z process area. After sectioning, materials could be passed on to the VDU through a connected greenhouse. Following decontamination, materials would be assayed to determine their radiological status. Conditionally clean or LLRW materials would be removed from the VDU hood and appropriately disposed of. Materials that remain contaminated to TRU levels would be processed through the VDU again as time allowed. After all reasonable attempts to decontaminate to LLRW levels were completed, materials still at TRU contamination levels would be disposed of as TRU waste. Liquid/sludge wastes generated in the VDU would be solidified[1] and disposed of. For estimating purposes and from previous experience using a VDU (McCoy 1982), the assumption is made that at least 90 percent of the TRU waste would be successfully decontaminated to LLRW levels. The remaining 10 percent would have to be disposed of as TRU waste. Also, it is assumed that 10 ft^3 of liquid TRU waste will be generated for every 100 ft^3 of TRU waste decontaminated in the VDU. Since approximately 213 ft^3 of material will be processed in the VDU, an estimated 22 ft^3 of liquid waste is expected to be generated.

The stated 200 grams per drum limit for plutonium is a criticality limit. Two drums of liquid waste equates to about 22 ft^3 of waste. This liquid waste will have to be solidified[1] prior to disposal. Assuming a volume increase of 50 percent for solidification, the resulting TRU waste volume would be about 33 ft^3.

4.2.5.3 Suggested equipment layout for sectioning

The Building 232-Z process area is recommended as the area where material sectioning and decontamination will be performed. Because equipment layout for D&D work will impact the productivity of all personnel working on this program, equipment orientation and waste containment layout within Building 232-Z must be planned carefully. Under the proposed layout (Figure 4.13) a band saw greenhouse and the VDU greenhouse would be set up in a corner inside Building 232-Z. This option would provide the facilities to section and decontaminate materials within the building. Initially, work space will be limited in the process area. Once the incinerator electrical panel and process hood are removed, conditions will be much improved. During the initial phase it is suggested that a portion of the wall section between the process area and the MCC and between the MCC and the chemical preparation room be removed to allow access to these two rooms from the process area. These rooms could then be used for additional storage space (Figure 4.13).

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[1] The method for solidification of TRU-waste liquid or sludge has traditionally been to add a grouting mixture or concrete. As of this writing, concern exists over the continued use of these methods.

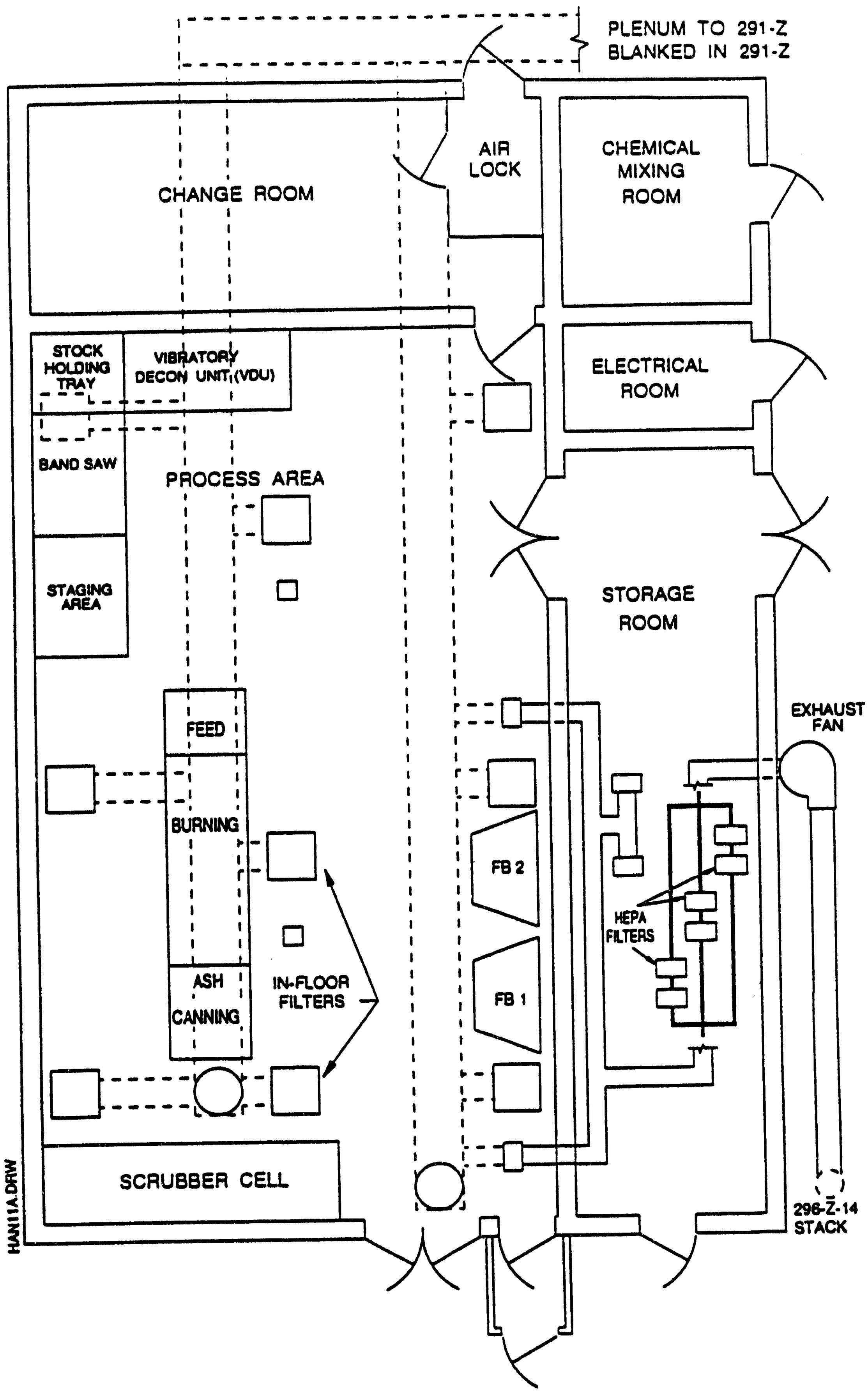

FIGURE 4.13. BUILDING 232-Z SEGMENTING AND DECONTAMINATION EQUIPMENT LAYOUT

A cost evaluation for the decontamination option shows that decontamination of TRU materials within Building 232-Z will cost about $336,000, which compares favorably with the estimated $992,722 for disposal of all TRU materials as TRU waste without attempting decontamination. (Both estimates include G&A/CSP and contingency costs) (Table 4.6).

4.2.5.4 Waste disposal

During the initial stages of the D&D program, clean and LLRW materials will be dismantled and cut up. These materials will be cut up only enough to allow pieces to fit easily into the waste containers and to allow handling of pieces with reasonable ease. It is recommended that an unregulated skip pan or dumpster be used to collect clean waste. Wastes that are LLRW should be collected in 55-gallon drums inside the double doors at the rear of Building 232-Z.

There are two options for disposal of waste decontaminated to LLRW status. Material classified as LLRW could be placed into waste boxes or 55-gallon drums. If the proposed equipment layout discussed above is adopted, 55-gallon drums would be the preferred option because of space limitations within Building 232-Z. Because materials will be sectioned into small pieces for decontamination, there should be no problems fitting pieces into the drums. Although working space may be slightly limited during the early stage of process-equipment removal, conditions will improve as equipment is removed. Also additional storage space could be obtained by using the MCC room and the chemical preparation room as storage areas.

4.2.5.5 Summary

It is recommended that a system be established within Building 232-Z that uses portable band saws or portable reciprocating saws for cutting pipe or angle iron into sections that may be easily handled by two people provided adequate space is available to ensure safe operation. Clean or LLRW materials would be cut up and discarded first. This would allow personnel to become familiar with the new tools and procedures before beginning work on the more hazardous TRU materials. Materials classified as TRU waste would then be removed, sectioned, decontaminated in the VDU, assayed, and packaged for disposal.

4.3 BUILDING DECOMMISSIONING

This section examines: (1) the necessity for a confinement structure, (2) options for decontamination of the Building 232-Z structure, (3) compares normal wrecking-ball style demolition of the building to the option of controlled dismantling, and (4) the option of performing no action. The criteria used to judge the alternatives discussed in this section are: (1) minimizing risk of injury or radiation exposure to workers and the public, (2) economic justification, and (3) adherence to federal, state, and local regulatory requirements (Appendix B).

4.3.1 Confinement Options

Possible Action:

1. Construct a confinement structure to prevent the spread of contamination during building removal.

2. Remove the building without a confinement structure using decontamination and dust control measures to prevent the spread of contamination.

Because the construction of an additional confinement system affects so many other parts of the D&D effort, it is desirable to establish the need for a confinement structure early in the project planning. The information necessary to determine the need for the confinement system may not be available until the

Table 4.6. Cost of Set up and Operation of Vibratory Decontamination Unit

Capital Investment	Cost (Thousands of Dollars)
VDU and greenhouse	No Cost
Relocation of VDU to Building 232-Z	10
Set up of VDU in Building 232-Z (greenhouse and electrical equipment)	15
Removal of VDU from Building 232-Z at end of project	10
Band saw with greenhouse (for sectioning material)	18
Assay system (use system currently available)	No Cost
Alpha, beta, gamma constant air monitor (CAM) (one now available in Building 232-Z)	No Cost
HEPA exhaust fan (in case floor vent is insufficient)	15
SUBTOTAL:	68
Operating Costs:	
Labor (480 hours at \$100/hour)[1]	48
Maintenance and repair (assume 10% labor costs)	5
Process materials (assume 10% of labor costs)	5
Waste disposal costs	
LLRW (assume 90% efficiency[2] in decontaminating TRU waste) (213 ft^3 x 90% x \$54/ft^3)	10
TRU waste (213 ft^3 x 10% x \$935/ft^3)	20
TRU liquid waste from VDU (33 ft^3 x \$935)	31
SUBTOTAL:	119
COMBINED SUBTOTAL:	187
GA/CSP (33.3%)	62
Subtotal	249
Contingency (35%)	87
TOTAL COST:	336

Key:

[1] Assume a crew of: one full-time craft worker, one full-time technician (operating the band saw and the VDU), one supervisor (part time), and one health physics technician (HPT). Craft worker and technician are charged at \$30 per hour, HPT at \$32 per hour, and supervisor at \$46 per hour.

[2] Decontamination efficiency refers to the ability of the VDU to reduce contamination levels from TRU status to LLRW status. The assumption is made that 90% (by volume) of the materials decontaminated will be successfully lowered to LLRW status. The remaining 10% will have to be disposed of as TRU waste.

removal of equipment, piping, filters, incinerator, etc., is completed. The information for determining the need and the kind of confinement system is established, therefore, by on-going information, project impact scenarios, engineering judgement, and best management practices.

The DOE 6430.1A *General Design Criteria* (DOE 1989) glossary defines a confinement system as a barrier between an area containing hazardous material and the environment. If constructed, the confinement structure would work in combination with other confinements (piping, duct, glove boxes, and Building 232-Z) providing the final barrier to the environment in the event of a release from the other primary confinements and/or enclosure systems.

Current information indicates there are approximately 848 grams of plutonium in the process room of Building 232-Z. The plutonium is found in the ventilation filter boxes and duct work, the incinerator, process pipe, and scrubber cell. Plutonium contamination will be substantially reduced during the residual plutonium-removal phase, and equipment removal. The stripping of the Building 232-Z interior will be complete before the removal of the building itself. Before removal of the building, the TRU inventory will be removed, except for minor amounts of TRU material that may be lodged in cracks, seams, or crevices where walls join together.

Under the first option, a confinement structure would be built around and over the Building 232-Z facility. Due to the proximity of other existing buildings, the confinement building would be sized just slightly larger than Building 232-Z (60 ft by 80 ft by 58 ft clear height). Construction of a larger confinement building would require removal or modification of one or more of: Building 2736-ZB, Building 2736-ZB shipping dock, or the 2731-ZA laundry storage building. Even with the proposed 60 ft by 80 ft by 58 ft clear height confinement building, construction of access to these surrounding facilities would be inhibited. Also, to prevent injury to personnel inside Building 232-Z, access probably would be restricted during overhead construction on the confinement building. It is likely that the covered sidewalk between Buildings 232-Z and 2736-ZB would need to be removed to allow construction of the confinement building foundation.

The confinement building would have its own ventilation system with HEPA filtration to capture any contaminants that may escape from Building 232-Z during its demolition. The confinement building ventilation system would be independent of the Building 232-Z facility ventilation system except for an electrical interlock to shut down the confinement building system in the event of a Building 232-Z system failure. (This interlock is intended to prevent an unintentional air reversal within the Building 232-Z facility.) Confinement building design and construction would take approximately nine months. The expected cost for confinement building design, construction, ventilation system, and confinement building dismantling (with GA/CSP and contingency), is about $1,666,000. Rigid frame or truss frame construction with a metal roof and siding on the building would allow the confinement building to be disassembled, easily decontaminated (if required), and saved for future use. The confinement building would act as the tertiary confinement system during most of the decommissioning work, and as the secondary confinement during building removal.

The second option examines Building 232-Z dismantling without a confinement structure. In this, as in the first option, residual plutonium would have been removed, and all equipment would have been removed already from Building 232-Z. All surfaces would have been decontaminated to the extent possible. Known localized contamination areas would have been decontaminated or sprayed with fixative to prevent contamination spread. A complete radiological survey would have been performed to determine the success of the decontamination program before proceeding with building removal. Water sprays or wet-saw cutting would be used to help prevent the generation of possible contaminated dusts. Continuous air monitoring will be performed to detect the presence of any airborne contaminants. Under this option, accessibility to Building 232-Z for demolition activities would be improved due to the absence of the confinement structure. If higher than expected levels of contamination were found during building removal and containment was deemed necessary, then a greenhouse could be constructed around that portion of the building.

Due to the difficulties posed by the construction of the confinement building, the difficulty of Building 232-Z removal activities within a confinement structure, and the cost of the confinement structure and the uncertainty of its need, removal of Building 232-Z within a confinement building does not appear to be the best option. However, the full extent of contamination within Building 232-Z is unknown at this time, so costs and schedules for this D&D Assessment assume that a confinement structure may be required. If it is decided prior to construction that the structure will not be required, then work could proceed without it, saving time and money for the overall scope of this assessment. On the other hand, if no funding were provided for the confinement building and it was decided one was necessary in spite of the difficulties caused by its construction and by impaired work within the structure, then work on this assessment would have to cease until funding were made available for a confinement structure. The final decision will have to be made after floor and wall surface decontamination efforts and after all process equipment has been removed from the facility.

4.3.2 Building Decontamination Options

Possible Actions:

1. Decontaminate the building interior and apply a fixative.
2. Apply only a fixative for contamination control during building removal.

A spray fixative or paint to lock down contaminants has been the method to control the spread of contamination in Building 232-Z over the years. As a result of this practice, many layers of contamination have been built up on the building interior.

The underlying structural steel and concrete surfaces could require the removal of a layer of TRU contamination. Prior to building removal, these mostly decontaminated surfaces would be repainted to refix any remaining contamination. The evaluation of sandblasting or hot water/vacuum systems for decontamination will depend on the surfaces encountered. The hot water/vacuum decontamination system is effective for loose, flaky paint and bare steel, or for surfaces compatible with a stainless steel abrasion tool. Sandblasting would be the method of choice where tightly adherent paint is present on rough or irregular surfaces. Although it generates higher volumes of waste, sandblasting would seem to be the ideal method for the existing building. Therefore, sandblasting will be the basis for cost estimating.

As an option, contamination control prior to building removal requires all interior surfaces be given another layer of paint or fixative to contain existing contamination. This may or may not require removal of high levels of contamination by some spot decontamination. Because this approach provides more activity in the facility, it could lead to controlled dismantling, which would eliminate traditional demolition. If no decontamination were performed, a sampling program would be needed to confirm that the building rubble was not TRU waste. A re-evaluation of the decontamination decision would be necessary should the building rubble be designated TRU waste. The next section involves the combined cost/benefits of decontamination and building removal. Decontamination allows the possibility of demolition, and a controlled building dismantling may result in less decontamination.

4.3.3 Building Removal

Possible Actions:
1. Demolish the building as a whole.
2. Dismantle the building a portion at a time.

The removal of a building can involve either a normal demolition or piecemeal dismantling. The main argument for dismantling a building a portion at a time as opposed to standard demolition is caution. If one does not know the actual amounts of contamination, then caution is advised. Another justification for dismantling is that decontamination of the building interior may be eliminated or reduced. Table 4.7 compares dismantling without decontamination versus demolition with decontamination.

4.3.4 No Action

Under this option, the building structure would remain intact following removal of material and equipment from within. RAC would be satisfied because plutonium would have been reduced well below 320 grams, which represents the acceptable risk quantity in the event of an earthquake and subsequent building collapse. Thorough decontamination of interior surfaces following equipment removal would help minimize radiation exposure rates and, thereby, satisfy ALARA guidelines.

This option seems acceptable because it meets RAC and ALARA guidelines. However, two other considerations must be made. First, the building structure could possibly be an obstruction for some future work in the area. Second, routine maintenance of the building ventilation system and routine radiological inspections would be required for the duration of the building's existence. A final decision for this option should be based on the acceptability of allowing the building structure to remain intact.

4.3.5 Discussion of Confinement, Decontamination, and Building Removal

It may be possible to perform the Building 232-Z D&D without a confinement structure. The amount of contamination remaining after decontamination efforts will determine the feasibility of this approach. Plan schedule and funding were prepared including time and cost estimates for the confinement structure. However, overall project schedule could be improved by about 9 months, and about $1.7 million could be trimmed from the budget if D&D work is performed without a confinement structure. A comparison between controlled dismantling and normal demolition shows that controlled dismantling is less expensive (Table 4.7). Controlled dismantling is also more conservative from a contamination-control standpoint, and is highly recommended if the no-confinement building option is adopted (Appendix C).

TABLE 4.7. Comparison of Building Decontamination and Removal Costs

	Controlled Dismantling (without extensive decon.) (thousands of dollars) With Confinement	Normal Demolition (with extensive decon.) (thousands of dollars) With Confinement	Controlled Dismantling Without Confinement Building (with extensive decon.) (thousands of dollars)
Decontamination Labor[1]	$ n/a	$ 28	$ n/a
Designation Sampling	18	18	18
Decontamination Waste[2]	n/a	41	n/a
Confinement Building[3]	362	262	n/a
Plus Ventilation[4]	337	337	n/a
Building Removal Equipment	36[5]	18[6]	36
Building Waste Disp.[7]	297	386	297
Building Removal Labor	74[8]	38[9]	74
Verification Sampling	42	42	42
Confinement Building Decontamination	5	20	n/a
Confinement Building Removal	297	297	n/a
SUBTOTALS	$ 1,368	$ 1,487	$ 467
GA/CSP (33 percent)	456	495	156
SUBTOTAL	1,824	1,982	623
Contingency (35 percent)	638	694	217
TOTAL	$ 2,462	$ 2,676	$ 840

[1] Crew of five (supervisor, three D&D workers, and health physics technical) for 4 weeks.
[2] 100 55-gallon drums of LLRW at $54/ft^3. Either sandblast grit or some other similar method.
[3] Cost based on a 60 ft wide by 80 ft long by 58 ft clear height confinement building to be designed for three span widths, three lengths, and two heights. The flexibility will enable the confinement building to be used on other projects or tasks.
[4] Ventilation cost for 60 ft wide by 80 ft long by 58 ft clear height.
[5] Crane, dump truck, backhoe, and concrete saws for 3 months.
[6] Front-end loader, dump truck, backhoe, and cutting saws for 1 1/2 months.
[7] Both estimates are based on $54/ft^3, controlled dismantling at 5500 ft^3 and normal demolition at 7000 ft^3 due to less efficient packing factor of demolition waste.
[8] Crew of eight (supervisor, three D&D workers, two riggers, one operator, and one HPT) for 7 weeks.
[9] Crew of six (supervisor, two D&D workers, two equipment operators, and an HPT) for 5 weeks.

4.4 DECOMMISSIONING CONSTRAINTS

The order of the decommissioning choices is discussed in Section 4.3 Constraints for the D&D of Building 232-Z are based on investigation, rationalization, and experience, not the result of other operation schedules. A flow diagram for the D&D process is shown in Figure 4.14.

The following are configuration or arrangement constraints affecting the D&D of Building 232-Z:

- Mechanical utility piping will be isolated from Building 232-Z before any equipment-removal work begins.
- Process piping/duct work with recoverable plutonium will be removed prior to beginning decontamination or dismantlement activities.
- Electrical isolation of Building 232-Z (at a later date) will be scheduled so that the installed systems are used as long as possible without creating a safety hazard.
- Air locks (greenhouses) and HEPA-filtered exhaust ventilation will remain operational on Building 232-Z (particularly the scrubber cell) and in the building duct work throughout the D&D effort, after which these items will be removed.
- Piping and equipment removal in Building 232-Z will proceed in such a manner as to avoid the spread of contamination.

4.5 TECHNICAL PLAN - PLUTONIUM REMOVAL AND RECOVERY

The effort involved in the plutonium removal and recovery process is described in Section 4.1, and illustrated in a detailed Operation Flow Diagram (Figure 4.15). A work breakdown structure (WBS) with accompanying cost and milestone schedule is shown in Figure 5.1. Required man hours and detailed cost information for each WBS element can be found in Appendix D.

4.5.1 Project Planning and Control

The initial evaluation and analysis of the methods of plutonium removal and recovery are included in the WBS. Sections 4.5.1.1 through 4.5.1.2 discuss the WBS for these items.

4.5.1.1 Criticality evaluation

The recovery of residual plutonium from this facility will result in the physical aggregation of fissionable materials that should be evaluated for criticality at various intervals throughout the work. This involves an assessment of the process technologies to handle, process, retrieve, and store fissionable material from the building. The goal of such an evaluation is to ensure the establishment of criticality prevention specifications (CPS) consistent with the *Nuclear Criticality Safety Manual* (WHC-CM-4-29) during the course of the plutonium-removal operations (one engineer - 160 hours).

4.5.1.2 Waste certification plan

The TRU-waste streams generated during the plutonium-removal work must be identified in this plan. Each waste stream must be identified and instructions given for packaging. In addition, the packages must be certified to WIPP Waste Acceptance Criteria (one engineer - 160 hours).

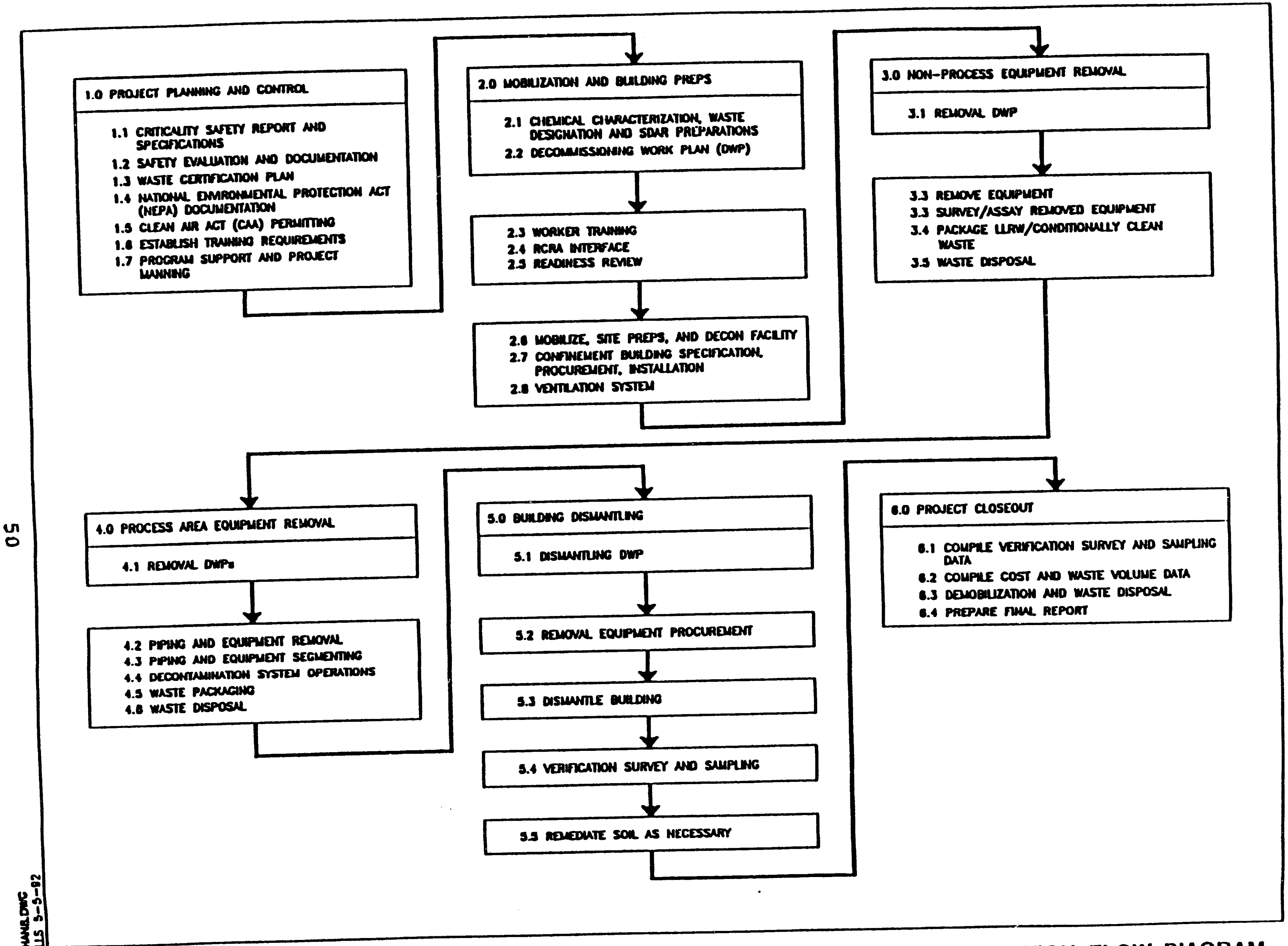

FIGURE 4.14. BUILDING 232-Z DECONTAMINATION AND DECOMMISSIONING OPERATION FLOW DIAGRAM

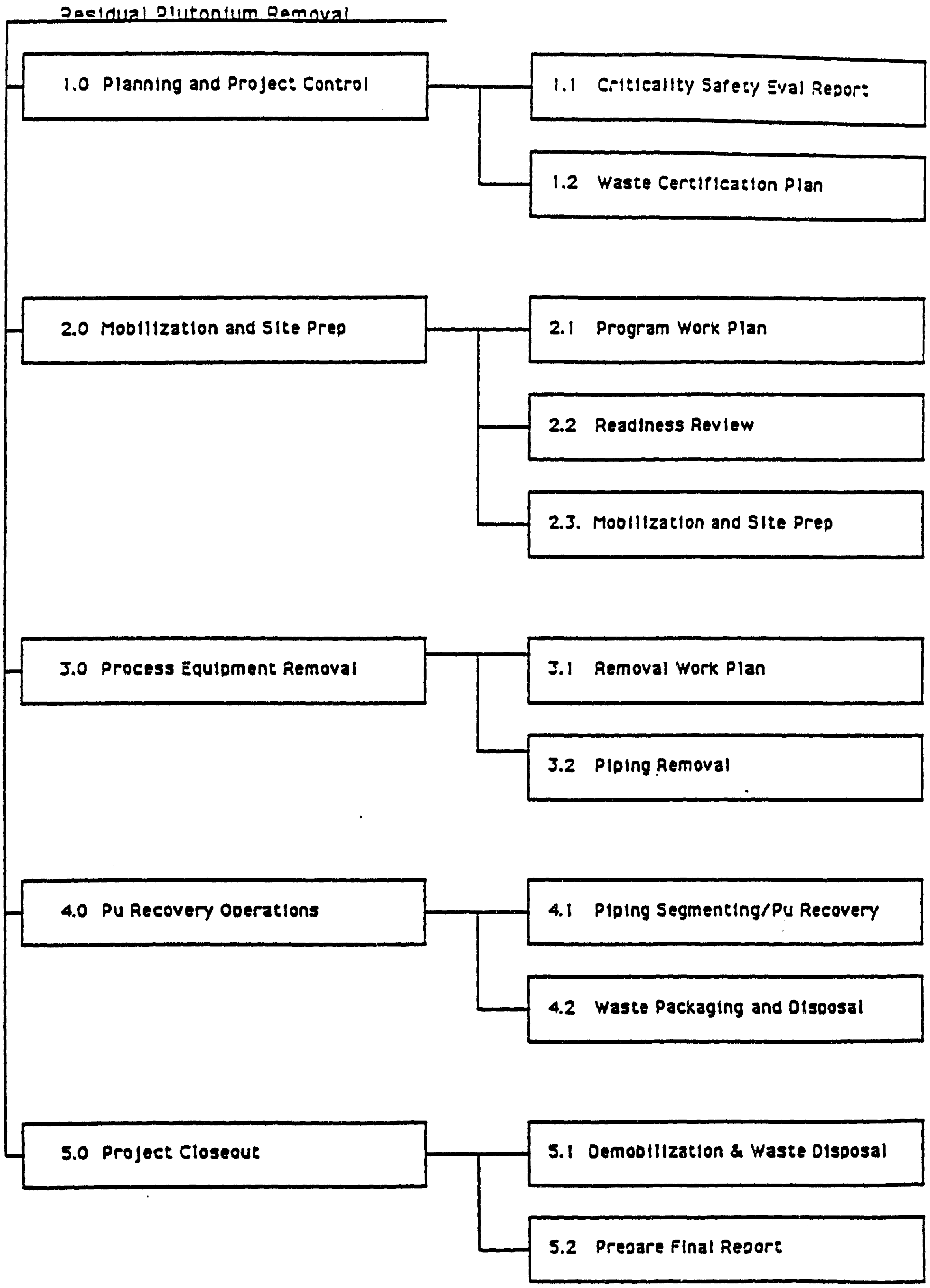

FIGURE 4.15 RESIDUAL PLUTONIUM REMOVAL OPERATION FLOW DIAGRAM

4.5.2 Mobilization and Site Preparation

Activities necessary to provide quarters for project personnel and to prepare Building 232-Z and its areas for plutonium-removal work are included in the WBS. (See Sections 4.5.2.1 through 4.5.2.3.)

4.5.2.1 Program work plan

This item is intended to cover the preparation of detailed instructions for all site preparation and plutonium-removal work (one engineer - 40 hours).

4.5.2.2 Readiness review

The Readiness Review (RR) is an appraisal of the thoroughness of preparations to initiate the plutonium-removal operations. The review board, comprised of senior personnel familiar with safety and environmental requirements, will examine project documentation (compliance items, etc.), equipment to be used, equipment availability, and the qualifications and training of the personnel doing the work. Recommendation to commence work is made when the RR action items have been completed and approved (one engineer - 80 hours).

4.5.2.3 Worker training

This item includes the worker training necessary for the removal of residual plutonium (one supervisor - 80 hours; two nuclear operators - 80 hours each; two craftsmen - 40 hours each; one radiation protection technician (RPT) - 40 hours).

4.5.2.4 Mobilization and site preparation

This item includes the mobilization of personnel necessary to perform the plutonium-removal work, their physical relocation to the site, and preparation of support facilities for these individuals (one supervisor - 20 hours; two nuclear operators - 20 hours each; two craftsmen - 40 hours each; one RPT - 40 hours).

4.5.3 Process Piping Removal

This WBS covers the removal of process equipment and piping in connection with residual plutonium-removal operations. These items are discussed in Sections 4.5.3.1 and 4.5.3.2.

4.5.3.1 Removal work plan

This effort covers the preparation of the detailed work instructions that will be required to remove the residual plutonium from process piping and equipment in the process area (one engineer - 160 hours).

4.5.3.2 Piping removal

Actual piping removal will be covered under this item. It is anticipated that the protective clothing requirements, respirator limitations, and ingress/egress procedures may limit productivity. Removal tools include portable band and/or reciprocating saws (one engineer - 100 hours; one supervisor - 100 hours; two nuclear operators - 200 hours each; two craftsmen - 200 hours each; one RPT - 200 hours).

4.5.4 Plutonium-Recovery Operations

This WBS item covers the actual removal of residual plutonium from process lines and equipment and the proper packaging and disposal of all generated waste. (See Sections 4.5.4.1 and 4.5.4.2.)

4.5.4.1 Piping segmenting/plutonium recovery

This effort will run concurrently with the piping removal effort described in Section 4.5.3.2 and will entail the segmenting of process piping containing residual plutonium into sections of suitable length to fit inside the plutonium-removal glove box and to be consistent with waste packaging requirements. Segmenting will be done with a horizontal-vertical band saw (one engineer - 80 hours; two supervisors - 160 hours each; one RPT - 160 hours).

4.5.4.2 Waste packaging and disposal

This WBS item is intended to cover those activities necessary to package and dispose of all the waste generated from the process area plutonium-removal operations. Although not considered waste, this WBS item also includes the proper packaging and storage for future use of the residual plutonium recovered. Waste disposal includes all administrative, supervisory, and transportation support as well as the actual disposal costs (two nuclear operators - 40 hours each; one RPT - 40 hours).

4.5.5 Project Close Out

The activities in this WBS element include the completion of the plutonium-removal work and the transition to the D&D phase, along with the documentation to confirm and report how the plutonium removal phase was performed. These activities are detailed in Sections 4.5.5.1 and 4.5.5.2.

4.5.5.1 Demobilization and waste disposal

This WBS item covers the work necessary to transition from the plutonium-removal phase to the D&D phase. Any contaminated material generated by this operation will also be packaged and disposed of under this item (one engineer - 20 hours; one supervisor - 40 hours; two nuclear operators - 40 hours each; two craftsmen - 40 hours each; one RPT - 40 hours).

4.5.5.2 Prepare final report

This WBS item covers the engineering and administrative support needed to prepare and publish the final plutonium-removal and recovery report for Building 232-Z. Although the decision has not yet been made, this report may be combined with the D&D final report referred to in Section 4.6.6.4 (one engineer - 80 hours).

4.6 TECHNICAL PLAN - DECOMMISSIONING APPROACH

The effort involved in each of the WBS elements is described in the following sections (see Figure 4.16). Each element has a corresponding section providing a detailed purpose and description. Following each WBS subsection description is the manpower requirement for the described task. (Detailed cost estimates, provided in Appendix D, correspond to each WBS section and subsection.)

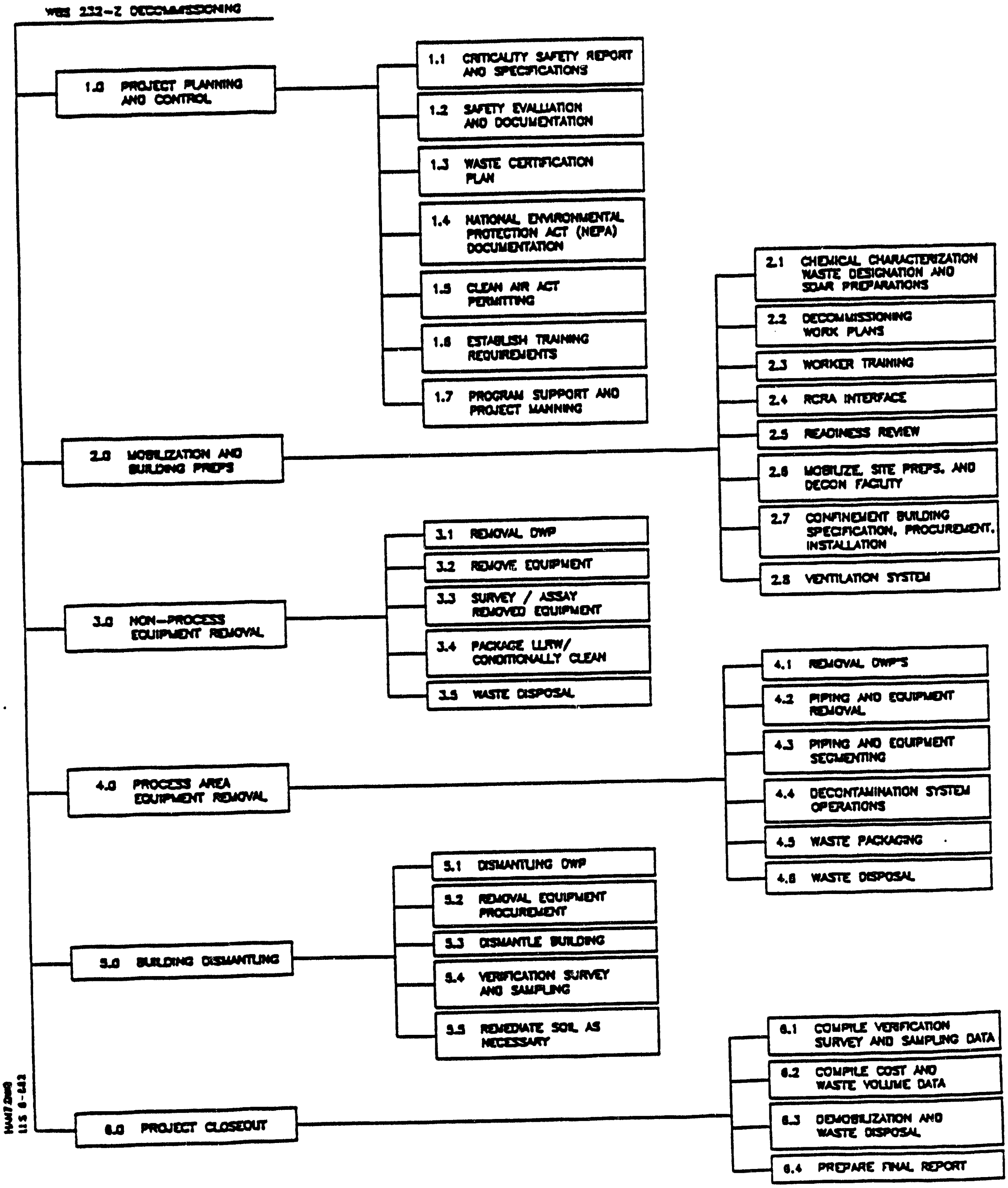

FIGURE 4.16 232-Z DECONTAMINATION AND DECOMMISSIONING WORK BREAKDOWN STRUCTURE

4.6.1 Project Planning and Control

The initial evaluation and analysis of the methods of decommissioning and the environmental impacts of this work are included in the WBS. Sections 4.6.1.1 through 4.6.1.6 discuss the WBS for these items (Figure 4.17).

4.6.1.1 Criticality safety report and specifications

The D&D of this facility will result in the physical aggregation of material that should be evaluated for criticality at various intervals throughout the work. This involves an assessment of the process technologies to handle, process, retrieve, and store fissionable material from the building. The goal of such an evaluation is to ensure the establishment of criticality prevention specifications consistent with the *Nuclear Criticality Safety Manual* (WHC-CM-4-29) throughout the D&D project (one engineer - 176 hours).

4.6.1.2 Safety evaluation

The possibility and consequence of accidents are the subjects reviewed in this plan. "The Safety Assessment of Source Term Reduction Activities In Building 232-Z" (Chew 1990) is to be used as a basis for this task. The reduction of possible accidents through implementation of engineered barriers and physical or administrative controls may result from this report (Off-site contractor).

4.6.1.3 Waste certification plan

The TRU waste streams generated during the decommissioning work must be identified in this plan. Each waste stream is to be identified and instructions given for packaging. In addition, the package must be certified stating that WIPP acceptance criteria have been met (one engineer - 352 hours).

4.6.1.4 Clean Air Act permitting

A modification to the Building 232-Z Clean Air Act permit may be required should there be a change in the ventilation system which might affect building operation. Section 246-247-090 of the Washington Administrative Code (WAC) stipulates that the Washington State Department of Health must be notified of any operational change to a permitted facility or change in release potential of a permitted facility. If such change affects the release potential of the facility, an air permit modification may be required. This permit modification is a prerequisite to WBS item 2.7 (Section 4.6.2.7) (one engineer – 352 hours).

4.6.1.5 Establish training requirements

This item is intended for developing the plan necessary to delineate the training requirements for the project workers (one engineer - 176 hours).

4.6.1.6 Program support and project manning

This item covers the preparation of a plan to delineate the personnel support for the project. This plan will be designed to provide an integrated man-loading schedule, including the number of people and qualifications, and the annual funding requirements for the entire project. This plan also will evaluate the viability of subcontractor performance to support this project. Figure 4.18 is the anticipated project organizational and responsibilities chart.

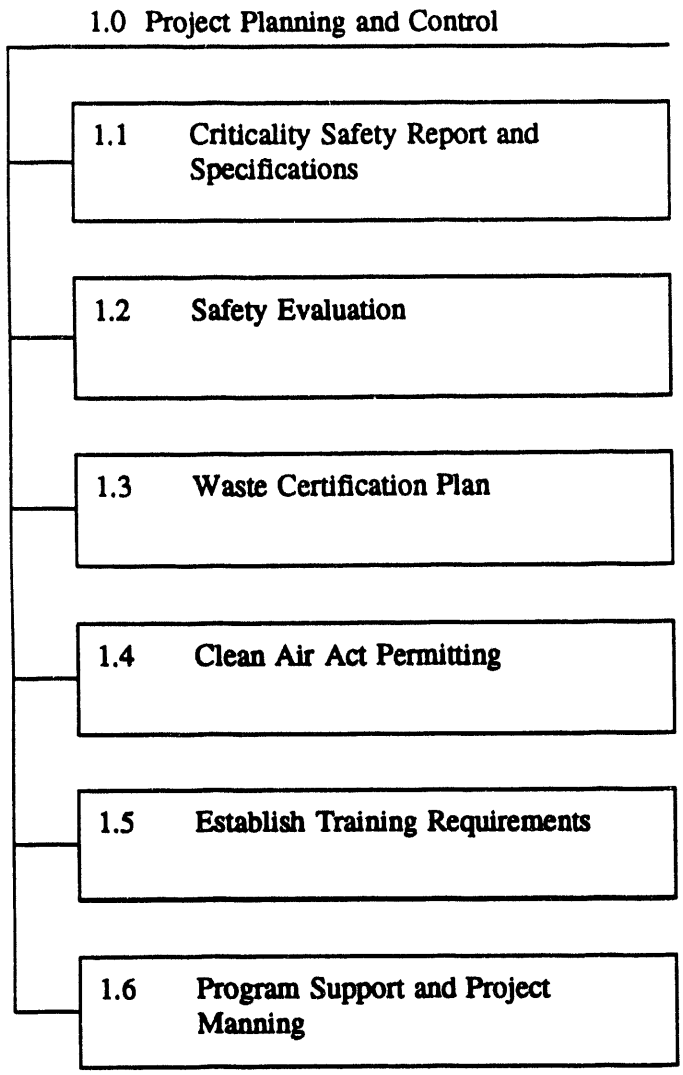

FIGURE 4.17. Project Control and Planning

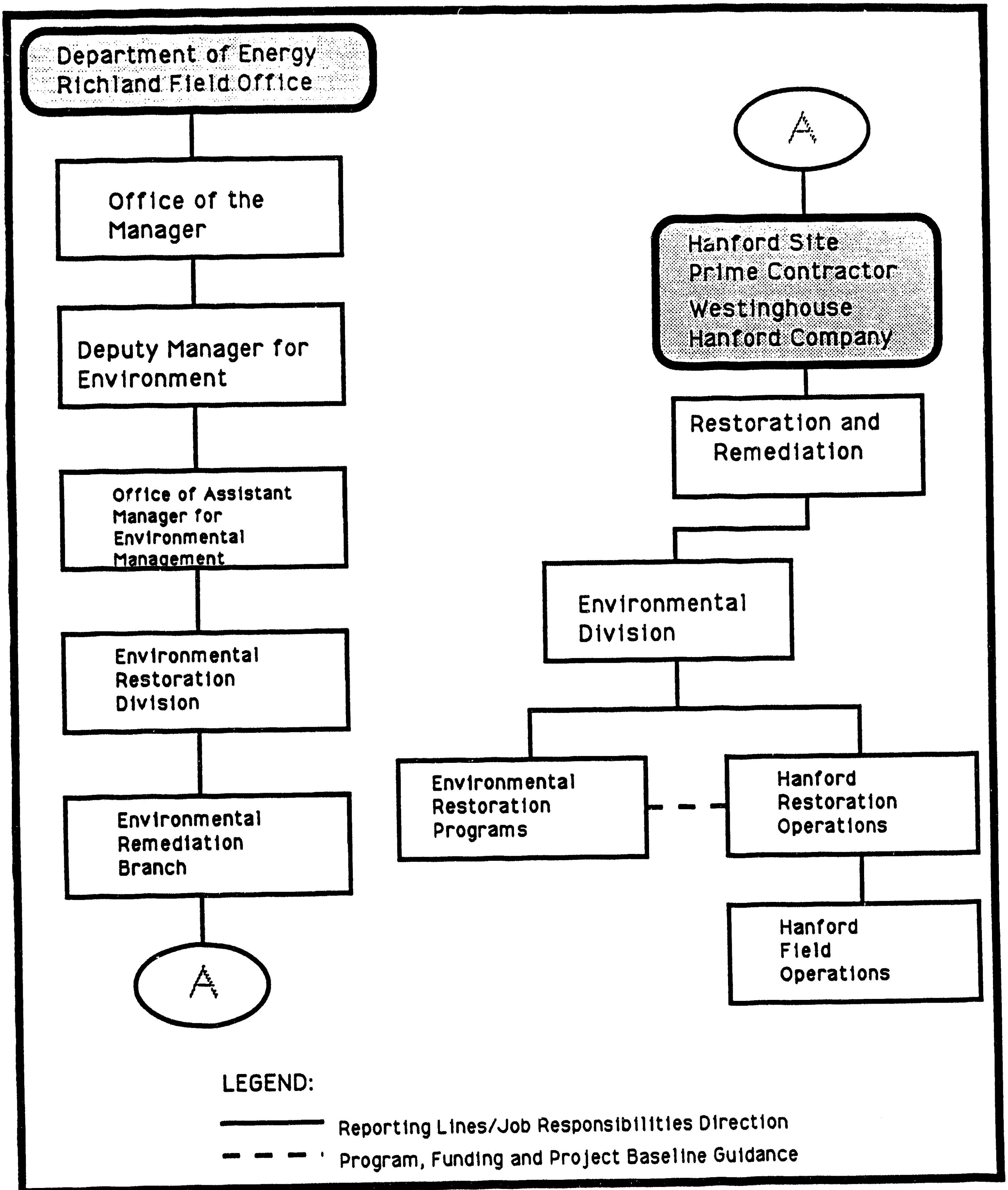

FIGURE 4.18. DECONTAMINATION AND DECOMMISSIONING ACTIVITIES ORGANIZATIONAL CHART

A commitment to high priority project funding support must be made prior to the start of this decommissioning work. This is especially necessary for projects having a radiological release potential. Due to the potential for the spread of plutonium contamination, and completion time for the project, this facility cannot reasonably be partially decommissioned and then placed in a safe condition while additional funding is arranged. If the Building 232-Z project is assured high priority funding until completion, then radiological safety will be greatly enhanced (one engineer – 528 hours).

4.6.2 Mobilization and Building Preparations

Activities necessary to provide quarters for project personnel and to prepare Building 232-Z and its areas for decommissioning work are included in the WBS. The WBS is shown in Figure 4.19 and discussed in Sections 4.6.2.1 through 4.6.2.6.

4.6.2.1 Characterization, waste designation, and storage/disposal approval record (SDAR) preparations

The characterization sampling, analyses, and reviews necessary for proper disposal of the waste generated by the decommissioning project are covered in this item. This task will determine the number of samples to be taken and the time schedule. (one engineer – 160 hours; two D&D workers, two craft workers, and one RPT – 80 hours each).

4.6.2.2 Decommissioning work plans

This item is intended to cover the preparation of detailed instructions for all the site preparation and modification work (one engineer – 352 hours).

4.6.2.3 Worker training

The scheduling of and actual worker training session(s) as outlined in the training requirements (Section 7.1.2) will be carried out under this item. The exact scope of the required training will be defined in the training requirements (one supervisor – 88 hours; three craft workers and five D&D workers – 80 hours each.)

4.6.2.4 RCRA interface

This item is intended to document whether or not there are any RCRA compliance issues applicable to this project work as a result of waste generation activities. The information that will be available will allow proper review and decision by WHC, DOE, and the State of Washington. Making this decision before the start of field activities is designed to ensure that any compliance issues will be factored into the work plans (one engineer – 176 hours).

4.6.2.5 Readiness review

The RR is an appraisal of the thoroughness of preparations to initiate the decommissioning project. The review board, composed of senior personnel familiar with safety and environmental requirements, will examine project documentation (compliance items, work plans, safety plans, etc.), equipment to be used, equipment availability, and the qualifications and training of the personnel doing the work. Recommendation to commence work is made when the RR action items have been completed and approved. Due to the complexity and length of this project, multiple RRs should be scheduled (two engineers – 704 hours each).

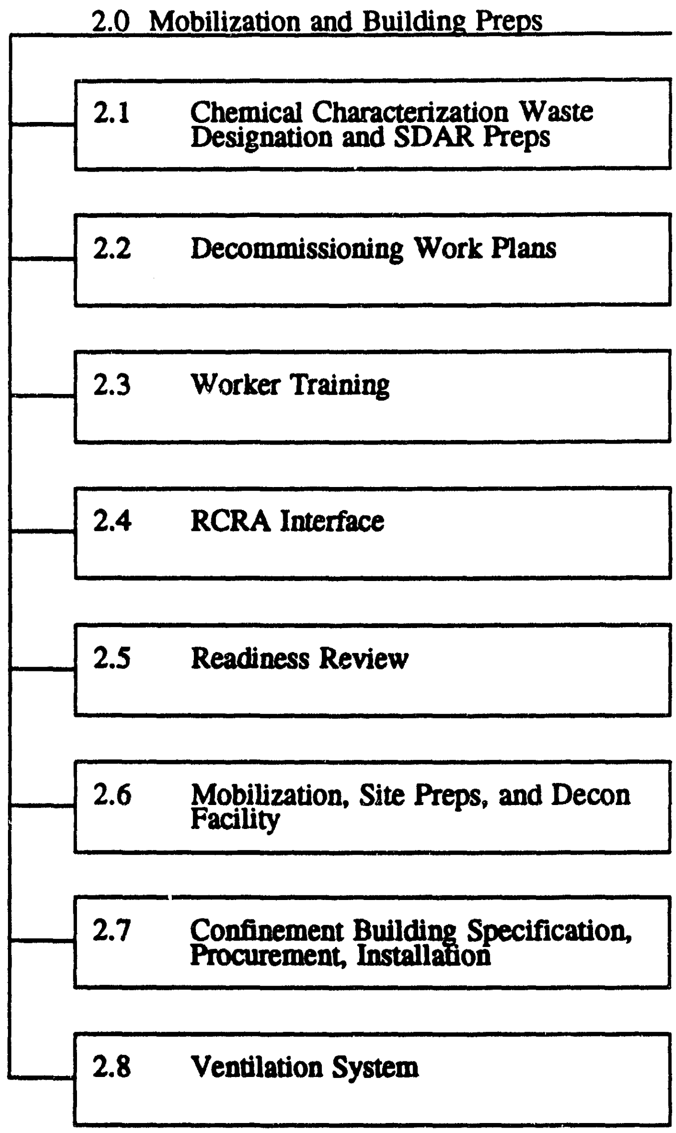

FIGURE 4.19. Mobilization and Building Prep

4.6.2.6 Mobilization, site preparation, and decontamination facility preparation

This element includes the following items:

1. The mobilization of the project manager, site supervisor, project engineer, and project HPT, and their physical relocation to the project site

2. Building and site preparations such as the provision of at least one double-wide trailer in the immediate vicinity that would provide a lunch room, locker room, and office space. A storage building is also necessary for the storage of maintenance items for decommissioning work; and for a breathing air system to support removal work in both the process area and the decontamination work zone (Parts 1 and 2 combined: one project control analyst - 160 hours; one supervisor – 320 hours; one RPT – 160 hours; four craft workers - 320 hours each; two D&D workers – 80 hours each.)

3. The design, procurement, fabrication, installation, and cold start-up testing and training of the VDU system (Part 3: one project control analyst - 264 hours; one supervisor, one RPT, three craft workers, and three D&D workers – 528 hours each).

4.6.2.7 Confinement building installation

This WBS item includes site preparation, procurement, and erection of a 18.3m by 24.4m by 17.7m clear height (60ft by 80ft by 58ft clear height) metal-cladded building with a steel frame of rigid or truss design. The building shall be designed for capability of three different span widths, two eave heights, and four to six bays (see Figure 4.20). Flexibility can be achieved by strategically locating column and rafter splices for height and width changes plus bay variation through the purlin design. This flexibility will allow the confinement building to be reused at other Hanford site locations that may require a confinement building of a different size. It shall have six emergency exit doors, an airlock-equipped normal access door, a 4.9m by 4.9m (16ft by 16ft) electrically operated roll-up door, and be equipped with a supply fan that can be interlocked with a HEPA-exhaust system. Personnel will enter the confinement building through the airlock (shown in Figure 4.20). Entry to the rest of Building 232-Z will be through the airlock near the change room. Material and equipment will pass through the confinement building roll-up door or through the double doors located near the scrubber cell (two engineers – 352 hours each; one project control analyst – 176 hours; building installation to be performed by an off-site contractor.)

4.6.2.8 Ventilation systems

The facility design and installation requirements for two 5000 ft^3/min HEPA-exhaust units are discussed in this task. They will be used for the ventilation of the confinement building, their primary function being industrial ventilation. (A typical HEPA-exhaust unit is shown in Figure 4.21.) Building 232-Z has an existing temporary ventilation system, as mentioned in Sections 2.1.1 and 4.2.1.1 (one engineer – 704 hours).

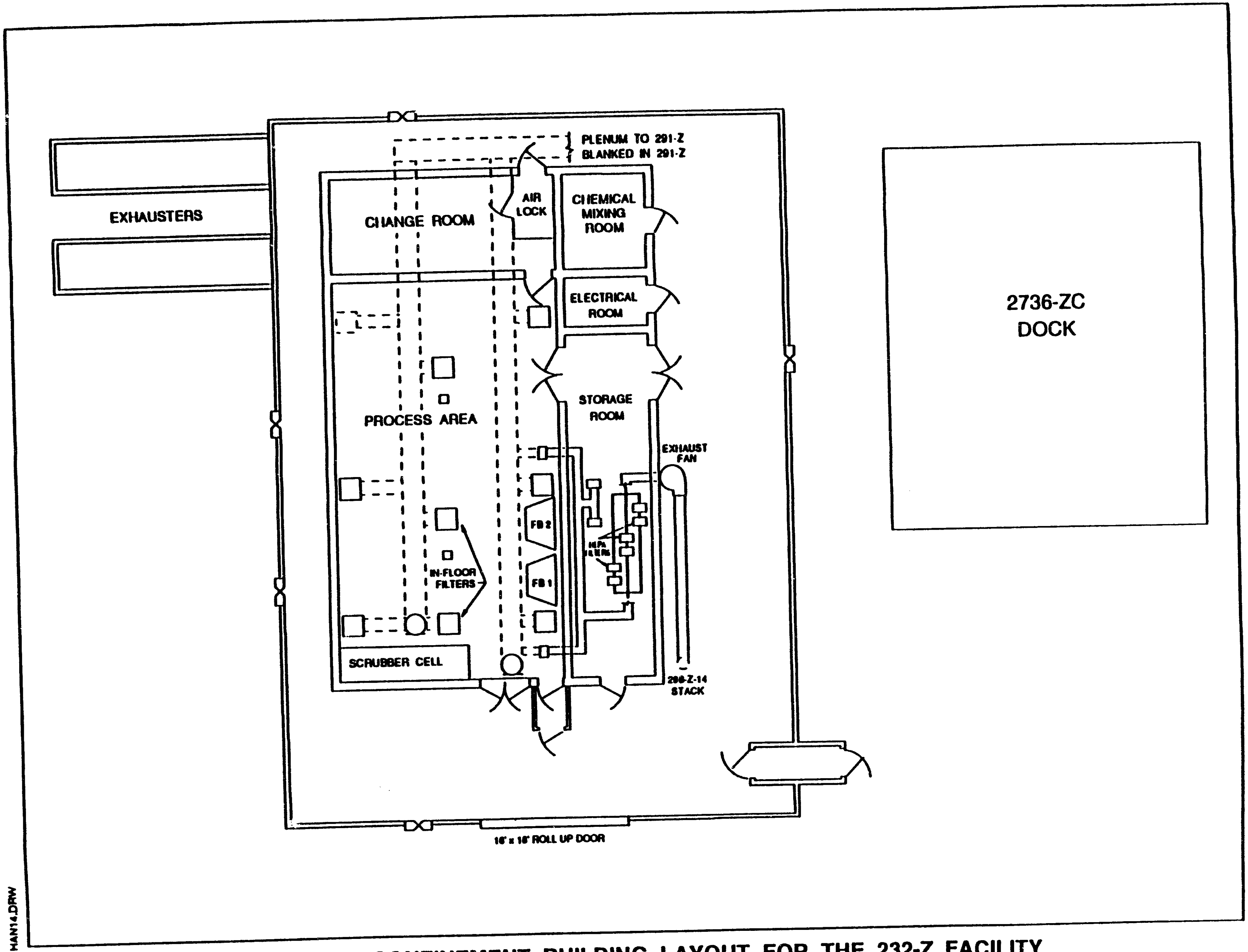

FIGURE 4.20. CONFINEMENT BUILDING LAYOUT FOR THE 232-Z FACILITY

FIGURE 4.21. TYPICAL HEPA FILTER EXHAUST UNIT USED AT HANFORD SITE

4.6.3 Non-Process Equipment Removal

Prior to residual plutonium removal and removal of piping and equipment in the process area, all conditionally clean materials (fixtures, utility piping, lighting fixtures, etc.) will be removed and sectioned as necessary for disposal. Conditionally clean materials will be identified based on the results of a thorough radiological survey. Materials will be designated conditionally clean according to DOE policy and programmatic needs. Electrical equipment and utility piping will be removed only after all miscellaneous hardware has been removed and after de-energizing the MCC and isolating and draining all utility lines. Following the removal of all conditionally clean materials, all LLRW materials will be removed, sectioned, and disposed of at the 200 West Area LLRW burial site. This WBS item is shown in Figure 4.22 and is discussed in Sections 4.6.3.1 through 4.6.3.4.

4.6.3.1 Removal instruction or procedures

This work will involve removal of both conditionally clean and LLRW materials. Work plans will have to be developed to address: (1) proper radiological support, (2) electrical isolation of Building 232-Z, (3) isolation of all other utilities such as water or steam, and (4) removal of conditionally clean and LLRW material and equipment (one engineer – 264 hours).

4.6.3.2 Remove equipment

Equipment removal will be performed based on increasing levels of contamination. This will result in consistent waste packaging procedures and increased worker competency prior to beginning work with TRU-waste materials. Work will be suspended when all conditionally clean and LLRW materials have been removed and disposed of (one project control analyst, one supervisor, one RPT, three craft support workers, and two D&D workers – 528 hours each).

4.6.3.3 Radiological survey of removed equipment

All materials will be surveyed before disposal to determine their radiological status. Clean scrap will be disposed of as such. Materials that are LLRW will be appropriately packaged and transported to the 200 West Area LLRW burial site. Any materials identified as TRU waste during this stage of the D&D assessment will be wrapped and stored for later sectioning and decontamination. Surveying will be performed as part of the equipment removal process, so no cost is allocated to this item.

4.6.3.4 Package clean waste and LLRW

This section covers packaging of clean wastes and LLRW materials removed from the building. A combined estimate of approximately 300 ft^3 of clean and LLRW materials will require disposal. This estimate is based on a review of available drawings and a visit to Building 232-Z (one D&D worker – 528 hours; one shipper – 20 hours).

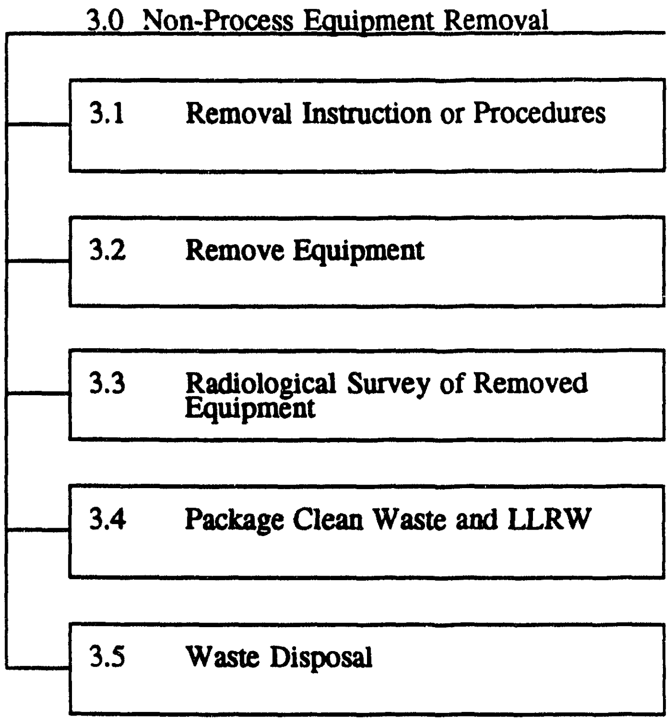

FIGURE 4.22. Non-Process Equipment Removal

4.6.3.5 Waste disposal

Waste disposal is covered within this WBS. Administrative and supervisory support as well as transportation and actual disposal costs are included.

4.6.4 Process-Area Piping and Equipment Removal

This includes the removal, decontamination, and disposal of the piping and equipment located in the process area of Building 232-Z. (See Figure 4.23, and Sections 4.6.4.1 through 4.6.4.6.) A VDU decontamination rate of up to 6 ft^3/day is used.

4.6.4.1 Process-area piping and equipment removal

This WBS item covers the preparation of the detailed work instructions that will be required to remove the piping and equipment from the process area (one engineer – 480 hours).

4.6.4.2 VDU relocation, VDU/bandsaw setup

This effort includes moving the VDU to Building 232-Z (one engineer - 80 hours; one supervisor - 120 hours; two nuclear operators - 96 hours each; two craftsmen - 128 hours each; one RPT - 120 hours; one driver - 24 hours).

4.6.4.3 Piping and equipment removal

This item includes removing piping and equipment removal in the process area. Protective clothing requirements, respirator limitations, and ingress/egress procedures may limit productivity. Removal tools will be portable band saws or portable reciprocating saws (one project control analyst, and one supervisor – 240 hours each; one RPT, two craft-support workers, and three D&D workers – 480 hours each).

4.6.4.4 Piping and equipment segmenting

This effort will run concurrently with the removal effort and the decontamination system operation, and will entail the segmenting of all the piping and equipment into 15 to 25 cm (6 to 10 in.) sections to prevent jamming of the decontamination equipment. Segmenting will be done with a horizontal-vertical band saw set up in the band saw greenhouse. The band saw greenhouse will be joined to the VDU greenhouse to allow transfer of segmented materials into the VDU greenhouse without the need for bagging segments (one craft-support worker and one D&D worker – 480 hours each).

4.6.4.5 Decontamination system operations

The operation of the vibratory finishing system is discussed in Section 4.2.3.5. This WBS item includes process piping and equipment decontamination, including receipt of the segmented pieces, operation of the VDU, and final assay to confirm the expected LLRW status (one project control analyst and one supervisor – 240 hours each; one technician – 480 hours).

4.6.4.6 Waste packaging

This WBS item is intended to cover those activities necessary to package all the waste generated from the process-area piping and equipment removal. This includes the sectioning and decontamination of

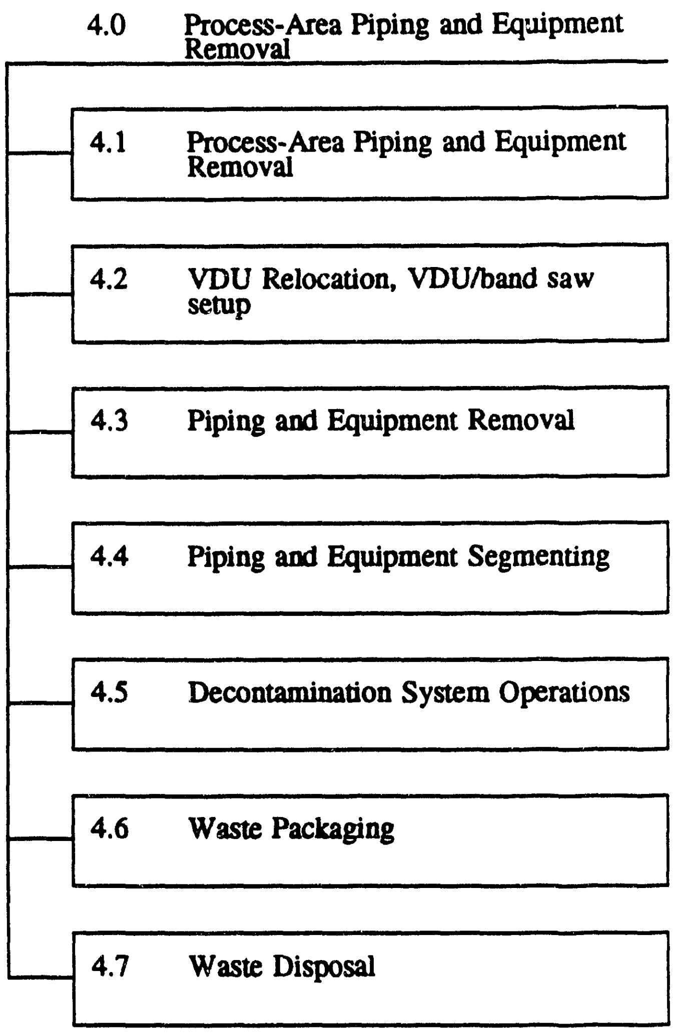

FIGURE 4.23. Process-Area Equipment Removal

approximately 213 ft^3 of TRU material to LLRW status, and the disposal of an estimated 86 ft^3 of TRU waste. The TRU waste estimate included 22 ft^3 of solidified VDU liquid waste (one D&D worker – 480 hours).

4.6.4.7 Waste disposal

The waste generated by the D&D removal activities and subsequent disposal are covered within the scope of this WBS item. It includes all administrative, supervisory, and transportation support as well as the actual disposal costs.

4.6.5 Building 232-Z Dismantling

This WBS section covers the actual building removal and site verification sampling as well as any soil remediation that may be necessary. (See Figure 4.24 and Sections 4.6.5.1 through 4.6.5.5.)

4.6.5.1 Dismantling decommissioning work plan

The preparation and approval of the work plan to dismantle, package, and dispose of Building 232-Z is addressed by this work package (one engineer – 352 hours).

4.6.5.2 Removal equipment procurement

This item will cover the equipment procurement necessary for building structure dismantling. Man lifts or man baskets will be procured under this item to provide a mobile work platform for work at high elevations (one engineer and one safety engineer – 40 hours each).

4.6.5.3 Building dismantling

This work package item is intended to cover the necessary supervision, manpower, and equipment necessary to dismantle Building 232-Z. Before the building can be dismantled, the underground pipe and duct work entering the building should be carefully disconnected and inspected for presence of contamination. They will have to be cut and capped at some agreed upon location. The sheet metal portions of the building will be taken apart, surveyed, and disposed of according to their radiological conditions. Some decontamination may be attempted if it is likely that the material could be released as clean scrap. Concrete portions of the building will be cut up into the largest size practical for handling purposes, then wrapped and disposed as LLRW. During the dismantling of the foundation and concrete slab, extreme caution must be used to avoid damage to the duct work and piping that passes through them. The preliminary method of dismantling the concrete is expected to be sawing or ribbon drilling into sections, rigging to a lay-down area, wrapping for disposal, and then shipment to the 200 West Area LLRW burial grounds. 8500ft^3 of LLRW is expected to be generated (one project control analyst -- 352 hours; one supervisor, one RPT, four craft-support workers and one D&D worker – 704 hours each).

4.6.5.4 Verification survey and sampling

This effort is intended to develop a sampling and survey plan that will document the radiological and chemical condition of the area under Building 232-Z (e.g., soil and rock). Also included in this work package is the surveying and sampling field activities and necessary laboratory analyses. This sampling and surveying effort may be performed twice: once following building removal to determine if soil remediation is needed, and then again to document the conditions following remediation. Cost estimates

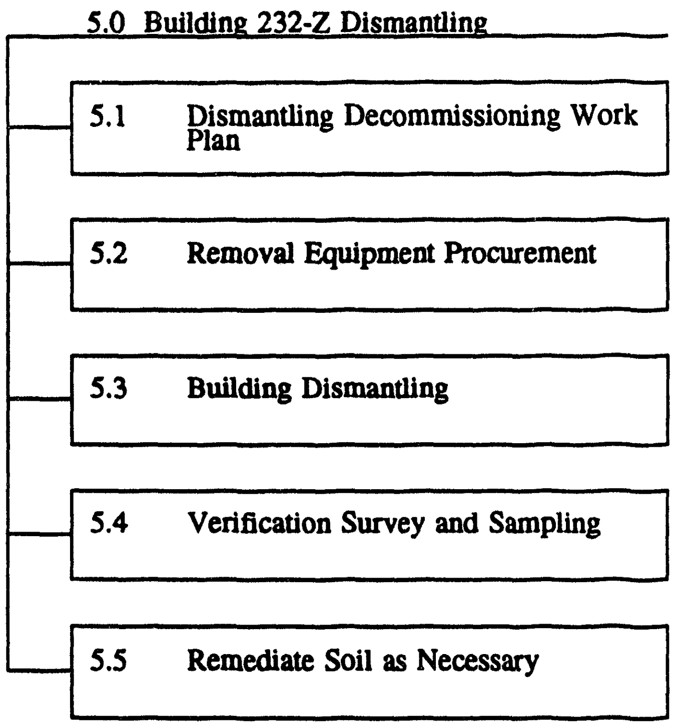

FIGURE 4.24. Building Dismantling

are based on analyzing 20 soil samples for chemical and radiological content (one engineer – 176 hours; two RPTs – 80 hours each).

4.6.5.5 Remediate soil as necessary

This includes the removal and disposal of the top foot of soil beneath Building 232-Z. This effort will generate approximately 2100ft^3 of contaminated soil that is assumed to be LLRW for estimating purposes. The exact designation of the area will be determined based on the verification sampling results. This designation will determine final "as left" conditions (in accordance with current requirements) as well as surveillance requirements in accordance with WHC-CM-4-10 (WHC 1988b) (one project control analyst – 8 hours; one supervisor, one RPT, two craft-support workers, and one D&D worker – 32 hours each).

4.6.6 Project closeout

The activities in this WBS element include the demobilization work and the documentation to confirm and report how the D&D Project was performed (Figure 4.25).

4.6.6.1 Compilation of verification survey and sampling data

This element covers the collection, evaluation, and presentation of the data collected as part of the verification process. This work will present information in a manner compatible with possible future RCRA/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) work in the area (one engineer – 352 hours).

4.6.6.2 Compilation of cost and waste volume data

This includes the annual compilation of project cost and waste volume information. For a project which covers multiple years and the associated personnel turnover, this information must be compiled annually to provide a meaningful final data package once the project is completed (one engineer – 176 hours).

4.6.6.3 Demobilization and waste disposal

This includes the work necessary to dismantle the exhaust units and confinement building. Any contaminated material generated by this operation will also be packaged and disposed of under this item. It is expected that the confinement ventilation unit will be radiologically clean; however, the process-exhaust unit may be contaminated to low-level criteria. The HEPA filter will be removed and disposed of as LLRW. This operation will generate an estimated 100 ft^3 of LLRW (one project control analyst – 160 hours; one supervisor, one RPT, six craft-support workers, and six D&D workers – 480 hours each.)

4.6.6.4 Prepare final report

This WBS item covers the engineering and administrative support needed to prepare and publish the final decommissioning report for Building 232-Z (one engineer – 704 hours).

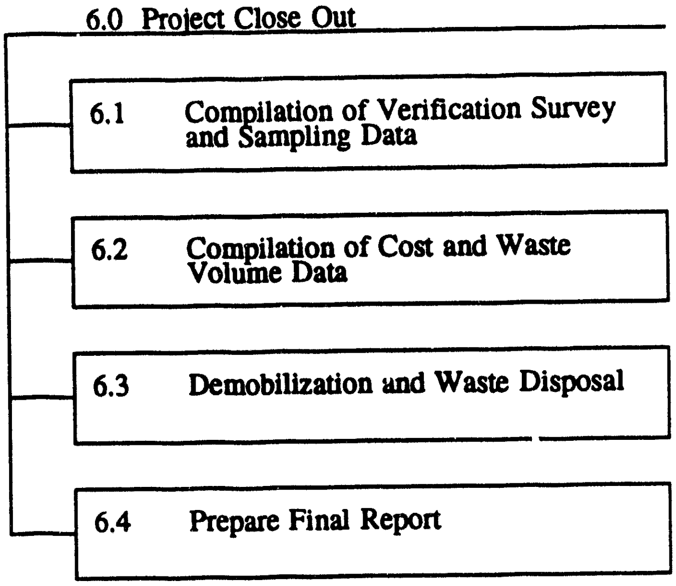

FIGURE 4.25. Project Close Out

5.0 COST AND SCHEDULE

5.1 COST ESTIMATE

The residual plutonium recovery and decontamination and decommissioning (D&D) of Building 232-Z are estimated to cost approximately $6.6 million in fiscal year (FY) 1992 dollars. This estimate includes the cost of the decontamination, assay systems, and the additional temporary exhaust unit for confinement building ventilation (if required), which will be capital equipment. Table 5.1 shows the breakdown of program costs.

5.2 PROPOSED PROJECT SCHEDULE

The proposed project is expected to take approximately six years to complete from the start of plutonium recovery to the end of D&D activities (Figure 5.1). This schedule is based on the timely authorization and allocation of funding necessary to complete this program. Costs for this program are developed in Appendix D and summarized in Table 5.1. Combined general and administrative (G&A) costs and common support pool (CSP) costs are estimated at 33.3 percent of project labor and equipment costs. Contingency costs are estimated at 35 percent for the following reasons:

- plutonium recovery is anticipated to start in 1993;
- D&D work on this project is not expected to begin until 1995, making economic inflation a concern;
- regulatory requirements may change between now and 1995;
- labor-cost rates are based on those for Westinghouse Hanford Company (WHC) workers. If a different labor pool is used, costs could be higher.

Table 5.1. Cost Breakdown of Each Phase of the Building 232-Z Project (in thousands of dollars)

WORK BREAKDOWN ITEM	SUBTOTAL	G&A/CSP (33.3%)	CONTINGENCY (35%)	TOTAL
Residual Pu Recovery				
1.0 Project Planing & Control	11	4	5	20
2.0 Mobilization and Site Prep	28	9	13	50
3.0 Process Piping Removal	67	22	31	120
4.0 Pu Recovery Operations	50	17	24	91
5.0 Project Close out	16	5	8	29
Residual Pu Recovery Total	172	57	81	310
Remaining D&D Activities 1.0 Project Planning and Control	113	37	53	203
2.0 Mobilization and Building Preparations	1,116	372	521	2,009
3.0 Clean/LLRW Equipment Removal	255	85	119	458
4.0 Process-Area Equipm Removal	388	129	181	698
5.0 Building 232-Z Removal	928	309	433	1,670
6.0 Project Close out	381	127	178	685
Other Equipment	332	110	155	597
Remaining D&D Activities Total	3,513	1,169	1,640	6,320
PROJECT TOTAL	3,685	1,226	1,721	6,630

232-Z SCHEDULE (Residual Plutonium Removal Activities)

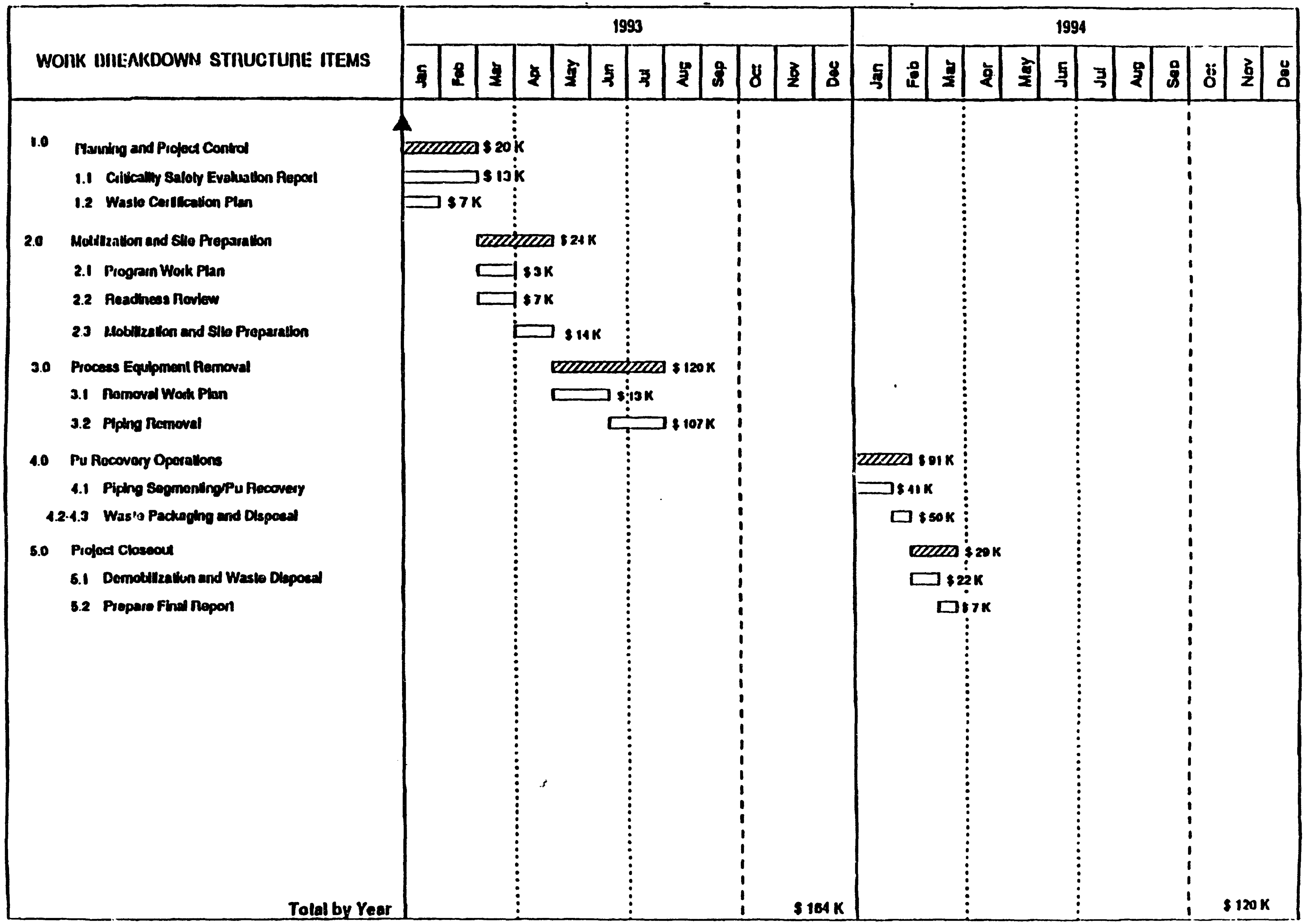

FIGURE 5.1. PROPOSED PROJECT SCHEDULE FOR 232-Z BUILDING

232-Z SCHEDULE (Remaining D & D Activities)

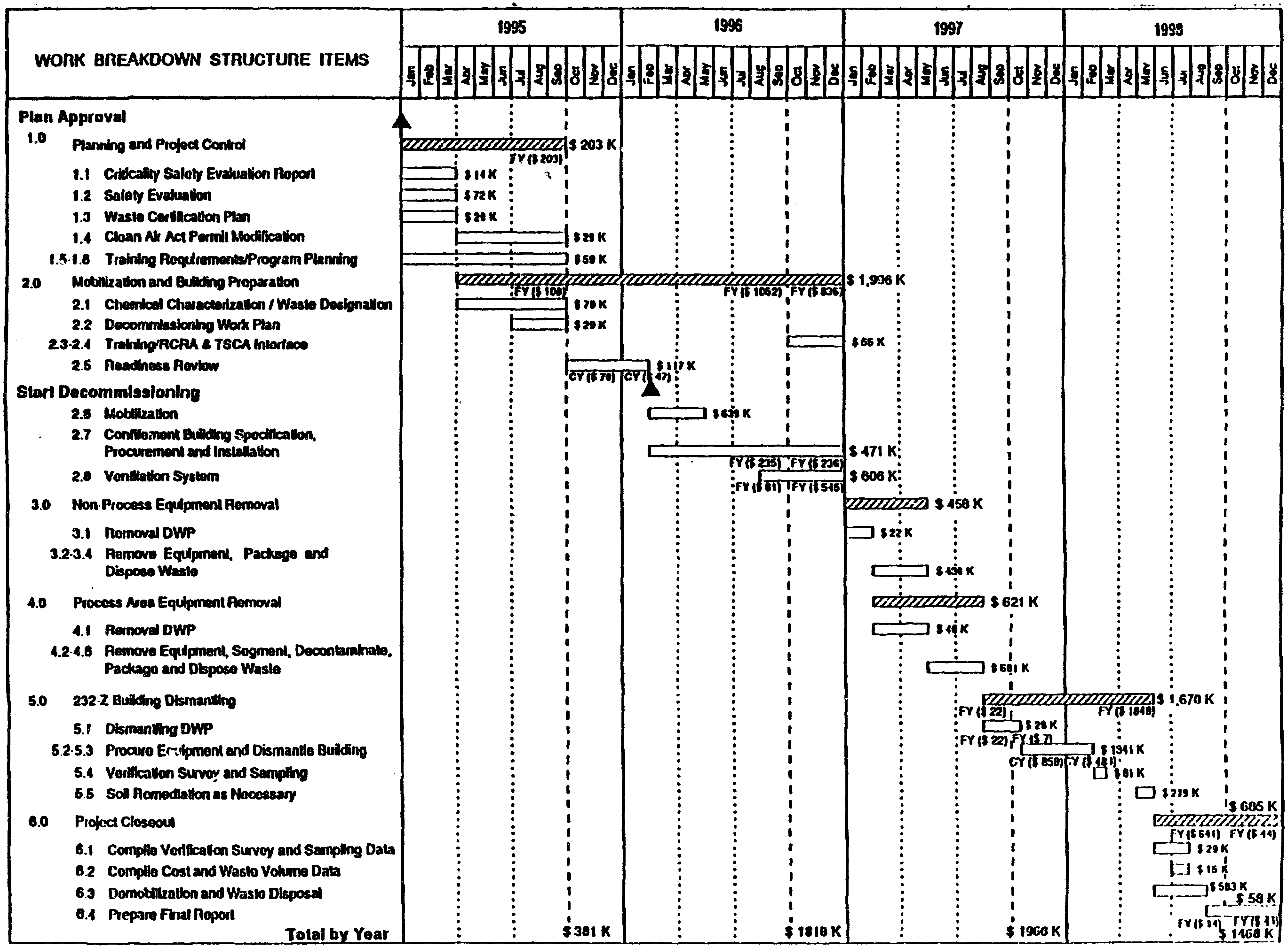

FIGURE 5.1. PROPOSED PROJECT SCHEDULE FOR 232-Z BUILDING (Continued)

6.0 SAFETY

This section identifies known or possible conditions that require specific attention for the decontamination and decommissioning (D&D) effort to proceed safely. These measures will be employed to eliminate unsafe conditions and minimize hazards.

6.1 RADIOLOGICAL SAFETY

All of the decommissioning work in Building 232-Z has associated radiological hazards. A combination of physical and administrative controls will be used to control these hazards.

6.1.1 Confinement Systems

Confinement is defined (DOE 1989) as the barrier and its associated systems between areas containing hazardous materials and the environment or other areas in the facility that are normally expected to have levels of hazardous materials lower than allowable levels. Since the deactivation of Building 232-Z in 1972, the following primary and secondary confinement systems have been put into place:

Primary: The piping systems and equipment act as the primary boundary.

Secondary: The building and its ventilation system act as a secondary confinement. The Building 232-Z exhaust fan provides a negative pressure system.

During the decommissioning project, the confinement boundary will change in that the piping and process equipment will be removed in stages and other barriers put in place to provide the confinement. During the equipment-removal and decontamination phase of the project, the confinement barriers will be as follows:

Primary: The greenhouse and attached glove boxes, maintained under a negative pressure, are the primary confinement barrier.

Secondary: Building 232-Z will be maintained under a negative pressure. This acts as a secondary confinement barrier. All waste will be packaged and the package exteriors will be surveyed. Waste packages will be removed from the area only after they are determined to be clean.

During the building dismantling phase of the project, the confinement barriers for any plutonium that remains in the facility are expected to be as follows:

Primary: The remaining building will act as the primary confinement as much as possible during this phase. This confinement layer will be broken as building parts are removed. It is during these times that the access and administrative controls on the outer building will be in effect.

Secondary: During the building dismantling, an outer confinement may be in place to provide an additional boundary. This outer building may provide the secondary confinement during those times that the boundary represented by Building 232-Z will be breached. The outer building will be equipped with an air lock at the primary personnel access point for use during these times. In addition, administrative controls placed on all the other access points to this building will be enforced to ensure that the barrier of the outer building is not breached simultaneously with the building layer.

Additional methods of containing radioactivity are decontamination, application of fixatives, and wrapping in plastic. These methods will be used to prevent the spread of contamination as waste containers and equipment are moved from one area to another within the project boundaries.

It is possible that an outer confinement building may not be used during D&D efforts. In that case no secondary confinement would be utilized for building removal. The decision to use a confinement building (or not) will be based on remaining contamination on building wall surfaces following completion of equipment and piping removal.

6.1.2 Criticality Controls

The radiological characterization document (Keele et al. 1990) placed the estimated plutonium-239 inventory of Building 232-Z at less than 900 grams (+/- 60 percent). The referenced document provides detailed methodology of the characterization work and lists the data that were used to determine this inventory estimate. By following the criticality control program outlined in DOE Order 5480.11, criticality concerns will be evaluated and the appropriated controls put into place before the physical removal work in the facility is begun.

The controls, as presented in criticality prevention specifications developed for the decommissioning, are expected to primarily address the control of geometries, the reduction of unanalyzed reflectors and moderators, and the use of poisons. For example, when pipelines that may contain liquids are being breached, a criticality safe waste container will be used. The vibratory decontamination unit (VDU) equipment used in the decontamination operation is designed to be geometrically favorable for criticality safety. The sludge settling tank is a small-diameter tank that is subcritical for any material that it could contain under normal or abnormal conditions.

6.1.3 Personnel Protection

Dress requirements and methods will be established by the Radiation Work Permit (RWP) system (WHC 1988b) to protect personnel from contamination. Section 6.2 discusses the industrial hygiene concerns and how these issues will be addressed during the decommissioning project. Current radiological surveys indicate that external radiation exposure will not be a significant problem in this facility. The measured dose rate levels are generally less than 0.1 mrem/hr in the majority of the facility, with some sections of the process area and pipe gallery up to 5 to 10 mrem/hr beta-gamma. The entire facility is generally less than 0.1 mrem/hr neutron. These levels do not necessitate stringent protective or shielding measures, but work time in these areas will be minimized whenever possible. Additional dosimetry (pencil dosimetry and finger rings) will be worn by workers to monitor personnel radiation doses so their exposures can be maintained below the prescribed levels.

Normally, two pairs of anticontamination clothing and a respirator will be worn for removal work in the contaminated areas of the building. When initially breaking into pipes in the process area, additional protection will be provided through the wearing of an acid- or water-repellent suit. The radioactive environment will be monitored using portable, hand-held instruments and by a continuous air monitor (CAM) located in or near the work area.

6.2 INDUSTRIAL SAFETY

This decommissioning project will pose industrial safety hazards similar to those encountered on any construction or demolition site. There are possible additional hazards associated with hazardous materials used in the plutonium concentration process or in more recent contamination stabilization efforts. All of the decommissioning work at Building 232-Z will be in compliance with DOE Order 5480.11, Radiation Protection for Occupational Workers. Required tasks will have a job safety analysis (JSA) conducted or a Hazardous Waste Operating Permit (HWOP) issued as appropriate. Hazards will be identified in the decommissioning work plans, prejob safety plans, hazardous work permits, asbestos work permits, or similar control documents as required.

As discussed in Section 4.4, mechanical systems will be isolated prior to the start of the decommissioning work in Building 232-Z. Isolation will occur in accordance with approved "lock and tag" procedures. This is necessary to prevent the possibility of cutting into pressurized piping during the equipment-removal phase. The original ventilation and monitoring systems will remain in service through the first part of the decommissioning project, and then be de-energized as the decommissioning progresses and the new ventilation system is placed in service. The schedule and logic for the isolation progression given in Section 4.4 is intended to result in the removal of the utilities and other energy sources before they can cause injury to personnel.

The installed fire protection system will be maintained in service until the electrical isolation of the facility and smoke alarms are incorporated into the design of the tertiary confinement building. Fire prevention will be practiced during the decommissioning project by minimizing the amount of flammable material brought into or stored in the building. Any construction materials used during the decommissioning will be fire resistant or retardant. The fire resistant or retardant qualities will be maintained by following the manufacturers' recommendations on these products. Portable fire extinguishers will be available in the work area.

Asbestos lagging (planking) will normally be removed with the piping to which it is attached. Established procedures will be followed while removing the asbestos material. Normal asbestos removal involves access controls, wetted removal, ventilation controls, and appropriate waste disposal measures. Because of the radiological controls that will be in place for this work, normal asbestos controls are seen as not having a significant impact on the work.

6.3 SAFETY DOCUMENTATION

Sections 6.1 and 6.2 discussed how radiological and industrial safety items will be addressed. An independent safety analysis must be performed to address these and other concerns. A safety analysis is defined as "A formally documented process to systemically identify the hazards of an operation or facility; to describe and analyze the adequacy of the measures taken to eliminate, control, or mitigate identified hazards; and to analyze and evaluate potential accidents and their associated risks."

The safety analysis for the Building 232-Z D&D Project will address all aspects of the project, from initial document preparation to final site restoration. The use of the tertiary confinement structure and the ventilation modifications described in Section 4.3 are to be specifically included in the construction.

It is anticipated that the required safety analysis may develop operating safety limits or requirements. The limits or requirements by necessity would place constraints on project activities to ensure that safe operations are maintained. The dynamics of the project will necessitate that controls and limits be established relative to the changing conditions experienced throughout the life of the project. As conditions change, some controls and limits will be phased out while others may be instituted. The predetermined conditions may be based on a building assay to determine the total transuranic inventory, a maximum loose surface activity level, the progress of the decommissioning, the status of the planned ventilation modifications, or similar measurable conditions that would prudently change the limits under which further operations were conducted.

7.0 QUALITY ASSURANCE

It is the DOE policy to establish quality assurance (QA) requirements to ensure that risks and environmental impacts associated with this plan are minimized and that safety, reliability, and work performance are maximized through the application of effective management systems commensurate with the risks of the proposed action.

7.1 DECONTAMINATION AND DECOMMISSIONING QUALITY ASSURANCE PROGRAM

The QA aspects of the Building 232-Z Decommissioning Assessment will be implemented as specified in DOE Order 5700.6C, Quality Assurance, August 1991, and its referenced QA Standards. Sections of this document will be referenced in the Building 232-Z D&D safety, criticality, and decommissioning work plans as necessary.

7.1.1 Management

Organizations responsible for implementing the decontamination and decommissioning (D&D) Assessment will develop, implement, and maintain a written Quality Assurance Program (QAP). The QAP will describe the organizational structure, functional responsibilities, levels of authority, and interfaces for those managing, performing, and assessing the adequacy of the D&D Work. The QAP will describe the management system, which includes the planning, scheduling, and cost-control considerations of the proposed actions.

7.1.2 Personnel Training and Qualifications

All personnel associated with the D&D of Building 232-Z would be trained and qualified to ensure they are proficient in their work duties. Continual training will be provided during all phases of the D&D work to ensure job quality is maintained.

7.1.3 Quality Improvement

The organizations will establish and implement processes to detect and prevent quality problems and to ensure quality improvement. Items and processes that do not meet programmatic, regulatory, or procedural requirements will be identified, controlled, and corrected. Corrections will include identifying the causes and preventing recurrence.

7.1.4 Documents and Records

Documents pertaining to the D&D of Building 232-Z would be prepared, reviewed, approved, issued, used, and revised to implement processes, identify specific requirements, or establish design. Records will be specified, prepared, reviewed, approved, and maintained.

7.1.5 Work Processes

The D&D work would be performed to established technical standards and administrative controls. The work will be performed under radiologically controlled conditions using approved procedures, guidelines, or other appropriate means.

7.1.6 Design

All items and processes pertaining to the D&D work would be designed using appropriate engineering/scientific principles and standards. Design work, including changes, would incorporate applicable requirements and design bases. Design interfaces will be identified and controlled with the adequacy of the design products verified or validated by individuals or groups other than those who performed the work. The verification or validation work will be completed before approval and implementation of the design.

7.1.7 Procurement

The organizations responsible for the D&D work would ensure that procured items and services meet established requirements and would be performed as specified. Potential suppliers will be evaluated and selected on the basis of specified criteria. The organizations would ensure that approved suppliers will continue to provide acceptable supplies and services.

7.1.8 Inspection and Acceptance Test

Inspection and acceptance testing of work items would be conducted using established acceptance and performance criteria. Equipment and instruments used for inspections and testing would be properly calibrated and maintained.

7.1.9 Management Assessment

Management at all levels involved in the D&D work would periodically assess the performance-integrated QA program. Issues that hinder the organizations from achieving the work plan objectives will be identified and corrected.

7.1.10 Independent Assessment

There would be routine and non-routine independent assessments conducted to determine item quality and process effectiveness, and to promote improvements. The organizations responsible for the independent assessments will have sufficient authority and freedom from the line organization to perform their responsibilities. The persons that will conduct the independent assessments will be technically qualified and knowledgeable in the areas assessed.

7.1.11 Sampling and Analyses

The services of various onsite and offsite analytical laboratories will be used in establishing levels and inventories of chemical and/or radiological constituents in waste products generated by the D&D efforts. Non-destructive analysis (NDA) techniques will be used in determining the levels of transuranic (TRU) activity in waste containers. Wet chemistry and radioactive counting may be employed to determine the disposal mode of any liquid waste.

All radiological and chemical analyses that may be performed to support site release or characterization following the removal of the buildings will be documented to support future Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or Resource Conservation and

Recovery Act (RCRA) work in the immediate area. If U.S. Environmental Protection Agency (EPA) Level 3 or higher analyses or documentation are needed to support either of these regulatory concerns, programmatic input from the appropriate organizations will be sought during the definitive planning for those efforts (see Appendix A, Sampling and Analyses).

8.0 MATERIAL DISPOSAL

8.1 MATERIAL REUSE

All process and support equipment removed from Building 232-Z will be disposed of as scrap – either clean, radioactive, or transuranic (TRU), as discussed in Section 8.2. Equipment that is purchased or installed specifically to support the decommissioning project will be salvaged whenever possible. These items include:

- Confinement building skin and support structure (if used). The interior building will be draped with plastic sheet to allow easy decontamination, if necessary;
- Two 5000 ft^3/min high-efficiency particulate air (HEPA) equipment exhaust fans, duct work, and stack assemblies;
- All confinement building electrical equipment and lighting fixtures (these items will be specified, purchased, and installed with salvage and future use as a consideration);
- Truck-access door and confinement building supply fan;
- Vibratory decontamination unit (VDU) decontamination system;
- Horizontal-vertical band saw.

8.2 WASTE DISPOSAL

The equipment-removal and building dismantling of Building 232-Z will result in significant volumes of solid waste, both low-level radioactive waste (LLRW) and TRU. The estimated volumes of these wastes are presented in Table 8.1.

The solid waste will consist of the equipment and materials removed from the building and the materials used to contain or clean contaminants. Materials removed from the historically clean areas of the building will be radiologically surveyed to determine their status. Equipment that is decontaminated or assayed as not exceeding the TRU waste limit of 100 nCi/g, as well as the building material itself, will be disposed of as LLRW.

Solid waste determined to be TRU will be packaged in containers and certified for storage at Waste Isolation Pilot Plant (WIPP). It is currently anticipated that all TRU waste from the Building 232-Z D&D Project will be packaged in 55-gallon drums.

Most wastes that will require solidification will be generated from two sources: any remaining liquid in the scrubber system, and the rinsate from the VDU process. This material will be either solidified or transferred to tank farms depending on both its TRU content and chemical designation.

Table 8.1. Building 232-Z Decontamination and Decommissioning Program Waste Generation

Source of Waste		Waste Type & Volume: LLRW (ft³)	Waste Type & Volume: TRU (ft³)	Pk'g factor	Packaged Volume (ft³): Clean	Packaged Volume (ft³): LLRW	Packaged Volume (ft³): TRU
Non-process Equipment		208		1.5		300	
Conditionally Clean Waste (non-process equipment related)					203		
Decontaminated material from VDU		192		1.5		288	
Secondary Wastes (gloves, tape, plastic, etc.)	Non-Process Equipment related	132		1.0		132	
	Process Equipment related	600		1.0		600	
Remaining TRU waste that is unable to be decontaminated			22	1.5			33
Liquid VDU Waste			33	1.0			33
Contaminated Greenhouses			30	1.0			30
Building Structure		8,500		1.0		8500	
Soil Under Building 232-Z		2,100		1.0		2100	
Demobilization Waste		100		1.0		100	
Totals					203	**11,309**	**96**

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APPENDIX A--SAMPLING AND ANALYSES

The 232-Z decontamination and decommissioning (D&D) Assessment has been organized to effect the maximum reduction of the Pu inventory during the equipment removal phase. The application of strict engineered controls and the maximum utilization of equipment removal in total containment have been applied to minimize the potential for worker exposure to contamination and minimize the amount of transuranic (TRU) waste generated.

During the decontamination phase, process piping exhaust ventilation duct work and all associated interior equipment will be removed. Strict adherence to the assessment will preclude any releases to the work and to the environment.

A sampling and analyses plan (SAP) will include but not be limited to extensive sampling and analyses of the paint chips for the presence of metals found in some paints as pigments, insulation sampling for the presence of friable asbestos, and sampling and analyses of the incinerator ash for the presence of nickel, chromium, and lead.

The SAP will be completed prior to the start of D&D work. The SAP will consists of 2 parts : (1) a quality assurance program (QAP) that describes the policy, organization, functional activities, and quality assurance QA and quality control (QC) protocols necessary to achieve Data Quality Objective (DQOs); and (2) a Field Sampling Plan (FSP) that provides guidance for all fieldwork by defining in detail the sampling and data-gathering methods to be used prior to and during the D&D work. The FSP will be written so that a field sampling team unfamiliar with the 232-Z facility will be able to gather the samples and field information required. The FSP and QAP will be a single document although they may be bound separately to facilitate use of the FSP in the field.

SUGGESTED SAMPLING AND ANALYSES PLAN FORMAT

The format for Part 1, the QAP, of the SAP follows.

Title Page -- Page for signatures of approval personnel, including the contractor project manager and QA manager.

Table of Contents -- Outline of report.

Project Description -- A general facility history, objectives of D&D work and facility description.

Organization and Responsibilities -- Organizational chart, identifying key personnel and organizations and responsibilities of key personnel.

Quality Assurance Objectives for Measurement -- Intended data use; a listing of method detection limits; a table of QC samples (duplicates, trip blanks, field blanks, and equipment rinseates) versus the number of samples by method and matrix (include extra sample volumes for QC samples); a detailed discussion of DQOs, including how they will be implemented; and a table showing the analysis method number, sample media, data quality assurance (DQA) level, and number of samples.

Sampling Procedures -- A description of sampling procedures; a discussion of the cleaning/preparation of sample containers; a description of sample preservation techniques and holding times; a discussion of field logbooks/forms/notebooks; and a discussion of material.

Sample Custody -- chain-of-custody procedures.

Calibration Procedures -- Written field calibration procedures, including frequency of calibration, source and traceability to National Institute of Standards and Technology (NIST) calibration standards, and calibration acceptance criteria; a detailed discussion of the field data evaluation process.

Analytical Procedures -- Tables of analyses method numbers and numbers of analyses per matrix for each sample location and the name of the analyte list and a list of analytes for multianalyte methods.

Data Reduction, Validation, and Reporting -- The principal criteria used to validate data, a detailed discussion of data handling and reduction procedures, methods for evaluation of blanks, and QC acceptance criteria.

Internal Quality control -- Discussion of matrix spike/matrix spike duplicates (MS/MSD); field duplicates, field blanks, trip blanks, equipment rinseates, surrogates; and identification of ways in which the QC information will be used to qualify data.

Performance and Systems Audits -- A discussion of performance and system audits to be performed.

Preventive Maintenance -- Discussion of preventive maintenance, including critical spare parts.

Data Assessment Procedures -- Discussion of precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters and statistical applications of data (laboratory responsibility).

Correction Actions -- A discussion of corrective action procedures, including field changes and responsibilities for corrective actions, and a discussion of out-of-control conditions reporting and follow-up procedures.

Quality Assurance Reports -- Results of audits, significant QA problems encountered, and recommended solutions; and the final report and its contents; a summary of final data quality; and summary tables of the data.

The suggested format for Part 2, the FSP, of the SAP follows.

Site Background -- A summary of any existing data, a description of the Building 232-Z facility and surrounding areas, a discussion of known and suspected contaminant sources, and a listing of probable transport pathways.

Sampling Objectives -- A description of intended data uses.

Sampling Location and Frequency -- Identification of each sample matrix to be collected, identification of the constituents to be analyzed, maps and/or drawings identifying the location of sampling points, and summary tables showing numbers of samples by matrixes and locations.

Sample Designation -- A description of the sample numbering system.

Sampling Equipment and Procedures -- A description of sampling procedures, including equipment to be used and material composition of the equipment; of a discussion of mobilization and demobilization; and a detailed description of, and procedures for, field screening methods, including preventive maintenance.

Sample Handling and Analysis -- Identification of sample holding times, preservation methods, types of sample containers, and volumes of samples to be collected; shipping requirements and procedures; chain-of-custody procedures; disposal of waste generated; and a discussion of field logbooks/forms/notebooks, including how to complete them and how they are controlled.

APPENDIX B--DECOMMISSIONING ALTERNATIVES

Alternatives Considered

The following alternatives were evaluated for the D&D of Building 232-Z:

1. Continue Present Action (No Action Alternative)
2. Source Term Reduction (Equipment Decontamination and/or Removal)
3. Decontamination and decommissioning (D&D) of Building

The categories used for the evaluation are Occupational Dose, Total Cost, Environmental Release Potential, and Long Range Impact. The new draft seismic accident analysis done for the consolidated Plutonium Finishing Plant (PFP) final safety analysis report (FSAR) shows that potential onsite consequences exceed approved risk acceptance criteria. Therefore, removal activities are warranted. These activities would involve at a minimum, the removal of the transuranic (TRU) waste.

Alternative Elimination

Continue Present Action - This alternative was eliminated due to the draft seismic accident analysis. Remedial actions at Building 232-Z are recommended to mitigate the potential release of plutonium because of postulated structural failure of Building 232-Z as the result of a Design Basis Earthquake (DBE) event.

Source Term Reduction and Partial Dismantling - This alternative would be less expensive and would reduce the potential for radioactive release to within acceptable risk guidelines. No programmatic use for Building 232-Z has been identified.

Based on the above alternative eliminations, only the complete D&D of Building 232-Z is considered further.

Occupational Dose

Occupational dose from the D&D of Building 232-Z was estimated using the Health Physics Survey Report dated August 1991. A 10 mrem/hr dose during the residual Pu recovery and the equipment removal phase and 1 mrem/hr dose during the decommissioning and removal of the building was estimated. The following assumptions and calculations can be made:

Assumptions

1. Engineering controls and personnel-protective equipment that are put in place are successful in preventing inhalation and, therefore, there are no internal dose considerations.

2. Residual Pu recovery activities within Building 232-Z are expected to take two craft workers and two nuclear operators 200 hours to complete, or 800 exposure manhours. At a dose rate of 10 mrem/hr, this equates to eight man-rem. Subsequent operations to reclaim Pu from piping

segments will add two man-rem (assuming two nuclear operators working for 200 hours, or 400 exposure manhours, at a dose rate of five mrem/hr). The total dose received during residual Pu recovery operations is, therefore, estimated to be 10 man-rem.

3. A major portion of the equipment will be decontaminated to LLRW limits. This is estimated to require an average crew of 3 crafts and 5 D&D workers and 1 technician up to 480 hours, conservatively estimated; therefore, 1440 man-hours at 10 mrem/hr corresponds to 14.4 man-rem, and the remaining 2880 manhours at 1 mrem/hr equates to a job total of 17.3 man-rem.

Dismantling of Building 232-Z structure may require decontamination but will, as a minimum, require some fixative application to the internal surfaces of the building. Decontamination will be accomplished by the use of scarifiers and perhaps abrasive blasting, and is the longer, higher exposure task. If a decontamination crew of four is physically in the building for 320 hours, this corresponds to 1.3 man-rem.

Actual dismantling operations are estimated to require a crew of eight for seven weeks. Although less than half of the time workers will be in the building and dose rates will continue to decrease with building removal, half time (140 hours) at 1 mrem/hr for the full crew is used in the calculations for conservancy. Dismantling operations will add 1.1 man-rem to this alternative job total.

Summary

The occupational dose estimate for D&D of Building 232-Z is estimated to be 29.7 man-rem.

FUTURE ENVIRONMENTAL RELEASE POTENTIAL

Immediate dismantling and disposal of Building 232-Z will involve a slightly higher radioactive inventory in the 200 West Area burial grounds. It is expected all surfaces will require sealing with plastic prior to shipping to the burial grounds, thereby minimizing the risk of future environmental release.

LONG RANGE IMPACT ON SITE RESTORATION ACTIVITIES

The removal of the 232-Z Building cannot interfere with nor impact future site restoration activities. The criteria was evaluated on a 0 to 10 scale where 0 is no impact and 10 is significant impact. The criteria included: 1) compliance to and in accordance with all applicable standards, regulations, codes, and DOE Orders with currently available technology; 2) no significant environmental release potential; 3) addition of no significant waste volume to the burial grounds. Based on the criteria evaluated, the D&D alternative is rated 0.

APPENDIX C--CONFINEMENT BUILDING OPTIONS EVALUATION

METHODOLOGY OF SELECTION CRITERIA AND EVALUATION WEIGHING

Numerical values for each containment option are based on its importance. The higher the number the greater the importance. A weighted factor was applied to the raw numerical score based upon the relative importance of each criteria. The ranking of containment alternatives was then arrived by totaling scores for all the selection criteria.

Sensitivity to Site Data

The areas of sensitivity for structural confinement are:

- Physical properties - the dimensions and configurations of buildings to be dismantled or demolished varies

- Number of buildings - the scope of this work includes one building site (Building 232-Z). But Building 233-S will have similar action taken and the re-use of the temporary confinement building is possible.

Flexibility and modularity are the basic measures of sensitivity to site data. A structure with a high degree of flexibility can be used over again on different building sites of various dimensions and configuration. The ability to expand or contract the size of the structure is modularity.

Since the number of building sites currently addressed is 2 and their differences in confinement area are small, flexibility and modularity of structure is assigned a weighing factor of 1.

Discussion of Assigned Values - Flexibility and modularity were evaluated equally for sensitivity to site data. The overall rating was the average of values given each.

The following demonstrates how the raw score was derived:

Modularity (Dimensional Change Capability)

	0 Dimension (0 points)	1 Dimension (1 points)	2 Dimensions (3 points)	3 Dimensions (5 points)
Alternative Number	2	3		1,4

The air-support structure, Alternative 2, is a fixed structure not capable of size adjustment, and is rated 0. The arched-tension structure, Alternative 3, can be expanded longitudinally and is rated 1. The rigid- and bridge-truss structures can be adjusted in length, width, and height, and are thus rated 3.

Flexibility (Potential Site Utilization)

	50% (1)	75% (3)	100% (5)
Alternatives	2	3	1, 4

An air-support structure can only work ideally at one site and may be unusable afterwards. Thus, it is rated 50 percent, or 2. The arched-tension structure can only be adapted to the site in one direction resulting in an excessive confinement. Thus, it is rated 75 percent or 3. Both the rigid- and bridge-truss structures can be designed to adapt in three directions for site conditions making one structure ideal for both sites. This is given a 5 rating (Table C.1).

Table C.1. Confinement Alternative Rating Table

Containment Alternative	Alternate Number	Raw Score	Weight Factor	Weight Score
Rigid structure	1	5.0	1.0	5.0
Air Support	2	0.5	1.0	0.5
Arched Tension	3	2.0	1.0	2.0
Bridge Truss	4	5.0	1.0	5.0

Sensitivity to Site Extremes

Seismicity, wind, and snow loads, sun effects, repeated assembly/disassembly cycles and topography are the site extremes at the Hanford Site. The minimum structural requirements that must be met by all temporary facilities are set by the federal and Hanford Plant Standards. Durability and site preparation are measures for sensitivity to site extremes. Physical endurance resulting from confinement design is durability. The site preparation includes the sensitivity of confinement building to topography.

The weighing factor for durability and site preparation is 3.

<u>Discussion of Assigned Values</u> - The durability and preparation factors for sensitivity to site extremes were divided equally. Their respective ratings are as follows:

Durability

	Poor (1 point)	Good (3 points)	Excellent (5 points)
Alternatives	2	3	1, 4

Alternative 2 has a tendency to deflate with punctures giving it a poor rating. The durability of alternative 3 is considered good. Alternatives 1 and 4 have steel siding and the given framing has excellent durability. These are rated 5.

Site Preparation

	Extensive (1 point)	Moderate (3 points)	Minimal (5 points)
Alternatives	1,2,3,4		

Alternates 1, 3, 4 require extensive site preparation prior to erection. The rigid and truss structures require level foundations and site work must be plumb. Alternate 2 requires perimeter foundation. All are rated 1 (Table C.2).

Table C.2. Sensitivity to Site Extremes

Containment Alternate	Alternate Number	Raw Score	Weighing Factor	Weighted Score
Rigid structure	1	3	3	9
Air Support	2	1	3	3
Arched Tension	3	2	3	6
Truss	4	3	3	9

As low as reasonably achievable (ALARA)/Containment

The practices used to reduce occupational exposures to workers are the normal application of ALARA concepts and Westinghouse Hanford Company (WHC) ALARA procedures. However, the purpose of this plan is to protect the environment surrounding the site from contamination.

The containment effectiveness is measured by its ability to keep contaminated dust particulate within the structure.

The containment is provided to control contamination. Contamination is the primary concern and the weighing factor is 5.0.

Discussion of Assigned Values - Containment Alternatives 1, 3, and 4 have comparable ability to retain internal contamination, and all are rated a 3.0. Containment 2 has the potential to release contamination into the environment as a result of the positive pressure used for its support, thus it rated a 2.0 (Table C.3).

Table C.3. Containment Alternatives Chart

Containment Alternative	Alternative No.	Raw Score	Weighing Factor	Weighted Score
Rigid Structure	1	3	5	15
Air Support	2	2	5	10
Arched Tension	3	3	5	15
Truss	4	3	5	15

Safety

Fire safety and structural integrity of the building in emergency conditions are the safety factors considered for containment selection. A weighing factor of 5.0 is used since the safety of the structure could affect the lives of the workers.

Discussion of Assigned Values - Alternates 1 and 4 have proven fire safety and structural integrity in emergencies and receive a raw score of 5. Alternate 3 is a tent-type structure with lesser fire resistance and structural integrity, thus it scored a 3.0. Alternate 2 was scored as a 1.0 because of the lack of structural integrity in emergencies and its potential as a fire hazard (Table C.4).

Table C.4. Safety Considerations

Containment Alternative	Alternate No.	Raw Score	Weighing Factor	Weighted Score
Rigid Structure	1	5	5	25
Air Support	2	1	5	5
Arched Tension	3	3	5	15
Truss	4	5	5	25

Cost

The basis for cost comparisons was limited to the results of reports WHC-SD-EN-ES-011 REV. 0 and WHC-SD-DD-ES-011.

Cost is considered to be of less significance than functional capabilities and safety, and was given a weighing factor of 3 (Table C.5).

Table C.5. Cost Scoring

Containment Alternative	Alternate No.	Raw Score	Weighing Factor	Weighted Score
Rigid Structure	1	2	3	6
Air Support	2	4	3	12
Arched Tension	3	3	3	9
Truss	4	2	3	6

Conclusion: The evaluation summary indicates that the rigid frame or truss frame structures would be the best structures for confinement (Table C.6).

TABLE C.6. Confinement Building Evaluation Summary

Containment Alternate	Sensitivity to Site Data	Sensitivity To Site Extreme	Alara/Confinement	Safety	Cost	Total
1. Rigid Structure	5.0	9.0	15.0	25.0	6.0	60.0
2. Air Support	0.5	3.0	10.0	5.0	12.0	30.5
3. Arched Tension	2.0	6.0	15.0	15.0	9.0	47.0
4. Truss	5.0	9.0	15.0	25.0	6.0	60.0
Weighing Factor	1.0	3.0	5.0	5.0	3.0	-

Table C.7 is the result of evaluating the various types of cranes that are of acceptable usage in a rigid- or truss-framed metal covered building. Accessibility to all areas of the building, availability, flexibility for future use on other projects, and cost of the crane system were items considered. Each area of concern was rated 1 to 10 with 10 being the best rating in relation to the crane system listed. The four categories for each crane was totaled and the one with the highest cumulative rating should be selected. Table C.7 indicates the mobile crane as best for usage in the confinement structure.

TABLE C.7. Crane Evaluation

Crane	Access- ibility	Avail- ability	Flexibil- ity	Cost	Total
Mobile	7	9	9	9	34
Gantry	8	4	5	3	20
Top Riding	9	5	2	2	18
Jib	1	6	2	7	16

APPENDIX D Estimate Summary

Table D.l. Procurement costs by Work Breakdown Structure item

Procurement By Item		Included in Estimate	Not Included In Estimate
2.0			
20 Lab analyses of samples		$ 22,500	
Double-wide office trailer (installed)		77,616	
20 x 20 metal building			$ 10,000
Locker room facilities			6,000
Lunch room facilities			6,000
40 Fresh air respirators			28,000
5-station Public Address system	(Est. $1000 ea)		5,000
Breathing air compressor to support 6 workers			6,000
Reciprocating Saw	($500)		500
Portable band saw	($500)		500
Handtools	($100)		100
100 Saw blades for stainless steel	($10ea)		1,000
2-10' long 3' by 3' glove box/hoods	(Est. $6000 ea)		12,000
1-2000 cubic feet per minute High-Efficiency Particulate Air vacuum units			5,000
1 Beta/gamma/alpha room air monitor unit with alarm			3,000
2 Air curtains, 8' by 8'	($800 ea)		1,600
2 Through the wall heat pumps and controls	($600)		1,200
1 Self-survey alpha meter			10,000
2 Complete assay systems sensitive to 1.0 Ci/g			14,000
Computer software and hardware for assay systems			3,200
55-gallon Drum roller			2,600
2 Drum hand trucks	($78)		144
12' long, 7' Drum lifting monorail system			4,500
2-5000 Cfm exhausters		300,000	
104 2' by 2' HEPA filters	($15)		1,560
Confinement building 60' by 80' by 58' inside clearance		150,000	
16' by 16' Power doors		5,000	
6 Exit doors		6,300	
Supply fan			5,000
Interlock controls for exhausted supply fans			6,000
SUBTOTAL		453,800	
SUBTOTAL			132,904
General & Administrative/Common Support Pool 33.3%			44,257
SUBTOTAL			177,161
CONTINGENCY 35%			62,006
TOTAL			239,167

Table D.l. (continued) Procurement by WBS item

Procurement By Item		Included in Estimate	Not Included In Estimate
4.0 Process-area piping equipment removal		$2,000	
Horizontal-vertical bandsaw			$ 6,400
Burial boxes (estimated to require 2 boxes)	($3,200)		6,750
Transuraic drums (estimated ten 55-gal drums)	($675 ea)		
5.0 Building Dismantling			
Lumber and plastic cover for open process hood 900 ft^2			$ 1,500
2 JLG or equivalent man basket			6,000
200 14" concrete blades	($12 ea)		2,400
20 Soil sample analyses		30,000	
11 Steel burial containers for 2,200 ft^3 for bulk LLRW	(16,000 ea)		176,000
6.0 Project Close Out			
Low Level Radioactive Waste containers included above			
SUBTOTAL		32,000	
SUBTOTAL			199,050
G&A/CSP 33.3%			66,284
SUBTOTAL			265,334
CONTINGENCY 35%			92,866
SUBTOTAL			358,200
TOTAL from Page 1			239,167
GRAND TOTAL			597,367

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