ENGINEERING CHANGE NOTICE

1. ECN 654022

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental ○ Direct Revision ◉ Change ECN ○ Temporary ○ Standby ○ Supersedure ○ Cancel/Void ○	Darryl Nelson, PFP Transition Engineering, H6-03, 373-2841	○ Yes ◉ No	August 19, 1999
	6. Project Title/No./Work Order No. Project W-460 Plutonium Stabilization and Handling (PuSH)	7. Bldg./Sys./Fac. No. 2736-ZB	8. Approval Designator E, S, Q, D
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) HNF-SD-W460-FDC-001, Rev. 0	10. Related ECN No(s). N/A	11. Related PO No. N/A

12a. Modification Work	12b. Work Package No.	12c. Modification Work Completed	12d. Restored to Original Condition (Temp. or Standby ECNs only)
○ Yes (fill out Blk. 12b) ◉ No (NA Blks. 12b, 12c, 12d)	N/A	N/A Design Authority/Cog. Engineer Signature & Date	N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change — 13b. Design Baseline Document? ◉ Yes ○ No

This revision of the Project W-460, Plutonium Stabilization and Handling (PuSH) FDC updates the approved FDC (Rev. 0). It has been revised in its entirety to reflect new direction to utilize the Savannah River Site Bagless Transfer System in lieu of the BNFL Bagless Transfer System.

14a. Justification (mark one)	14b. Justification Details
Criteria Change ◉ Design Improvement ○ Environmental ○ Facility Deactivation ○ As-Found ○ Facilitate Const. ○ Const. Error/Omission ○ Design Error/Omission ○	See 13a. The normal ECN documentation from FSP-PFP-0848, such as the Design Process Record and the Radiological Design Checklist are not appropriate for this FDC. The same holds true for the USQ process. Formal USQ and design documentation will be established throughout the Definitive Design stage.

15. Distribution (include name, MSIN, and no. of copies)	RELEASE STAMP
See attached distribution list.	SEP 02 1999 DATE: HANFORD RELEASE STA: 15 ID: 20

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): 654022

16. Design Verification Required	17. Cost Impact — ENGINEERING		17. Cost Impact — CONSTRUCTION		18. Schedule Impact (days)	
○ Yes	Additional ○	$ N/A	Additional ○	$ N/A	Improvement ○	N/A
◉ No	Savings ○	$ N/A	Savings ○	$ N/A	Delay ○	N/A

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specification	☐	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐
Conceptual Design Report	☒	Installation Procedure	☐	Component Index	☐
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐
Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐
Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
FSAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐
Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐	Tickler File	☐
Environmental Report	☐	Inspection Plan	☐	________	☐
Environmental Permit	☐	Inventory Adjustment Request	☐	________	☐

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number/Revision
HNF-SD-W460-CDR-001, Rev. 0		

21. Approvals

	Signature	Date		Signature	Date
Design Authority	P E Roege [signature]	8/19/99	Design Agent		
Cog. Eng.	D W Nelson [signature]	8/19/99	PE		
Cog. Mgr.	T E Huber [signature]	8/19/99	QA		
QA	S Zeller [signature]	8/19/99	Safety		
Safety	R R Allen [signature]	8/19/99	Design		
Environ.	J E Bramson [signature]	[illegible]	Environ.		
Other	L L Reed [signature]	8/19/99	Other		
USQ Eval	N/A DWN 8/1		FDH	[signature]	8/19/99
US Core Eval	N/A DWN				
W A Holstein Sr	[signature]	8/19/99	DEPARTMENT OF ENERGY		
R E Gregory	[signature]	8/19/99	Signature or a Control Number that tracks the Approval Signature	99-TPD-340	8/25/99
D J McBride	N/A [signature]	8/19/99			
H R Risenmay	[signature]	8-19-99	ADDITIONAL		
W F Russell(ADC)	[signature]	8-19-99			
T W Campbell	[signature]	8-19-99			
J C Sinclair	[signature]	8/19/99			

DISTRIBUTION SHEET

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Distribution	Darryl Nelson	Page 1 of 1
		Date 9/2/99
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Functional Design Criteria - Plutonium Stabilization and Handling Project W-460		ECN No. 654022

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
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FUNCTIONAL DESIGN CRITERIA - PLUTONIUM STABILIZATION AND HANDLING (PUSH) PROJECT W-460

Darryl W Nelson
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U.S. Department of Energy Contract DE-AC06-96RL13200

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Abstract: This Functional Design Criteria (FDC) contains information to guide the design of the Stabilization and Packaging Equipment necessary to oxidize and package the remaining plutonium-bearing Special Nuclear Materials (SNM) currently in the Plutonium Finishing Plant (PFP) inventory. The FDC also guides the design of vault modifications to allow storage of 3013 packages of stabilized SNM for up to 50 years.

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Page 1

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Functional Design Criteria - Plutonium Stabilization and Handling (PuSH) Project W-460

Change Control Record

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FUNCTIONAL DESIGN CRITERIA

PLUTONIUM STABILIZATION AND HANDLING (PuSH)

PROJECT W-460

Issued by:

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under Contract DE-AC06-96RL13200

August 19, 1999

for the
U.S. DEPARTMENT OF ENERGY
RICHLAND OPERATIONS OFFICE
RICHLAND, WASHINGTON

REVISED BY:

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Paul E. Roege, PFP Facility Engineering	8/19/99 Date
Fred R. Crawford, Director, PFP Project	8/19/99 Date

U.S. DEPARTMENT OF ENERGY:

U.S. Department of Energy, Richland Operations Office	8-25-99 Date

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PLUTONIUM STABILIZATION AND HANDLING (PuSH) FUNCTIONAL DESIGN CRITERIA

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

ALARA	As Low As Reasonably Achievable
BTC	Bagless Transfer Can
BTS	Bagless Transfer System
BWHC	B&W Hanford Company
CAM	Continuous Air Monitor
CCTV	Closed Circuit Television
C/S	Containment and Surveillance
CSER	Criticality Safety Evaluation Report
DA	Destructive Assay
DBA	Design Basis Accident
DBE	Design Basis Earthquake
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U. S. Department of Energy
ECO	Environmental Compliance Officer
EM-60	DOE HQ Environmental Management
FSAR	Final Safety Analysis Report
FDH	Fluor Daniel Hanford
FDNW	Fluor Daniel Hanford Northwest, Inc.
HLAN	Hanford Local Area Network
HEPA	High Efficiency Particulate Air
HNF	Document designator for Hanford Site after October 1, 1996
HQ	DOE Headquarters
IAEA	International Atomic Energy Agency
LANL	Los Alamos National Laboratory
LCU	Local Control Unit
LOI	Loss on ignition
LLNL	Lawrence Livermore National Laboratory
LLWTF	Low Level Waste Treatment Facility
MAA	Material Access Area
NDA	Nondestructive Assay
NMSTG	Nuclear Materials Stabilization Task Group
OAK	DOE Oakland Office
PFP	Plutonium Finishing Plant
PIV	Physical Inventory Verification
PHMC	Project Hanford Management Contract
PSE	Preliminary Safety Evaluation
Pu	Plutonium
PuSAP	Plutonium Stabilization and Packaging
PuSH	Plutonium Stabilization and Handling (Project W-460)
PVMP	Plutonium Vulnerability Management Plan
QAPD	Hanford Quality Assurance Program Description
RFETS	Rocky Flats Environmental Test Site
RL	U.S. Department of Energy-Richland Office
SGSAS	Segmented Gamma Scan Assay System

SISMP	Site Integrated Stabilization Management Plan
SNM	Special nuclear material
SPE	Stabilization and Packaging Equipment
SPS	Stabilization and Packaging System
SRS	Savannah River Site

FUNCTIONAL DESIGN CRITERIA

PLUTONIUM STABILIZATION AND HANDLING (PuSH)
PROJECT W-460

1.0 INTRODUCTION

This document provides the Functional Design Criteria (FDC) for Line Item Project RL-98-D-453, Plutonium Stabilization and Handling (PuSH), also known as Project W–460. The project consists of nine (9) major modules:

1. The Stabilization Module
2. The Bagless Transfer System (BTS) Module
3. The Inner Can Leak Test Module
4. The Outer Can Weld Module
5. The Outer Can Leak Test Module
6. The NDA Laboratory Modification Module
7. The Vault Modification Module
8. The Infrastructure Modification Module
9. The Operations Trailer Module

Modules 1, 2, 3, 4, 5, and 6 involve the procurement of Plutonium Stabilization and Packaging Equipment (SPE) and the installation of SPE in the 2736-ZB building at the Plutonium Finishing Plant (PFP) at the Hanford Site. The entire suite of equipment is referred to as SPE in this document where detailed description is not necessary. Module 7 involves the procurement of Heating, Ventilation and Air Conditioning (HVAC) and storage rack equipment for installation in the 2736-Z building at the PFP. Module 8 involves the modification of infrastructure elements to support the project. Module 9 involves the acquisition and installation of existing Hanford Site trailers for Operations personnel during operating campaigns. A key goal of the Project W-460 design is to balance simplification of the level of automation while minimizing worker dose.

Section 1.1 provides background information for Project W-460. Criteria contained in Sections 2.0 through 5.0 constitute the technical and functional requirements for design of Project W-460 project elements.

1.1 Background

The Hanford Site near Richland, Washington has completed its production mission and is now executing a new mission of environmental restoration. Part of the new mission is to stabilize and suitably store or dispose of all remaining plutonium-bearing Special Nuclear Materials (SNM) at the Site. Plutonium-bearing SNM is stored in the Plutonium Finishing Plant (PFP) Complex, a facility that formerly produced plutonium in metal shapes and oxide powder for defense purposes. The PFP is located in the 200-West Area on the Hanford Site, approximately 30 miles northwest of Richland, Washington. Much of the SNM inventory at the PFP is of solid form, consisting of plutonium metal or oxide, plutonium/uranium oxides of varying purity, and other plutonium compounds and forms stored in sealed packages in secure storage vaults.

The Defense Nuclear Facilities Safety Board (DNFSB) was chartered by the U. S. Congress to oversee safety-related issues at nuclear facilities. The DNFSB generated Recommendation 94-1, dated May 26, 1994, which calls for plutonium SNM stabilization and storage actions to be expedited. As part of response commitments, the U. S. Department of Energy (DOE) chartered the Nuclear Materials Stabilization Task Group (NMSTG) to manage the multiple tasks required to have all remaining fissile materials at DOE sites in safe storage.

The NMSTG formed several task teams of technical staff from all affected DOE sites; each task team is charged with solving a specific technical problem associated with the effort. One team compiled DOE Standard DOE-STD-3013-94, which contains technical guidelines for the stabilization and packaging of SNM containing greater than 50 percent by weight plutonium to be placed in long-term interim storage. The specific stabilization parameters and packaging configurations discussed in the Standard have been a subject of much technical discussion; a major revision of the Standard (DOE-STD-3013-96) was issued to address key changes determined necessary by users. This FDC will refer to the 1996 revision of the Standard as "3013" for brevity.

The Plutonium Stabilization and Packaging (PuSAP) task team was chartered to implement 3013 via a common DOE procurement of stabilization and packaging equipment as well as the packaging materials themselves. The PuSAP task team is led by staff from NMSTG with members from the Rocky Flats Environmental Test Site (RFETS), the Savannah River Site (SRS), the Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL) and the Hanford Site. The DOE Oakland Office (OAK) is acting as the contracting office for the procurement. Using a consensus approach, the team established requirements for a Pu Stabilization and Packaging (PuSAP) system. Procurement documents were issued via OAK, and a contract was awarded (DOE Contract DE-AC03-96SF20948, the PuSAP contract) to a team headed by British Nuclear Fuels Limited and Raytheon Engineers and Constructors. The contract includes design, construction and installation of a prototype unit at RFETS plus very similar units for SRS and Hanford, plus initial procurement of package components. The Hanford unit is referred to in this document as the baseline automated Stabilization and Packaging System (SPS).

In a December 22, 1998, memorandum from the Deputy Assistant Secretary for Nuclear Material and Facility Stabilization (EM-60), the SRS Operations Office and the Richland Operations Office (RL) were tasked with providing preliminary information to begin review of options for other stabilization and packaging options at the Hanford Site. This evaluation involved participation from a significant cross section of recognized program and technical personnel from key organization, including:

- DOE-RL, DOE Headquarters (HQ), DOE-OAK.
- Fluor Daniel Hanford (FDH), B&W Hanford Company (BWHC), Fluor Daniel Northwest (FDNW).
- Support from SRS, LANL, LLNL, and RFETS.

The evaluation team concluded that a Hanford-designed Stabilization suite and the use of the SRS Bagless Transfer System (BTS) in conjunction with outer can weld capability to produce a welded inner can and welded outer can is a viable, cost-effective alternative to the use of the baseline automated SPS. In addition, the use of this packaging alternative supports the Hanford Site technical baseline of shipping SNM to SRS for long-term storage in 3013 packages.

1.2 Purpose

Project W-460 will consolidate stabilization, packaging, and storage functions into a single location within the PFP facility, the 2736-Z Complex. This will allow eventual deactivation of other PFP facility areas while maintaining the functions required for safe storage.

Although PFP has an active program for stabilizing remaining inventories of SNM, the Site presently does not have the capability to package stabilized SNM into the welded containers specified by 3013. In addition, the container configuration designed and accepted to date is larger than that which is currently in use at the PFP and will not physically fit into the existing storage fixtures in secure vault storage at the PFP. Consequently, Project W-460 is comprised of several elements (Modules) that will fully implement the provisions of 3013 for SNM inventories of plutonium and plutonium/uranium oxides and will assist in complying with the commitments of DNFSB Recommendation 94-1 to stabilize and package SNM at PFP. Project W-460 provides stabilization, packaging, and vault modifications for SNM. In addition, support system and infrastructure modifications will be provided as part of this project.

1.3 Scope

Project W-460 is comprised of nine major modules:
(See Section 1.7 for a more detailed description)

- #1-Stabilization Module
  The basic function of the Stabilization module is to provide confinement, heat SNM to the temperatures specified in 3013, and fill a convenience can.

- #2-BTS Module
  The basic function of the BTS module is to provide confinement and to provide an inner welded container in accordance with the requirements of 3013.

- #3-Inner Can Leak Test Module
  The basic function of the Inner Can Leak Test module is to verify the inner welded container meets or exceeds the leak tightness requirements of 3013.

- #4-Outer Can Weld Module
  The basic function of the Outer Can Weld module is provide an outer welded container in accordance with the requirements of 3013.

- #5-Outer Can Leak Test Module
  The basic function of the Outer Can Leak Test module is to verify the outer welded container meets or exceeds the leak tightness requirements of 3013.

- #6-NDA Laboratory Modification Module
  The basic function of the NDA Laboratory modification module is to provide Non-Destructive Assay capabilities for 3013 packages.

- #7-Vault Modification Module
  The basic function of the Vault Modification module is to provide safe, secure vault storage locations in the 2736-Z Building to accommodate the 3013 packages.

- #8-Infrastructure Modification Module
  The basic function of the Infrastructure Modification module is to provide support systems to accommodate all the modules of the Project W-460.

- #9-Operations Trailer Module
  The basic function of the Operations Trailer Module is to house Operations and Operations Support personnel for the duration of operations in 2736-ZB.

1.4 Project Justification

Storage of plutonium SNM (metals or oxides of greater than 50 percent by weight plutonium) in a common package for 50 years of safe, stable storage is one of the key elements of the DOE program to stabilize nonreactor nuclear facilities across the United States. This key element is embodied in DOE Standard DOE-STD-3013-96. Although DOE standards are guidelines rather than compliance documents, the NMSTG has directed compliance with its provisions.

It will be necessary to modify the vault storage fixture configuration because the 3013 package designed to date is larger than the current PFP packaging configuration and will not fit into the current monitored storage pedestals in the PFP vaults. In addition, the 3013 Standard specifies a much higher design internal pressure than existing Hanford Site storage packaging, making certain existing safety and security equipment ineffective. Project W-460 will focus on an approach that minimizes the modification of existing storage areas within the PFP secure vaults rather than constructing an entire new facility to accommodate the 3013 packaging design. Care must be taken to simultaneously satisfy safety considerations along with both domestic and international security requirements.

A dose estimate (Vogt, 1996) prepared for PFP management has shown that worker radiological exposure will require careful management to remain within current occupational guidelines and meet facility environmental safety and health objectives during the stabilization and packaging work remaining at PFP. A key goal of the design will be to balance simplification of the level of automation while minimizing worker dose. Tools and automated approaches will be considered to minimize worker dose accumulations during transport and handling of 3013 packages. To minimize exposure during local transport within PFP, the SPE should be located within the same Material Balance Area (MBA) as currently used.

1.5 Site Location

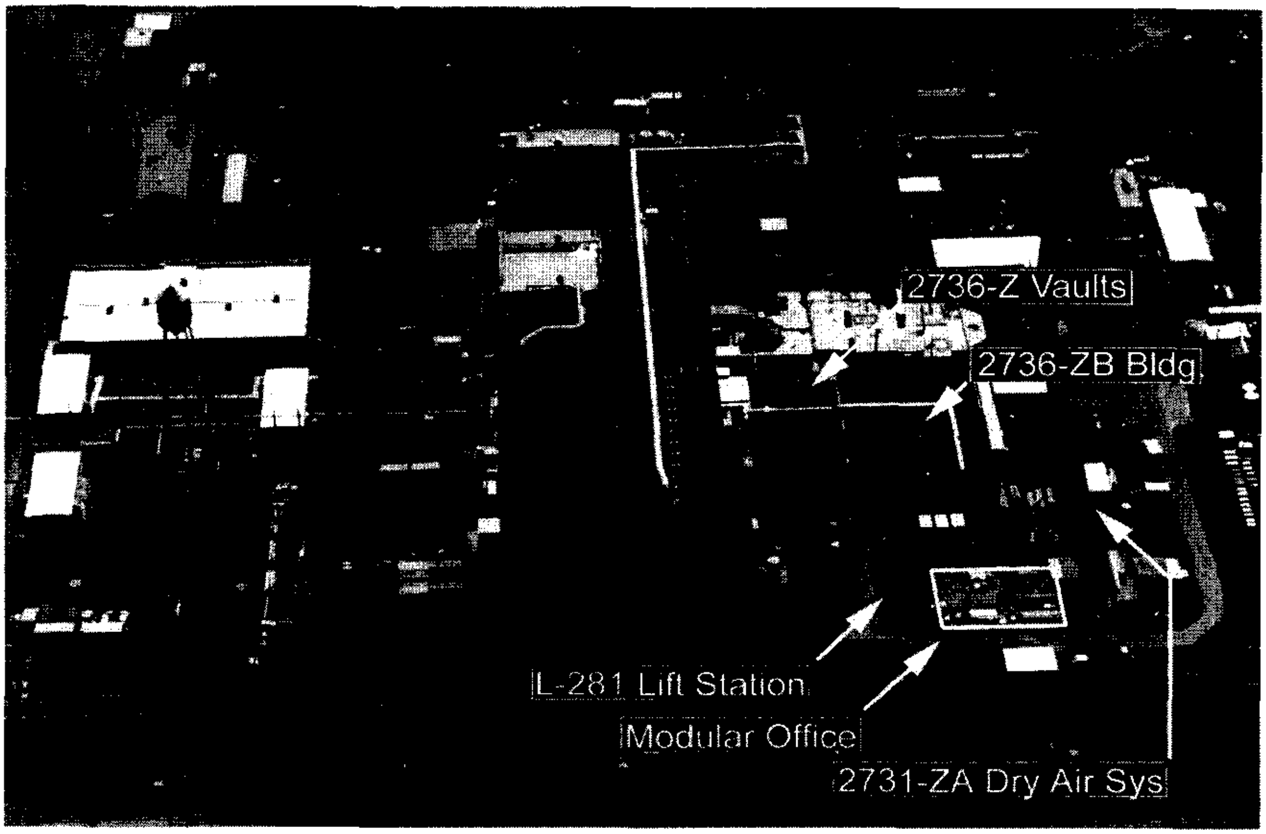
The SPE will be installed at the PFP facility. Preliminary evaluations have concluded that the SPE will be located in Rooms 641 and 642 of the 2736-ZB facility within the PFP Protected Area. Installation of the SPE will not disturb virgin ground. Ground will be disturbed for the installation of Module #9, Operations Trailer and for the installation of a back-flow preventer as part of Module #8, Infrastructure Modification. Preliminary evaluations have concluded that the Operations and Operations Support trailer will be located west of 2736-ZB within the PFP Protected Area. See Figure 1.

Several facility modifications to the 2736-ZB facility and the connected storage vault, the 2736-Z facility, will be required to install the SPE within the 2736-ZB facility and to modify the vault areas to accommodate the currently accepted configuration of the 3013 packages.

The processing system requires a significant amount of floor space to allow for adequate material separation mandated by criticality safety considerations and to allow for adequate workspace. The following specific site factors, as specified in SD-CP-TI-202, "*Location Assessment for the Plutonium Stabilization and Handling Process*", were considered in locating the SPE:

- Minimization of worker radiation exposure during processing resulting from background radiation levels and manual operations to as low as reasonably achievable (ALARA),
- Criticality safety,
- Security and safeguards,
- Cost and ease of installation of the SPE,
- Minimization of worker radiation exposure and manpower for transporting SNM to and from secure storage vaults and the NDA laboratory,
- Availability of plant services.

FIGURE 1



1.6 Project Integration

Integration of Project W-460 into national and Hanford Site activities will require a significant effort. Primary programmatic interfaces are briefly discussed below:

The BTS portion of Project W-460 will be coordinated through an intersite task order between RL and the SRS field office and a Memorandum of Understanding between BWHC and WSRC. An SRS Project Management Plan will delineate responsibilities and interface points for the BTS portion of Project W-460.

Resources and activities to support Project W-460 will be coordinated with other PFP stabilization and deactivation activities as planned by EP-0853, the Hanford Site Integrated Stabilization Management Plan (SISMP); a planning document which defines PFP activities necessary to stabilize and safely store the remaining plutonium at the Hanford Site. Project W-460 shall minimize interference with the completion of other DNFSB Recommendation 94-1 PFP stabilization and deactivation activities or safe maintenance of the PFP facility.

Project W-460 will be coordinated with Hanford Site capital projects. The most significant to Project W-460 is: W-420, *Stack Monitoring Upgrades.*

In addition to the usual domestic security considerations, international security shall be considered for all aspects of Project W-460 via DOE agreement with the IAEA. For instance, it is anticipated that some additional secure vault storage monitoring equipment will be required. It is also anticipated that the portion of the PFP inventory under IAEA safeguards be segregated during stabilization, packaging and storage operations.

Some reconfiguration of laboratory space, existing vault monitoring equipment, and other functions within the 2736-ZB Building will be required for installation and operation of the SPE and support equipment. The addition of an operations trailer with changerooms will provide the required space for operations personnel for the duration of SPE operation to stabilize and package the PFP inventory. SPE operational scenarios will be determined during definitive design.

1.7 Project W-460 Equipment and Process Description

Plutonium-bearing solids (~8000 items) containing greater than 50 weight-percent plutonium and uranium will be processed in a system designed to reduce the material to a oxide form (with the exception of alloyed and unalloyed metals) and to remove volatiles and moisture in preparation for safe, stable 50-year storage. The types of SNM to be handled in the Stabilization Module include the following:

- Plutonium Oxides
- Mixed Plutonium-Uranium Oxides (MOX)
- Alloyed and Unalloyed Metals (Packaging Only)

Note: Alloyed and Unalloyed Metals will be brushed in 234-5Z

Note: If the unirradiated fuel at Hanford is downloaded and requires packaging into 3013 containers for shipment to SRS, the SPE would be utilized. This effort is not within the scope of Project W-460 and will be scheduled so that it will not impact DNFSB Recommendation 94-1 activities.

The radionuclide content of materials to be processed is predominantly ^{239}Pu, with varying proportions of other isotopes of plutonium plus uranium. Some alloys contain other metals in small quantities. The distribution of ^{240}Pu in the inventory to be handled is approximately:

<4 % ^{240}Pu	~1% of total inventory
4-7 % ^{240}Pu	~40% of total inventory
7-16 % ^{240}Pu	~18 % of total inventory
16-19 % ^{240}Pu	~36% of total inventory
>19 % ^{240}Pu	~5% of total inventory

Incoming materials will be in a variety of container configurations and sizes (See Table 2). The SPE must be capable of receiving the majority of existing storage packages via a sphincter seal, with provision for an alternate receipt mechanism for unusual packages. As the PFP is actively stabilizing SNM prior to installation of the Hanford SPE and packaging those materials in alternate convenience cans, the SPE must be capable of moving the alternate convenience cans directly to the packaging area, bypassing the furnaces.

TABLE 2

DIMENSIONS OF SELECTED CONTAINERS USED AT PFP			
Designation	Type	Diameter	Height
Oversize Can (Outer)	Overpack, Crimp Seal	4.75"	6.75"
7-Inch Foodpack Can	Overpack, Crimp Seal	4.25"	7"
PUREX Secondary Can	Overpack, Crimp Seal	4.0625"	6.25"
Large Tomato Can	Overpack, Crimp Seal	4.25"	4.875"
Small Tomato Can	Overpack, Crimp Seal	4.0625"	4.625"
Hanford Convenience Can (Innermost can of the Hanford Convenience Can Package)	Material, Organic-Free Crimp Seal	3.4375"	8"
0.8L PUREX Slip Lid Can	Material, Slip Lid	3.4375"	5.625"
0.5L Slip Lid Can	Material, Slip Lid	3.5"	3.5"

A brief description of each of the Project W-460 Modules is provide below:

- #1-Stabilization Module
  The basic function of the Stabilization module is to provide confinement, receive Plutonium-bearing items, provide a waste pathway, open items, heat the item contents to the temperatures specified in 3013, test the material for stability, and allow for the placement of material into a convenience can. The Stabilization module includes an airlock, a Material Preparation Area (MPA), a Transport Area (TA), a Furnace Area (FURN), a Loss On Ignition (LOI) Area, and a Fill Area (FA). An evaluation team was convened to determine the optimum location to house the SPE (See Section 1.5). The team concluded that the SPE should occupy Rooms 641 and 642 in the 2736-ZB Building. Subsequent evaluations have concluded that the Stabilization module portion of the SPE should be placed inside Room 642.

- #2-BTS Module
  The basic function of the BTS module is to provide confinement in the upper portion of the BTS, receive filled convenience cans via the Stabilization Module, receive 7-inch foodpack cans via a sphincter port, enable the convenience cans to be placed into a container with a contamination-free exterior, fill the inner can head space with helium, weld a plug to the inner wall of the container, and then cut the middle of the weld while maintaining upper glovebox confinement. Included in this module is a closed-loop cooling system for the weld cable. Preliminary evaluations have concluded that the BTS module should be placed inside Room 642 in the 2736-ZB Building.

- #3-Inner Can Leak Test Module
  The basic function of the Inner Can Leak Test module is to receive an inner welded container (BTC) and verify the BTC meets or exceeds the leak tightness requirements of 3013. Radiological contamination check capability is also included in this module. Preliminary evaluations have concluded that the Inner Can Leak Test module should be placed inside Room 642 in the 2736-ZB Building.

- #4-Outer Can Weld Module
  The basic function of the Outer Can Weld module is to receive an inner welded container (BTC), place the BTC inside an outer container, fill the outer can head space with helium, place an outer container lid onto the container and weld the lid to the container in accordance with the requirements of 3013. Preliminary evaluations have concluded that the Outer Can Weld module should be placed inside Room 641 in the 2736-ZB Building.

- #5-Outer Can Leak Test Module
  The basic function of the Outer Can Leak Test module is to receive an outer welded package and verify the package meets or exceeds the leak tightness requirements of 3013. Radiological contamination check capability is also included in this module. This module also includes equipment and space to verify conformance of the weld to the requirements of 3013. Preliminary evaluations have concluded that the Outer Can Leak Test module should be placed inside Room 641 in the 2736-ZB Building.

- #6-NDA Laboratory Modification Module
  Project W-460 will modify the NDA Laboratory (Room 637 in the 2736-ZB Building). The functional requirements of the NDA Lab modifications are as follows:
  - Radiography of container contents
  - Isotopic Counters to accommodate 3013 containers
  - Assisted handling system to handle 3013 containers
  - Calorimeters to accommodate 3013 containers
  - Existing NDA equipment will require relocation

  Laboratory equipment for nondestructive assay (NDA) of 3013 packages will be purchased and installed in the 2736-ZB facility NDA laboratory, Room 637. Up to three calorimetry units will be purchased to accommodate the new package configuration and operation. The isotopic systems will operate under the current configuration. For waste measurements, the Segmented Gamma Scan Assay System (SGSAS) will be updated if required to handle SPE throughput rates. A radiography unit will be procured and space made available for it to determine each container's baseline. Site preparation for these items will be undertaken in a coordinated fashion to minimize disruptions to NDA laboratory operations.

- #7-Vault Modification Module
  Secure vault storage locations in the 2736-Z Building will be modified to accommodate the 3013 packages. A portion of the PFP inventory, under agreement with the IAEA, must be maintained physically separate from the rest of the inventory. The storage configuration will be determined based upon requirements of domestic and international security. Security equipment and data management configuration (seals, item-identification equipment, database connections, etc) will be modified as needed.

  Operational sequencing will be required to allow construction access while minimizing radiological dose to construction and operational workers and maintaining required physical security. Any temporary storage modifications will be designed, installed, and removed by Project W-460.

- #8-Infrastructure Modification Module
  Project W-460 will modify existing infrastructure support systems. Capacities of facility ventilation systems will be verified and enhanced if necessary. Configuration of the systems will be modified if necessary to provide appropriate separation of facility and process enclosure ventilation. New systems will be installed if no system currently exists. Addition of a new exhaust stack and associated compliant monitoring equipment should be considered in the design. The capacity of utilities and support systems required for operation of the SPE and of the modified vaults will be verified. Reconfiguration or enhancement may be required for existing utilities, such as electrical power. Utilities not currently available or of insufficient capacity at 2736-ZB such as helium gas, argon gas, or inert gas will be supplied by Project W-460. The Infrastructure Modifications Module is comprised of the following major items:
  Helium system needed for backfill and cover gas in the BTS and Outer Weld Modules
  Welding cover gases in addition to helium (argon cover gas applicability is being evaluated)
  Inert gas system for the glovebox atmospheres
  Room ventilation for added capacity
  Glovebox exhaust to maintain confinement
  New exhaust stack/monitoring with a tie-in to annunciator ANN-714
  Continuous Air Monitoring of the BTS welding enclosure
  Criticality detector installation
  Decontamination shower for personnel decontamination
  New back-flow preventer installation in the Fire System
  Plant Instrument air for pneumatic components
  120 VAC 60 HZ Power Supply System for general electrical service
  480 VAC 3-Phase 60 HZ Power Supply System

Surveillance equipment and international safeguards equipment currently in Room 642 must be relocated within the 2736-ZB facility to make room for the SPE.

- #9-Operations Trailer Module
  The Operations Trailer Module will house a minimum of thirteen (13) 2736-ZB Stabilization staff members. The Operations Trailer will have lunchroom, male and female changeroom, lavatory and shower capabilities for a minimum of thirteen (13) 2736-ZB Stabilization staff members. PAX, telephone and Hanford Local Area Network (HLAN) services will also be provided.

2.0 PROJECT PERFORMANCE REQUIREMENTS

General performance requirements are provided in this section. Section 6 provides detailed design criteria, where additional information adds value to the design.

2.1 Performance Requirements For Module #1-Stabilization

The Stabilization Module must:

- Be capable of providing four (4) convenience cans of 3013-compliant oxide to the BTS Module in a 24-hour period. This oxide throughput rate assumes furnace operation to stabilize previously unstabilized oxide.
- Provide the capability to prepare process waste streams for disposal and allow for removal from the module.
- Provide the capability to stage 3 foodpack cans in a fixed array awaiting handling.
- Provide the capability to open foodpack cans.
- Provide the capability to screen the oxide to remove foreign matter.
- Provide the capability to weigh the oxide to an accuracy of .01 grams.
- Provide the capability to mitigate contamination migration from the Material Preparation Area to the Furnace Area.
- Provide the capability to insert new components and remove failed components from the Material Preparation Area. The insertion area must accommodate the largest component which could fail.
- Provide the capability to accept foodpack cans.
- Provide equipment to maintain annual personnel exposure at less than 500 mrem per year (TEDE) and less than 15,000 mrem (skin and extremity) due to the stabilization operation.
- Meet nuclear material control and accountability requirements.
- Provide size reduction of the process material before entry and after removal from the ovens. The size reduction process shall produce a free flowing product that passes through a 10 mesh sieve.
- Provide two stabilization furnaces (with two compartments per furnace) that have control capability to easily vary the heating rate and provide hold time at different temperatures. The furnace shall be able to reach 950C in less than four (4) hours on heatup, soak for two (2) hours or more at 950C, and cool down to 25C in less than six (6) hours. The furnace shall be able to operate up to eight (8) continuous hours per cycle with an internal oxidizing atmosphere at >950C. The temperature of the furnace outer shell (accessible surfaces) shall never exceed 50C under any circumstances.
- Provide the capability to transfer furnace boats to and from the furnaces.
- Provide space for furnace boats to cool.
- Provide the capability to homogenize the oxide prior to material stability testing.
- Provide the capability to fill convenience containers for placement into the BTS Module.
- Provide the capability to crimp seal the convenience can prior to placement into the BTS Module.
- Provide one material stability testing furnace with the capability to heat the material to 1000C for one hour. The temperature of the furnace outer shell (accessible surfaces) shall never exceed 50C under any circumstances.
- Provide the capability to weigh the stability test sample (10 grams) to an accuracy of .01 grams.
- Provide rework capability, including opening of outer welded and inner welded containers.

2.2 Performance Requirements For Module #2-BTS

The BTS Module must:

- Produce twelve (12) inner welded containers (3013-compliant) in a 24-hour steady state operational period.
- Provide equipment to maintain annual personnel exposure at less than 500 mrem per year (TEDE) and less than 15,000 mrem (skin and extremity) due to the the inner can welding operation.
- Receive filled convenience containers from the Stabilization Module.
- Provide capability to directly receive and unload existing containers of solid SNM stored in PFP vaults.
- Provide the capability to open foodpack cans.
- Provide the capability to prepare process waste streams for disposal and allow for removal from the module.
- Provide capability to safely receive a convenience container into the staged BTC.
- Provide the capability to purge the inner welded can head space with helium after placement of the convenience can and maintain the helium atmosphere during the welding operation.
- Provide the capability to monitor the weld tip and the cutter wheel tolerances and alignment.
- Provide a welded inner container which meets the requirements of DOE-STD-3013-96.

2.3 Performance Requirements For Module #3-Inner Can Leak Test Module

The Inner Can Leak Test Module must:

- Provide capability to safely verify the inner welded can meets the requirements of DOE-STD—3013-96 for leak-tightness.
- Provide a location to check for radiological contamination on the exterior of the inner welded can.

2.4 Performance Requirements For Module #4-Outer Can Weld Module

The Outer Can Weld Module must:

- Produce twelve (12) outer welded 3013-compliant packages in a 24-hour steady state operational period.
- Provide the capability to ensure the outer welded can head space contains helium after the welding operation is complete.
- Provide equipment to verify conformance of the weld to the requirements of 3013.

2.5 Performance Requirements For Module #5-Outer Can Leak Test Module

The Outer Can Leak Test Module must:

- Provide the capability to safely verify the outer welded can meets the requirements of DOE-STD-3013-96 for leak-tightness.
- Provide a location to check for radiological contamination on the exterior of the outer welded can.
- Provide a location to verify conformance of the weld to the requirements of 3013.

2.6 Performance Requirements For Module #6-NDA Laboratory Modification Module

The NDA Laboratory Modification Module must:

- Provide an apparatus to assist the laboratory technician in the handling of the 3013 package.
- Provide laboratory equipment for nondestructive assay (NDA) of 3013 packages.
- Provide calorimetry units to accommodate the new package configuration.

- Provide upgrades to the segmented gamma scan assay system (SGSAS) to accommodate SPE throughput rates.
- Provide a radiography unit capable of determining container contents.
- Provide space for a radiography unit capable of determining container contents.

2.7 Performance Requirements For Module #7-Vault Modification Module

The Vault Modification Module must:

- Not increase the Safeguards and Security vulnerability of the facility.
- Provide shielded transport for 3013 packages from the SPE to the NDA laboratory or storage vaults in the 2736-Z Complex.
- Provide an apparatus to assist the operator in the handling of the 3013 package.
- Provide the capability to safely store up to 3000 full 3013 packages.

2.8 Performance Requirements For Module #8-Infrastructure Modification Module

The Infrastructure Modification Module must:

- Provide structures, systems and components to support the operation of the SPE.
- Provide HVAC to ensure adequate ventilation control during normal operations and Design Basis Accidents (DBA).
- Provide equipment to detect radiological contamination within the welding and cutting portion of the BTS Module.
- Provide radiological decontamination shower capability to 2736-ZB.
- Install new back-flow preventer in the Fire System
- Install new exhaust stack/monitoring equipment with a tie-in to annunciator ANN-714

2.9 Performance Requirements For Module #9-Operations Trailer Module

See Figure 1, Page 6

The Operations Trailer Module must:

- Provide the capability to accommodate a minimum of thirteen (13) 2736-ZB Stabilization staff members.
- Provide a lunchroom, changeroom, lavatory and shower capabilities for a minimum of thirteen (13) 2736-ZB Stabilization staff members.
- Provide PAX, telephone and Hanford Local Area Network (HLAN) capabilities.

2.10 Component Design Life

Design life requirements are for the stabilization and packaging equipment as well as the interface equipment. The equipment used for stabilization and packaging shall be capable of operating continuously 24 hours a day, 5 days a week for 7 years, and then intermittently for the following 13 years. After the PFP inventory is stored in 3013 packages, it is anticipated that the SPE will be needed to operate for a brief campaign once a year to accommodate safeguards requirements.

2.11 Materials of Construction

Materials of construction and equipment used in Project W-460 shall be compatible with the radiological and chemical environment to which they will be exposed for the specified design life of that component.

In several areas of the SPE, equipment and packaging materials will be exposed to high temperatures (up to 1200C [2192F]) and frequent thermal cycling. These materials shall be chosen for strength and dimensional stability at high temperature, resistance to corrosion, and high resistance to thermal stress cracking.

To the extent practicable, process hardware located inside SPE gloveboxes shall be fabricated of Type 300 series stainless steel, or a similar stainless steel with high temperature properties. Commercial stainless steel hardware may be used outside the glovebox.

Gasket materials for equipment shall be chosen as needed for low permeation, compatibility with air, argon, helium, and nitrogen. The design shall specify radiation-resistant gaskets and gaskets which are resistant to oil, if necessary.

Components contacting packaging elements shall be compatible with Type 316 stainless steel.

2.12 Required Availability

The equipment used for stabilization and packaging shall be capable of operating continuously 24 hours a day, 5 days a week for 7 years, and then intermittently for the following 13 years (see section 2.10). Support utilities shall be capable of operating for the same durations.

Facility support systems, i.e., ventilation, fire suppression, alarm functions, power and other utilities shall be capable of operating continuously 7 days a week, 24 hours a day, for 20 years. Redundant equipment shall be supplied to ensure continuous operation of certain vault safety and security equipment. Critical systems such as exhaust ventilation systems for contamination control and heat removal, safeguards and security monitors, and criticality alarms shall have backup power available. Design of critical systems shall be such that minimal scheduled maintenance outages are required.

2.13 Operability and Maintainability

Installation of SPE interfaces, laboratory equipment, and relocation of existing facility functions shall provide a safe, efficient, and secure system for personnel to operate and maintain.

Principles of human factors engineering shall be considered throughout the design of project systems. Instrumentation and controls shall have the capability of monitoring and controlling all parameters necessary for SPE long-term operations. Physical configuration and spacing of fixtures and equipment shall provide for ease of service and operational needs. As much as possible, the design shall utilize standard components that are currently utilized and readily available as spares.

3.0 PROCESS AND STORAGE CRITERIA

3.1 Stabilization and Packaging Equipment Support System Process Criteria

Process criteria for systems and components that interface with the SPE are described in this section.

3.1.1 Utility Interfaces for SPE

The following table indicates the utilities required for the SPE which are the responsibility of Project W-460 to design and install. Capacities for each utility shall be verified during definitive design.

TABLE 1. UTILITY REQUIREMENTS FOR THE SPE

Utility	Description	Utility Needs
1. Glovebox Ventilation Supply	This system supplies inert gas to most of the gloveboxes and pneumatic actuators.	A new inert gas system will be installed in the 2731-ZA building which will supply inert gas for pneumatic actuators, and glovebox atmospheres.
2. Glovebox Ventilation Exhaust	The exhaust system exhausts the gloveboxes and filters the ventilation flow with HEPA filters. The exhaust system maintains a negative pressure in the gloveboxes.	A new SPE process exhaust stack will be installed to accommodate the SPE glovebox exhaust ventilation system and the existing Room 636 glovebox exhaust.
3. Helium Supply	Helium is supplied to the process to fill the head space of the inner and outer containers for leak detection.	Helium bottles or a higher capacity supply will be installed outside the building to supply the required volume of gas.
4. Welding Gases	This system supplies argon for the BTS shroud gas during the TIG welding process. The shroud gas for the outer can welding module is TBD.	Argon bottles or a higher capacity supply will be installed outside the building to supply the required volume of gas.
5. 120 VAC Power Supply System	This system supplies electrical power to the glovebox system.	Spare breakers in the current system (room 602) could be used to supply the needs of this system.
6. 480 VAC Power Supply System	This system supplies electrical power to the muffle furnaces, LOI furnace, and radiography equipment.	The electrical feed to the 2736-ZB Building will have to be upgraded to handle this new load. A new electrical panel may need to be installed for distribution to the SPE.

It is likely that certain large flows will be intermittent, thus overall capacities will be analyzed for reduction at the start of definitive design.

3.1.2 Instrumentation and Control

The project shall tie into the existing centrally based utility control (MICON™) system for use with the SPE. MICON™ system programming and certification is to be performed by PFP personnel. The location of system controls for the SPE will be determined by Project W-460. The instrumentation and controls necessary to monitor and control operation of support systems for the SPE shall be controlled by the MICON™ control cabinet located in 2736-ZB, Rm 602. Where feasible, support system controls shall be incorporated with the SPE control system. Control panels should, where possible, be located at a sufficient distance from the gloveboxes and material handling operations to minimize radiological dose to operations staff.

The project shall provide instrumentation and controls necessary to monitor and control operation of the SPE. The project shall provide an operator console near the SPE at a sufficient distance from the gloveboxes and material handling operations to minimize radiological dose to operations staff.

3.1.3 Software and Video/Electronics

Any software utilized by support systems controllers shall be developed, acquired, and used in accordance with HNF-PRO-309, *Computer Software Quality Assurance Requirements* and HNF-PRO-310, *Computer Security Within the Procurement Cycle.*

For all Modules, (except Module #2 and Module #4), where software and video/electronics are provided by this project, a software Acceptance Test Procedure (ATP) will be written by the Architect-Engineering (A-E) company and approved by PFP Engineering. Module #2 and Module #4 software ATP's will be written by WSRC and the Module #4 vendor, respectively, and approved by PFP Engineering. PFP personnel shall witness the test. The software ATP shall test all software over the range of function, shall test the response to abnormal inputs, and shall specify an integrated test over the range of system operation. The A-E shall compile a test report to document the test results. Functional field tests will be conducted and an Operational Test Procedure (OTP) shall be written by PFP Engineering to exercise all hardware and software components utilized in the performance of the SPE; a test report shall be compiled by PFP Engineering to document the test results and shall be issued as a Hanford Site supporting document.

3.1.4 Piping and Vessels

Piping and vessels for SPE utilities and support systems shall be designed in accordance with applicable ASME codes and standards. All glovebox structures are designated Safety Significant. The safety classification of all piping and vessels inside the glovebox shall be determined in accordance with HNF-PRO-430, *Safety Analysis Program* and SD-CP-SAR-021, Rev. O-L, *PFP Final Safety Analysis Report* (FSAR).

Project W-460 shall provide for extensive cleaning of piping after construction, but before connection to equipment, to ensure the lines are free of foreign material. Flushes should include a detergent solution in turbulent flow to remove grease and carry away all particulate material followed by an extensive demineralized water rinse. Finally, the lines shall be completely dried using a dry nitrogen purge. The lines shall be capped until ready for connection to the equipment. Care shall be taken to prevent any foreign material from entering the system while making the connections.

Piping for the utility support system shall have a constant slope to ensure complete drainage when flushed.

3.2 Storage Vaults

Project W-460 will provide vault modifications to permit the storage of filled 3013 containers.

The modifications for storage will comply with the requirements for criticality control and industrial safety. If structural components are penetrated, the modification shall be seismically analyzed to maintain the current seismic performance of the facility.

3.3 Utility Services

Electrical power and refrigerated ventilation are required to service the vaults. Both utilities are available or can be made available from within the PFP facility. The definitive design for Project W-460 will determine what modifications will be needed within the PFP Complex utilities.

3.3.1 Electrical

The 2736-Z facility currently has two electrical panels (A and E). The power supply for the storage complex may require upgrading to meet capacity requirements and is within the Project scope.

3.3.2 Ventilation and Air Conditioning

The ventilation systems for the storage vaults, the new SPE process area and NDA laboratory will require modification to accommodate Project W-460. The modifications are within the Project W-460 scope. Ventilation system design for the vaults and for the process area will ensure both heat removal and contamination control. New components of the ventilation systems shall be designed in accordance with DOE Order 6430.1A, *General Design Criteria*, DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, DOE STD 1066-97, and ASME N509-1989, *Nuclear Power Plant Air-Cleaning Units and Components*. Existing ventilation systems may require upgrades as necessary to ensure adequate ventilation during normal operations and design basis accident (DBA) conditions. These upgrades are not within the scope of Project W-460. Any major new ventilation system components shall meet the current design requirements for new systems.

The total volume of air handled for the storage vaults shall be that which is required for continuous cooling and pressure zone segregation, and shall include the infiltration air from outdoors. Likewise, the air handled for the process area in the 2736-ZB Building shall be that which is required for continuous cooling and contamination control via relative pressure zones, and shall include the infiltration air from outdoors. The ventilation system shall provide enough airflow to maintain a comfortable work environment per DOE Order 5480.11, *Radiation Protection for Occupational Workers*.

For equipment supplied as part of Project W-460, sufficient redundancy and/or spare capacity shall be provided as necessary to ensure adequate ventilation during normal operations and design basis accident (DBA) conditions. Refer to Appendix A and SD-CP-SAR-021, Rev. O-L, *PFP Final Safety Analysis Report* (FSAR), Section 5.2.3.7, for a functional and physical description of the system. It is permissible that the ventilation systems fail to a static condition during a DBA, provided that each system remains physically whole to provide radiological confinement.

Storage conditions shall be in accordance with those prescribed in 3013, which may require enhanced mechanical chilling of makeup air.

3.3.3 Ventilation Zones

Facility ventilation for the 2736-Z Building Complex shall be zoned as specified in the PFP FSAR, Rev. O-L, Sections 5.4.1 and 5.4.1.1.7, with the new SPE process area in zone II. The pressure controller for zone II will be located in the SPE area. The differential pressures described shall be with respect to atmosphere and shall be considered minimum. Airlocks and other barriers shall be provided as required to separate zones to ensure ventilation balance and contamination control and to maintain pressure differentials. A minimum 31 Pa (0.125-in wg) differential pressure shall be maintained between adjacent zones.

Inlet filtration for process makeup air and 2736-ZB room makeup air shall be designed to enhance the flow of makeup air from outdoors while ensuring a minimum capture of dust under high-wind conditions.

Back flow of contamination from the contaminated SPE gloveboxes into the SPE process air supply system shall be prevented via back flow prevention or High-Efficiency Particulate Air (HEPA) filtration.

3.3.4 Vault Storage Capacity

A maximum of 4000 kg (8800 lb) plutonium in the form of oxides at 50 wt% Pu, totaling about 8000 kg (17,600 lb) bulk weight, needs to be stored in packages as described in 3013. The storage configuration is anticipated to be constrained by heat removal capacity and criticality controls.

3.3.5 Vault Storage Design

The vault storage design must meet Safety Class requirements, with particular emphasis on temperature, seismic and criticality controls. Criticality and required maximum long-term temperature conditions will determine the exact vault storage density.

Agreement with the IAEA is likely to continue the current specification that vault inventory under IAEA surveillance be kept physically separate from the rest of the PFP inventory, making it necessary to allocate an entire vault room for the IAEA material. The total number of rooms to be modified will be determined by allowable storage density.

4.0 FACILITY CRITERIA

4.1 Architectural and Civil/Structural

Design of components and systems to be installed in the 2736-Z Complex must not interfere with the seismic resistance of existing structures.

All construction, occupancy ratings, and existing building requirements will be governed by NFPA Codes.

Project W-460 shall provide calculations of the rate of heat rise during static vault conditions such as the aftermath of a DBA, in order to ensure that the structural design of vault storage fixtures provides convective cooling in case of a ventilation system failure prolonged for several weeks.

4.2 Heating, Ventilation, Air Conditioning

Background information on the existing heating, ventilation, and air conditioning systems in the 2736-Z Complex can be found in Appendix A.

Process ventilation for SPE equipment installed for Project W-460 shall exhaust to a new exhaust stack through three testable HEPA filtration stages in series unless only two testable HEPA filtration stages can be accommodated in the available space.

Project W-460 shall provide control connections to enable future complete ventilation system control (both automatic and manual) from the 2736-Z complex area, to facilitate eventual shutdown of the 234-5Z ventilation control room while the storage vaults remain operating.

SPE interface design shall include glovebox gas supplies (inert gas); process exhaust is to be provided by connection to a new exhaust system. Heat loading and zone control shall be evaluated in the definitive design stage of Project W-460. Room ventilation requirements shall be analyzed for adequacy. An evaluation will be required to ensure the existing exhaust system capacities and configurations are adequate for the increased density of containers in the modified vault storage rooms.

All nuclear grade filtration equipment and components will be constructed to American Society of Mechanical Engineers (ASME) N509 and tested to requirements of ASME N510.

The addition of several calorimeters and radiography to the NDA laboratory and the staging of 3013 packages, BTC's, and 7-inch foodpack cans in Room 638 may require a change in the capacity of refrigerated ventilation to these areas to effectively maintain a constant working temperature of 20C to 28C.

4.3 Utilities

Utility support services to the gloveboxes shall comply with *DOE/RLID 5480.7A, Glovebox Fire Protection Criteria*. The following new or enhanced utility supplies are required for SPE operation:

- Helium System (for container backfill in the BTS and Outer Weld Modules),
- Inert Gas System (for the Stabilization and BTS Modules),
- Room ventilation (existing and additional HEPA filters),
- Ventilation Exhaust System from Gloveboxes,
- Welding Gases (argon and helium for welding),
- Plant Instrument Air System (for some instruments and pneumatics),
- 120 VAC 60 HZ Power Supply System,
- 480 VAC 3-Phase 60 HZ Power Supply System,

4.3.1 Process Water

Closed loop cooling is required for the BTS TIG welder cable, using a non-hazardous recirculating fluid. Water for fire suppression (ie., room sprinklers) is available via existing supply lines to the building fire suppression sprinkler pipe system. Corridor 625 has a 50 mm (2 in.) pipe with up to 757 lpm (200 gpm) capacity.

There are no direct connections to the 243-Z Low Level Waste Treatment Facility (LLWTF) from 2736-Z/ZB facilities. The design should not introduce any liquid process waste which cannot be removed from the facility in a batch-wise method.

4.3.2 Electrical

Electrical supply capacity shall be evaluated by the definitive design. The SPE requires 120 volt single phase and 480 volt three phase power. If required, the 480 volt three-phase power supply to 2736-ZB will be upgraded to accommodate the loads added by Project W-460 and to provide 10% spare capacity for future load additions to 2736-ZB. The capacity requirements for each feed will be determined during definitive design. The electrical power supply evaluation shall include an evaluation of the existing metering data, alternatives of transferring power for external loads (such as air conditioners 1, 2, and 3 and 2736-ZC) to a separate power source, and reducing peak demand requirements for intermittent loads such as welding equipment. Uninterruptible power requirements shall fulfilled by utilizing the existing UPS in room 623 unless adequate capacity is not available.

The upgraded power supply shall have a single 480 volt, three phase, normal power feed from site electrical distribution and a single 480 volt, three phase, back-up power feed from 2721-Z. At the point of connection to the 2736-ZB power distribution system, power feeders for the SPE shall meet the requirements of IEEE-591, *"IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems."*

4.3.3 Lighting

The existing building lighting system will provide basic room lighting for the SPE installation and operation. Any additional task lighting will be determined and added during the definitive design stage. Temporary lighting for construction will be provided on an as-needed basis. Modifications of task lighting may be required in the storage vaults, depending on storage fixture configuration and security requirements.

4.4 Communications Systems

Specific communication system components in the SPE operating area will be specified during definitive design. These components will include an intercom, private automatic exchange (PAX) phone for internal use, a public telephone, and a tie-in to the PFP talk-box system. Due to rearrangements in various facility work spaces, all communications systems now located in the 2736-Z complex shall be analyzed for adequacy and modified as necessary.

4.5 Automatic Data Processing

Any new automatic data processing desired will be incorporated into the SPE operating control system or the NDA laboratory control computers, as required. The automatic data processing shall, at a minimum, process and retain data required by DOE-STD-3013-96 and shall be exportable to standard spreadsheet programs. The automatic data processing shall have reserve capacity to process and retain additional process control information. Data removal will be by media such as diskette or removable hard drive for subsequent analysis.

4.6 Energy Conservation

The design of Facility modifications will implement sensible energy conservation measures to the extent that it does not adversely affect system reliability, maintainability, project costs, maintenance costs or life cycle costs.

4.7 Maintenance

All facility modifications and equipment shall be designed to permit routine maintenance activities and reduce the need for specialized equipment wherever practical and cost effective. Operating systems shall minimize exposure to hazardous or radioactive environments. ALARA practices shall be incorporated into all design for the maintainable and replaceable components as well as all maintenance activities. Equipment selections should be standard components whenever possible.

Mechanical and electrical systems shall be easily maintainable as defined by the demonstrated replacement of wear-critical parts within two hours. Space shall be provided adjacent to all equipment and confinement systems to allow easy access for maintenance.

5.0 GENERAL REQUIREMENTS

Federal, State, and local laws and regulations, and DOE orders and standards, in effect at the start of the design shall apply to the extent specified in the *Plutonium Finishing Plant Standards/Requirements Identification Document*, SD-MP-SRID-003 (S/RID) Rev. 1. International agreements applicable to the PFP in place at time of publication of this document are also listed. Additional agreements may be negotiated during the detail design and implementation of Project W-460.

5.1 Safety

5.1.1 Safety Classifications

Preliminary safety analyses have concluded that the filtration, seismic, criticality, and off-gas monitoring components and systems of the vault storage rooms, the NDA laboratory and the SPE are Safety Class. The SPE gloveboxes are Safety Significant. As part of the scope of Project W-460, a draft PFP Safety Equipment List will be submitted during the definitive design to include the systems, structures and components installed and modified by Project W-460.

5.1.2 Criticality

All structures, systems and components shall be designed, fabricated and operated to remain sub-critical for all fissile materials to be stabilized or stored in PFP. Since there is a potential for critical concentrations of fissile material in the SPE and in storage areas, criticality analyses shall be provided. All storage units, equipment, vessels, and piping shall be engineered to prevent criticality without the use of nuclear poisons. Project designs shall conform to requirements listed in HNF-PRO-537, *Criticality Safety Control of Fissionable Material.*

As part of the scope of Project W-460, the Criticality Safety Evaluation Reports (CSER) for the storage vaults and NDA laboratory shall be updated to reflect modifications and new equipment configurations. A separate CSER shall be provided for the SPE and related equipment.

The 2736-ZB criticality detectors shall not be moved from their present locations.

5.1.3 Safety Analysis

The current revision of the PFP FSAR (Rev. O-L) limits the plutonium inventory in certain portions of the facility. Preliminary analysis shall be performed during the definitive design to verify whether the addition of the SPE would change the possession limits and whether criticality limits to be applied to the project would affect the PFP Authorization Basis.

A Preliminary Safety Evaluation (PSE) was completed in conjunction with the original Project W-460 conceptual design. An analysis shall be performed to ensure that the scenarios in the PSE are still applicable and that there are no new scenarios resulting from the project's new mode of execution. Detail descriptions, accident analyses and descriptive changes to the FSAR shall be completed prior to acceptance of the completed project.

5.1.4 Contamination Control

All structures, systems and components designed for the SPE portion of Project W-460 shall confine contamination to the vicinity of the source and minimize contamination spread. Gloveboxes shall be designed such that during glovebox waste removal activities, contamination levels can be verified before removal from confinement. Glovebox confinement shall be achieved by ventilation control (differential pressure), by directing air from uncontaminated areas toward areas of higher contamination, by High-Efficiency Particulate Air (HEPA) or equivalent filtration or equivalent back flow isolation, and by the use of airlocks. Contamination migration by airflow within the SPE shall be minimized.

5.1.5 Radiation Exposure

The maximum annual exposure to a facility worker from all sources must not exceed the cumulative limits set forth in 10 CFR 835, *Occupational Radiation Protection*, and in HSRCM-1, *Hanford Site Radiological Control Manual*, summed over all controlled access areas. The radiation exposure of each operations worker is limited to no more than 1.0 rem per year, with administrative controls (HSRCM-1, Article 212) and a worker monitoring program which provide hold points starting at a cumulative exposure to any worker at 0.5 rem. Where necessary, shielding shall be provided to maintain personnel radiation exposure levels ALARA as governed by 10 CFR 835, Subpart K, and DOE Order 5480.11, *Radiation Protection for Occupational Workers*. Guidelines for achieving exposure levels that are ALARA are contained in PNL 6577, *Health Physics Manual of Good Practices for Reducing Exposure to Levels that are as Low as Reasonably Achievable* (ALARA), DOE STD-1128-98, *Guide to Good Practices for Occupational Radiological Protection in Plutonium Facilities* and DOE/EV/1830.T5, *A Guide to Reducing Radiation Exposure to As Low As Reasonable Achievable (ALARA)*. The source term used for shielding design should be the maximum expected during normal operation. Source terms which may develop in operating and storage areas shall be considered in the design. The minimization of background radiation levels shall also be considered in the design.

Maximum annual dose limits to the public as a result of PFP operations shall be in accordance with SD-CP-SAR-021, *PFP Final Safety Analysis Report*.

Where there is potential for airborne contamination, allowance shall be made for internal deposition of radionuclides in determining the total dose. Maximum allowable airborne contamination levels are provided in HSRCM-1.

There are varying levels of Americium in-growth in the plutonium stored at the PFP. For the calculation of radiation exposures, 85 g Am-241 per 5 kg of Pu oxide should be assumed as an average concentration.

Consideration shall be given to maintenance and decontamination activities associated with a given design option. Design shall be planned to confine total per capita worker radiation exposure to less than 500 mrem annually. Exposure rate limits apply at points where personnel are located during a particular maintenance or decontamination activity as opposed to general areas. Access categories may be temporarily changed when required for maintenance and decontamination.

5.1.6 Industrial Safety

Project W-460 industrial safety hazards will be identified in the project's Hazard and Operability (HAZOP) study. The identified hazards will be eliminated or reduced through implementation of safety and health standards, policies and procedures in the Occupational Safety & Health Topic under Project Hanford Policies & Procedures.

5.1.7 Industrial Hygiene

Design and construction shall ensure compliance with applicable industrial health and safety standards (29 CFR 1910 and 29 CFR 1926), policies and procedures in the Occupational Safety & Health Topic under Project Hanford Policies & Procedures. Design and construction shall also ensure compliance with the most recent consensus standards applicable to occupational safety and health (e.g. ACGIH Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices).

5.1.8 Fire Protection

Facility modifications (including vault equipment) shall be designed in accordance with DOE/RLID 5480.7A, *"Fire Protection"*. The exception is that glovebox and glovebox fire detection and suppression systems shall be designed in accordance with DOE-STD-1066-97 *DOE Standard Fire Protection Design Criteria*, Section 15; and applicable NFPA standards, including NFPA 801, the standard for Facilities Handling Radioactive Materials.

Overheat detection shall be provided in all gloveboxes, spaced at a maximum of 8 feet apart. Areas of ambient heat will require the proper temperature heat detector. Automatic fire suppression shall be required if the atmosphere within a glovebox contains more than 4 percent oxygen.

The fire-fighting category for areas of the 2736-Z complex modified by Project W-460 shall be analyzed and updated during definitive design.

5.1.9 Container Surveillance During Storage

The laboratory equipment required for safeguards also supports a safety function for surveillance of packages in storage. In addition, since existing means of verifying the absence of package pressurization are not suitable for use with the 3013 packages, space for a radiography unit capable of verifying the physical condition of package contents will be required. Site preparation for these items will be undertaken in sequence to minimize disruptions to the NDA laboratory operations.

5.2 Environmental Protection and Compliance

A Notice of Construction shall be prepared and submitted to the State of Washington Department of Health and the U.S. Environmental Protection Agency prior to construction. All work that will be performed that has the possibility of radiological or non-radiological emissions shall be brought to the attention of the PFP gaseous effluent cognizant engineer and the PFP Environmental Compliance Officer (ECO).

The installation of the SPE will result in the addition of a new exhaust stack and be designated under the 40 CFR 61, *National Emission Standards for Hazardous Air Pollutants (NESHAP)*. The stack monitoring equipment will meet the requirements of 40 CFR 61, Subpart H. Stack monitoring equipment required solely because of this designation will be within the scope of Project W-460 and will be consistent with Project W-420 Stack Monitoring System Upgrades.

All solid waste that will be generated during installation and operation of the SPE shall be reviewed by the PFP solid waste engineer and disposed of in accordance with PFP waste handling procedures.

No services are currently provided for treating industrial wastewater discharges from 2736-ZB. The closed loop cooling liquid for the BTS TIG welding cable may constitute a potentially contaminated liquid stream. Project W-460 must make provisions for the transport of the liquid to the 243-Z facility for treatment prior to discharge to the Treated Effluent Disposal Facility.

The Plutonium Finishing Plant Stabilization Environmental Impact Statement provides basic National Environment Policy Act (NEPA) documentation for Project W-460. However, a review will be conducted to verify any supplemental analysis needed for operation of the systems installed by Project W-460.

A cultural resource review has been completed for PFP stabilization activities. The Memorandum of Agreement to Mitigate the Historical Significance documentation for the Plutonium Finishing Plant complex has been approved by the Department of Interior. No further review is required.

5.3 Safeguards and Security

While the overall amount of SNM in the storage vaults will not change appreciably due to Project W-460, the type, quantity and distribution of SNM in 2736-ZB is likely to change from current levels. Both the SPE and the NDA laboratory will contain Safeguards Category I types and amounts of SNM during stabilization and packaging operations which will require changes to physical protection and certain security boundaries.

The processing of SNM requires physical protection as outlined in the Department of Energy orders: DOE 5632.1C *Protection and Control of Safeguards and Security Interests* and DOE 6430.1A *General Design Criteria.* Material tracking and accountability requirements are provided in the Department of Energy order DOE 5633.3B *Control and Accountability of Nuclear Material.*

For purposes of safeguards related design and operations, an SPE Processing Area will be defined as the contiguous area consisting of rooms 638, 641 and 642. The boundaries will be defined by the North, East and West walls of room 638; the East and West walls of room 641; and the South, East and West walls of room 642.

The storage vaults, laboratory and the SPE Processing Area will be contained within the existing 2736-Z Building Material Access Area (MAA). Access to the MAA and storage vaults will be controlled by the protective force and central alarm station. The MAA and vault doors are equipped with balanced magnetic switch sensors. The interior and exterior of the MAA vault doors are monitored by Closed Circuit Television (CCTV) cameras.

Authorized access into the SPE Processing Area (including the control room), the laboratory and the storage vaults will be controlled by enforcing a "two person rule" system. The two-person rule will ensure that at least two knowledgeable people in the Personnel Security Assurance Program are in the area when work is in progress.

From a safeguards perspective, consideration should be given to the separation of material storage room 638 from operation rooms 641 and 642 via a wall which meets vault boundary requirements, including the area above the dropped ceiling in each room. The existing wall between 638 and 641 is stud and drywall construction that does not meet requirements for a vault room.

A security vulnerability risk analysis for this area will be included as part of a routine annual update and is not included within the scope of Project W-460.

5.3.1 Safeguards Material Control and Accountability

5.3.1.1 Stabilization and Packaging Equipment

Capability shall be provided for all necessary nuclear material accounting data generated by the SPE to be transmitted to the PFP nuclear material accounting system. This may be accomplished via remote or manual instrumentation, and/or provision for manual collecting of data.

Capability for clean out or measurement of holdup and scrap nuclear materials shall be a design feature of any equipment provided by Project W-460 which will directly contact SNM, in particular the SPE. The design must accommodate daily administrative checks and a physical inventory every 2 months, with a limit-of-error for inventory differences of less than the smaller of a Category II quantity of special nuclear material or 2% of total throughput and active inventory.

Provision shall be made for access to appropriate nuclear material measurement systems to ensure compliance with domestic safeguards limit-of-error for SNM inventory difference requirements. An SNM safeguards statistical analysis shall define and allocate acceptable uncertainty values to each component of the measurement system.

Package components and the completed packages shall meet safeguards requirements for Category I types and amounts of SNM. Pertinent safeguards concepts embodied in the design of the 3013 package include a permanent and unique item identification number, an inherent tamper-indicating design, and a physical structure which permits accurate NDA of the contents.

Support capabilities shall be provided to permit appropriate sampling for destructive analysis prior to packaging, as well as the opening and repackaging of 3013 packages. Both domestic and international safeguards may require sampling on a periodic basis during processing; it is not yet clear whether sampling for destructive analysis will be required during periodic SNM inventories after processing. The requirement for sampling includes provision of a means to ensure that particles in the batch to be sampled are relatively uniform in nature (if the material is not a powder, a crushing device will be needed) and well-mixed (requires a blender) and a balance which is accurate per safeguards standards plus a means of transferring the sample away from the sampling area to the laboratory.

5.3.1.2 Plutonium Storage Vault

Existing safeguards vault instrumentation is incompatible with the 3013 package; all items shall be analyzed and functions continued via modifications as required by DOE Order 5633.3B. Near real time container identification, tamper indication, and nuclear material verification are required to support domestic safeguards inventory requirements. As feasible, there shall be no permanently installed active equipment elements within the storage vault rooms. Passive elements are acceptable, provided no maintenance is required. Active elements include electrically powered sensors and equipment, equipment with moving parts, and similar equipment. This requirement is imposed to allow operation of the vaults without entry for maintenance.

The vault fixture design shall permit the removal of containers from storage locations for repackaging, sampling, or measurement for domestic or international safeguards purposes. 3013 package temperature, weight and dose rate will dictate whether container handling will be manual or remote and will be decided during definitive design.

5.3.2 Interface with International Atomic Energy Agency

Storage of a portion of the PFP SNM inventory is maintained under an agreement between the United States and the IAEA per *IAEA Information Circular/288*. Packaging and storage conditions for these materials are specified *Safeguards Criteria*, TS-No.#3, 1994-04-15, an agreement between the United States and the IAEA.

Where possible, project design shall take into account measures which would allow joint IAEA and operator use of vault inventory measurement and surveillance equipment. Specific design requirements relating to this concept shall be developed during discussions between the IAEA, contractor safeguards, and the design agency prior to finalization of the definitive design.

Containment and Surveillance (C/S) requirements of the IAEA shall be met in the storage vault design per IAEA Technical Standard TS-No.3. "Containment and Surveillance" is a specialized security term that embodies physical measures to keep nuclear material secure (containment) and to detect the presence of specific nuclear materials in a specific location (surveillance). The IAEA requires Dual C/S for storage vaults under their purview, ie. for each location, two independent methods of containment and two independent methods of surveillance are employed as a check and balance. As feasible, Triple C/S features shall be included in the vault design to ensure that Dual C/S can be maintained at all times, even during failure of one method of either containment or surveillance. The assurance of Dual C/S can reduce the cost of future IAEA safeguards activities by taking advantage of rules which permit less frequent and less intensive inspections if these measures have been maintained between inspections by the IAEA.

5.4 Natural Forces

The PFP Vault Storage Facility, Building 2736-Z, was designed to Hanford Plant Standards (DOE-RL 1989) and the UBC of 1967 for seismic resistance. The 2736-ZB building was designed to Hanford Plant Standards (DOE-RL 1989) and the UBC of 1976 for seismic resistance. As the 2736-ZB building is the primary confinement barrier, the SPE will not be designed to be the primary confinement barrier. The SPE will be safety class structurally for criticality control during a seismic event but is not required to maintain confinement..

The PFP FSAR contains restrictions on the quantities of plutonium that may be released in a seismic event. The PSE will verify if any other natural phenomena events need be compensated for in the designs for Project W-460. All plutonium handled outside of the SPE shall be contained as required for storage vault items. Design of SPE interface items, laboratory and storage components shall ensure that no component jeopardizes the facility classification.

All other equipment shall be secured as required by the NFPA revision in effect at the time of construction. The project is anticipated to be within the analyzed bounds of the PFP Authorization Basis for natural phenomena.

5.5 Design Format

Drawings that interface with existing PFP facility drawings shall provide traceability to these existing drawings by identifying the affected Hanford drawings in accordance with HNF-PRO-1819, *PHMC Engineering Requirements*.

Modifications which affect the accuracy or completeness of any Essential Drawing identified in H-2-99480, *PFP Essential and Support Drawing List*, shall require that revision of the affected Essential Drawing be completed by the Project.

Equipment Component Identifier numbers designated for new equipment shall be defined in accordance with SD-CP-RD-024, *Component Identifying Standard for the PFP*. Labels shall be installed in accordance with drawing H-2-89710 "PFP Labeling Standard."

5.6 Quality Assurance

Quality Assurance and Quality Control services shall be provided for design specification, design, materials procurement, fabrication, installation and acceptance testing activities. Quality Assurance Program requirements are derived or based upon HNF-MP-599, *Project Hanford Quality Assurance Program Description (QAPD)*, which defines the implementation of 10 CFR 830.120, *Nuclear Safety Management Quality Assurance* for PFP as it is designated a non-reactor nuclear facility. ASME NQA-1-1994 may be used to implement 10 CFR 830.120.

Reviews, Inspections, and other Oversight services shall be supplemented with any additional services defined by the designers and fabricators as being essential to assuring the adequacy of the design conformance of "as-installed" with the design requirements. Physical work performed On-Site and Off-Site shall be performed in accordance with a QA Plan (QAP), approved prior to contracted work, which shall implement 10 CFR 830.120. The QAP of an Off-Site vendor shall be approved by the designated Hanford contractor prior to the start of definitive design.

Fire system materials shall be procured and inspected as Quality Level 3 in accordance with HNF-PRO-259, *Graded Quality Assurance*.

5.7 Decontamination and Decommissioning

All structures, systems and components shall be designed to limit dispersion of radioactive materials, and facilitate decontamination and decommissioning or reuse. All internal surfaces should be finished (ground, polished, etc.) to facilitate decontamination. Within the glovebox, cracks, crevasses and corners shall be minimized to facilitate decontamination. Components anticipated to contact radionuclides should be designed for easy disassembly using common tools, to the extent practical. Disassembled components should be compact enough to fit in an existing type of disposal package such as a 208 liter (55 gallon) drum. Auxiliary equipment that has no requirement to be placed in a surface contamination area should be located in a buffer zone if practical.

5.8 Human Factors Considerations

Human factors engineering shall be considered for all phases of design in Project W-460.

Operation of the SPE shall be primarily monitored and controlled from a remote control interface (computer) in a single location, as feasible. This location will be within view (either direct or via camera) of the SPE but in a location to limit personnel exposure to ALARA.

All interface/workstations shall allow for varying staff ergonomics and shall be sealed as feasible to allow for easy decontamination.

All hand-operable equipment shall be positioned such that it can be seen by the operator during manipulation. Any support equipment requiring operation while in the SPE operating room must be easily accessible (if within a glovebox, from glove ports) to allow for maintenance. As much as possible, hand-operable equipment shall be consolidated in a minimal number of gloveboxes to expedite operations.

Both intercom (PAX) and normal telephone lines shall be within several feet of any control interface/workstation.

The connection of an electronic database to the operator console shall be evaluated and determined by PFP Process Engineering during definitive design.

5.9 Testing

Acceptance and operational testing of all Project W-460 modules shall be in accordance with approved Acceptance Test Procedures (ATP) and Operational Test Procedures (OTP). Operational testing of the SPE may be conducted using surrogate material for plutonium oxide, such as cerium oxide or tungsten oxide, to be determined by PFP Process Engineering. The A-E shall ensure that all required testing apparatus connections are specified and included to support the referenced testing.

6.0 Project Performance Characteristics

6-A SPE Performance Characteristics

6-A.1 Stabilization and Packaging Equipment

SPE-1 In any 24-hour period during steady state operations, the SPE shall be capable of providing the following throughput values: four (4) DOE-STD-3013-96-compliant packages of previously unstabilized oxide plus twelve (12) DOE-STD-3013-96-compliant packages of convenience can oxide packages which were previously stabilized to DOE-STD-3013-96 temperature criterion.

SPE-2 SPE design shall minimize waste generation during operation and maintenance.

SPE-3 The SPE shall be capable of maintaining nuclear material control and accountability of process materials and waste streams which are part of, or generated by, operations within the system.

SPE-4 The SPE internal components shall be capable of consistent, successive operation through the wall of a contaminated glovebox.

SPE-5 The design of the SPE handling and processing equipment shall consider the pyrophoric and chemical reactivity of actinides.

SPE-6 Provision shall be made for handling fine powders to avoid dissemination of significant quantities in system confinement enclosures and the spread of contamination through associated ventilation duct work.

SPE-7 The SPE shall be designed to meet safety requirements for Performance Category-3 and System Group II (e.g., equipment must maintain structural and pressure boundary integrity but need not remain functional during and after a natural phenomena event).

SPE-8 All structures, systems and components shall be designed to resist applicable loading including dead weight, operating (thermal, vibration, live loads, and environmental loads, as applicable) and seismic hazard loading. Provisions of DOE-STD-1020-94 shall be used for application of loads due to seismic hazards, except that a ductility factor of 1.0 shall be used and design stresses shall not exceed code allowables.

Load combination shall be analyzed for the design basis earthquake (DBE) used in the PFP FSAR, Rev. O-L. The dynamic approach shall be used for seismic analysis of the SPE per DOE-STD-1020-94. The calculated forces shall then be applied to the system or equipment statically in order to estimate the demand.

SPE-9 The SPE design shall accommodate fixed array positions for retaining of SNM during unattended periods.

6-A.2 Receipt of Nuclear Material

RA-1 The SPE shall provide capability for the receipt of existing containers into a glovebox (see Table 2, Section 1.7). The majority of containers shall be accommodated via inlet sphincters, with airlock or bag-in capability of sufficient size to accept the largest storage container as needing to be unloaded in the SPE.

RA-2 For material control and accountability, the SPE shall process (as data) all information on labels for incoming storage packages. This information shall be maintained in data storage in the process control computer, and coupled with 3013 package identification as the material is processed through the SPE.

RA-3 The Receipt Area shall provide capability of receiving existing containers manually.

6-A.3 Preparation of Material for Stabilization

MPA-1 Capabilities shall be included for the unloading of existing packages, waste stream handling, and accountability of process materials and waste streams.

MPA-2 Capability shall be provided for collection and removal of extraneous packaging materials associated with incoming containers.

MPA-3 The system shall have the capability for opening BTC's and welded 3013 packages for re-stabilization and repackaging, as necessary, or if the container closure does not meet 3013 requirements.

MPA-4 The SPE shall have capability to stabilize small pieces of plutonium metal (<100 grams) within a batch tray of oxide.

MPA-5 Some of the material to be stabilized is non-homogeneous and may be too coarse to pass through a 10 mesh sieve screen prior to thermal stabilization. All material constrained by the screening process shall be removed and clumped oxide shall be broken down or pulverized. These materials may consist of components such as ceramics, graphite, iron or stainless steel hardware (fasteners), plutonium metal, and clumps or chunks of oxide. Working space within the or Material Preparation Area shall be provided to house size reduction and blending equipment for this use, with the ability to transport trays to the area either prior to or subsequent to stabilization.

MPA-6 The handling equipment shall allow for visual inspection of the material prior to and after stabilization.

MPA-7 The design must enable the operator to compact the incoming containers (crimped foodpack, slip-lid containers, or convenience can).

MPA-8 The height of compacted containers to be disposed of shall not exceed 2-in.

MPA-9 The SPE shall provide capability for contained dispensing of plutonium oxide from incoming containers into furnace trays to minimize plutonium oxide dispersion and migration.

6-A.4 Transport of Containers within the Glovebox System

TA-1 Transport of incoming convenience cans shall be provided from the beginning of the Material Preparation Area to the Fill Area.

TA-2 The SPE shall be capable of transporting trays of plutonium oxide from the Material Preparation Area, to/from the Furnace Area, to/from the LOI Test Area, and to the Fill Area. During this transfer, the powder in the tray must remain in a level uniform layer. The dissemination of contamination shall be minimized.

TA-3 Remote visual monitoring capability of can and tray transport in the Transport Areas shall be provided if physical barriers prevent visual verification of can or tray location.

6-A.5 Thermal Stabilization via Furnaces

FURN-1 Thermal stabilization of the plutonium oxide shall be accomplished by maintaining the oxide at >950C in an oxidizing atmosphere for a minimum of two hours.

FURN-2 The furnaces shall operate in an oxidizing atmosphere with a gas having less than 1000 ppm moisture. The flow of supplied gases shall be regulated to between 0.5 and 10.0 scfm with control to $\pm$0.1 scfm. Filtration shall be required to ensure no contamination of the material being stabilized. The exhaust from the furnaces shall be discharged directly to the process ventilation system.

FURN-3 The furnace shall be able to reach 950C in at least four (4) hours on heatup, soak for at least two (2) hours at 950C, and cool down to 25C in less than six (6) hours.

FURN-4 The maximum temperature of the outer shell of the furnace shall not exceed 50C.

FURN-5 The controller for the furnace shall be located outside the glovebox and shall include a display of the furnace temperature. The furnace temperature shall also be continuously recorded by chart and by a data logger. The furnace shall be able to operate continuously for up to 8 hours at >950C in an oxidizing atmosphere.

FURN-6 Furnaces shall have the capability to limit heating and cool down rate, and to provide hold times at different temperatures in order to allow operational programming of furnace cycles.

FURN-7 Each furnace shall have the capability of stabilizing two full batches of plutonium oxide simultaneously while maintaining a critically safe configuration.

6-A.6 Stability Testing of Stabilized Oxide

LOI-1 The SPE shall include an in line capability for determining the moisture / volatile content of a representative batch sample by heating the sample in an oxidizing atmosphere to a temperature of 1000C ±50 C for at least one hour or via equivalent ThermoGravimetric Analysis.

LOI-2 The plutonium oxide shall be proven to be thermally stabilized to less than 0.5 percent loss on ignition (LOI). The SPE shall have the capability to retain this characteristic through final packaging.

LOI-3 A dessicator and a balance for analytical-quality weighings shall be provided for holding of LOI samples until final weighing is completed.

6-A.7 Filling of Convenience Containers

FA-1 Movement of furnace trays from the batch furnaces into the Fill area shall utilize conveyors and extension tools to maintain exposure ALARA.

FA-2 A balance for weighing of filled convenience cans shall be provided, with 2-place accuracy.

FA-3 Provision shall be made to allow filling the convenience container with free flowing stabilized oxide and avoiding the significant dissemination of powder.

6-A.8 Packaging in Inner Welded Can

BTS-1 In the BTS area, all movements of convenience cans and insertion of the convenience can and plug into an inner can shall be done manually. Provisions shall be made for the use of extension tools and Pu handling best practices.

BTS-2 In the BTS area, all movements of packaging components shall be done manually.

BTS-3 The sphincter seal shall be designed for ease of replacement.

6-A.9 Leak Testing

LT-1 Provide helium leak detectors for testing the seal on both the inner container and the outer container. The leak detector system(s) shall be designed to:

1) Have a sensitivity twice as great as the minimum leak. DOE-STD-3013-96 requires the maximum leak to be less than or equal to 1×10^{-7} standard cubic centimeters of gas per second across a pressure gradient of 1.0 atmospheres. This is equivalent to 4×10^{-12} moles of air or helium per second.

2) Minimize the potential for radioactive contamination should a container leak.

3) Prevent vacuum pump oil from being drawn into the glovebox.

4) The location of the leak detectors shall take into consideration the potential for a false leak indication should the atmosphere outside the container become contaminated with helium.

6-A.10 Packaging in the outer Can

OWM-1 All functions of the outer can weld and monitoring area shall be designed to balance simplification of the level of automation while minimizing worker exposure during: receipt of sealed inner cans into empty outer cans, welding of the outer can assembly, testing of the outer can for removable surface contamination, leak testing of the outer can weld, movement of the outer can assembly within the Outer Can Weld and Monitoring Area, and movement of the completed storage package into the shielded transporter.

OWM-2 The Outer Can Weld Module shall be designed to provide a welded outer can which complies with DOE-STD-3013-96.

6-B Specialty Component Specifications

6-B.1 Gloveboxes

BOX-1 The design of system gloveboxes shall comply with DOE 6430.1A, Sections 1161-1 and 1161-2, and with the Guidelines for Gloveboxes, American Glovebox Society.

BOX-2 The design shall specify that the gloveboxes and hood shells shall be at least 7 gauge Type 304 stainless steel. All internal structural members and supports and exterior stands shall be 304 stainless steel. Determination of glovebox skin thickness shall consider structural issues for preventing glovebox floor warpage during SPE operations.

BOX-3 The design shall specify that the windows located on top of the gloveboxes for lighting shall be 1/4 inch wire glass. All other light and viewing windows shall be safety plate glass.

BOX-4 Glove rings/ports shall be specified in the design to provide a means to install airtight flexible gloves for access and manipulation inside the glovebox. All glove ports/rings shall be of a push-through type design. All glove rings/ports shall be specified in the design to accept airtight plugs and shall be designed to be installed to the walls of the glovebox.

BOX-5 The glovebox design shall provide storage fixtures inside gloveboxes and hoods for tools and equipment parts. The glovebox design should minimize items welded directly to the gloveboxes to facilitate decontamination and operational flexibility.

BOX-6 Continuous butt welds are required for the glovebox skin and should be located away from corners or edges. Whenever possible, gloveboxes shall be welded to one another, to entry cabinets, and to airlocks.

BOX-7 The glovebox design shall provide isolation doors to mitigate the spread of contamination from one glovebox to another. The design shall specify that each isolation door shall be fabricated from stainless steel, finished the same as the glovebox.

BOX-8 Gloveboxes shall be designed such that during glovebox waste removal activities, contamination levels can be verified before removal from confinement.

BOX-9 The design shall specify that all glovebox exterior surfaces that are visible and accessible should have a uniform appearance as near the interior box finish as possible. Surfaces of structural members inside gloveboxes shall correspond to the shell finish. Machined surfaces shall have a 64 to 125 AA finish and rounded corners. Outside structural members shall have a mill finish, aesthetically similar to the exterior shell finish.

BOX-10 The design shall specify all process and service piping as well as electrical and instrument lines shall enter or exit gloveboxes by means of pass-through connectors that do not compromise leak tightness (e.g., welding, low-permeability gaskets, or potting).

BOX-11 The design shall specify that all gas supply lines shall be HEPA-filtered before they pass through the glovebox shells in order to prevent migration of contamination into the clean supply lines.

BOX-12 The design shall specify that utilities (e.g., water, air, gas) serving gloveboxes shall be provided with shutoff or isolation valves outside the glovebox.

BOX-13 If the opening and closing of isolation doors are automated, the design shall specify an interlock to prevent cycling.

BOX-14 Pneumatic operators within a glovebox shall be designed to use air or nitrogen.

6-B.2 Transport of Completed Packages

ST-1 The shielded transporter shall be designed to transport two storage packages, set vertically in a shielding block. The wagon shall be designed to keep the center of gravity low enough to minimize any tipping hazard. The block shall be designed to maintain critically safe spacing during movement of one package while another remains in the shielding block.

ST-2 A locking mechanism will be provided to prevent the shielded transporter from moving unexpectedly when being filled or awaiting filling with completed storage packages.

ST-3 The design of the shielded transporter will be provide sufficient shielding to minimize occupational exposure to ionizing radiation (ALARA).

6-B.3 Furnace Trays

FT-1 Any single container, crucible, or ladle containing or transporting SNM in the glovebox systems shall be designed to be limited to a maximum of 4.9 kg ^{239}Pu as oxide of bulk density between 1.5 and 6 g/cc.

FT-2 Furnace trays shall be designed to contain the quantity of plutonium oxide required in FT-1, at a maximum depth of 1.5-in at an estimated density of 2 gm/cc while leaving about 0.5 inches of freeboard between the top of the oxide layer and the lip of the tray.

FT-3 Furnace trays shall be designed to be capable of withstanding more than 100 repeated heating and cooling cycles between ambient temperature and 1,000C without excessive oxidation, distortion, or degradation of the tray identifier.

6-B.4 Atmosphere in Enclosures

ATM-1 The design for the interface between the SPE and the ventilation system shall prevent backflow into the gloveboxes from the facility ventilation system.

ATM-2 The gas supply line design shall specify HEPA inlet filtering or a backflow prevention device between the supply and the glovebox atmosphere to eliminate backflow of radiological contamination. HEPA filters in the supply system shall be located as close to the glovebox as practicable to minimize ductwork contamination.

ATM-3 The design shall specify that the glovebox process exhaust lines shall contain HEPA filters to provide initial filtering prior to the process exhaust system. These filters are not included in the two stages of required testable HEPA filtration in the exhaust system. HEPA filters in the exhaust system shall be located as close to the glovebox as practicable to minimize ductwork contamination.

ATM-4 Any hoods used in the SPE shall be designed to minimize the gas flow required to meet/maintain a minimum face velocity of 150 ft/min.

ATM-5 Differential pressures in the SPE shall be such that the flow of air through leakage in the confinement systems will always be from areas of lower contamination to areas of higher contamination, for example, from the general facility, to the SPE room, to the interior of the gloveboxes or hoods. Backflow of air from a more contaminated area to a lesser contaminated area shall be prohibited via filtration or backflow preventers.

ATM-6 To prevent glovebox over pressurization, a means of rapidly exhausting the glovebox (e.g, dump valves or similar device) shall be provided on gloveboxes that have a potential pressure source.

ATM-7 The design of gas inlets to the gloveboxes and furnaces shall preclude dispersal of plutonium oxide from open furnace trays.

6-B.5 Electrical Components Within Gloveboxes

E-1 The design shall specify that electronics, controls, and power supplies shall be contained in cabinets mounted in a rack where possible.

E-2 The design shall specify that all electrical connectors within gloveboxes shall be dust tight.

E-3 The design shall specify that the electrical connectors at glovebox walls shall be plug-type disconnects and shall comply with MIL-C-5015.

E-4 The design shall specify that the lighting fixtures for gloveboxes shall have illuminaries with baffles, or other devices, to diffuse light and to ensure that the bulb is not visible to the operator's eye. The lighting interior and exterior to the glovebox shall provide a method for adjustment to minimize glare. The ease of viewing at working surfaces and points of operation shall be considered during the design of lighting for gloveboxes. A desirable lighting level at these locations is 50-60 foot-candles.

E-5 Fluorescent lighting with 120 V receptacles is preferred but other types may be used when necessary. Lights may be grouped with a common switch for a number of lights serving a hood or glovebox.

E-6 Lighting fixtures shall be installed exterior to the gloveboxes to the extent practical to aid in maintenance of the fixtures.

E-7 Electrical equipment and lighting shall be designed and installed to meet the requirements of NFPA 70 and NFPA 101.

6-B.6 Seismic Considerations for Support Structures and Platforms

SSP-1 All structures, systems and component supports shall be designed per the criteria found in the References in Section 7 for the appropriate Performance Category of the SSC.

SSP-2 Existing structures, systems and components used for the SPE shall be reviewed and upgraded, if necessary, to ensure their capability to withstand applicable loading, if affected by Project W-460. Existing structures, systems and components which are not going to be used for the SPE, and are left as is in the area of the project location, will be reviewed for seismic interaction affecting safety related SPE equipment.

SSP-3 Concrete anchorage will be designed using the guidelines of HNF-PRO-097 *Engineering Design and Evaluation* and DOE-STD-1020-94 *Natural Phenomena Hazards Design and Evaluation Criteria for Department of energy facilities.*

SSP-4 Equipment supports will be designed to avoid resonance resulting from the harmony between the natural frequency of the structure and the operating frequency of supported reciprocation or rotating equipment per DOE 6430.1A, section 0111-2.8.1.

SSP-5 Seismic loads for concrete anchorage of fixtures and equipment in the 2736-Z Complex shall be calculated using References in Section 7.

6-C Safety Considerations

6-C.1 Industrial Safety

SAFE-1 The SPE design shall protect workers sufficiently from hazards to ensure that workers can perform actions required during normal operations, anticipated operational occurrences, and postulated accidents.

SAFE-2 The design shall ensure prompt, safe shutdown in emergencies, and allow ready access to areas where manual corrective actions are required.

SAFE-3 The SPE design shall ensure that "Safety Class" components will continue to perform their functions during all normal operations and anticipated operational occurrences and during and after any postulated emergency or accident condition. Safety Class components or items shall continue to operate until appropriate corrective actions can be taken to bring the facility or system to a safe condition and the function of the Safety Class item is no longer required.

SAFE-4 The design of the gloveboxes and the equipment, or location of equipment, in the gloveboxes shall prevent pinch points and shall prohibit sharp corners and protrusions that can puncture glovebox gloves. All corners shall be smooth and rounded to a minimum radius of about 5/8 inches.

SAFE-5 Machine Guarding: The design shall specify machine guards where machinery and moving parts are accessible to prevent injury from inadvertent contact. Machine guards shall meet the requirements of 29 CFR 1910, Subpart O, Machinery and Machine Guarding, and including section 212, General Requirements for All Machines.

SAFE-6 Electrical Safety: All electrical components shall be designed to meet all local and site code requirements as well as those in 29 CFR 1910, Subpart S, Electrical Standards, and including sections 302 to 308, Design Standards for Electrical Systems.

SAFE-7 Lock-Out/Tag-Out Requirements: Potential sources of hazardous energy (i.e. electrical, hydraulic, high pressure lines, etc.) will be designed to have the capability to be locked out in accordance with 29 CFR 1910, Section 147, Control of Hazardous Energy Sources.

SAFE-8 Work Platforms and Work Surfaces: Work platforms and surfaces shall be designed to meet the requirements of 29 CFR 1910, Subpart O, Walking and Working Surfaces, and including section 23(c), Protection of Open Sided Floors, Platforms and Runways, and section 24, Fixed Industrial Stairs.

SAFE-9 Compressed Gases: The design of the storage facilities and systems for compressed gases shall meet the requirements of 29 CFR 1910, Subpart M, Compressed Gases and Compressed Air Equipment, and all incorporated references.

As good engineering practice, fittings for the inert gases will be developed to ensure that compressed air or oxygen cylinders cannot be inadvertently connected to the systems which are used to inert glove boxes and enclosures. The use of compressed air to power pneumatic machinery in areas of the process where there is the potential for ignition of plutonium or other materials shall be minimized to the extent practical.

6-C.2 Radiation Shielding Requirements

RAD-1 Shielding shall be included in the design of the gloveboxes. Operator exposures shall be maintained ALARA with a goal of less than 500 mrem per year (TEDE) and less than 15,000 mrem (skin and extremity) due to the SPE operation. Measured or calculated exposures should include the logged time/dose for all processing steps in the SPE, including those performed both inside and outside the gloveboxes.

RAD-2 In glovebox areas, stainless steel and lead shall be used to shield gamma radiation and solid hydrogenous materials shall be used to shield neutron radiation. Any flammable shielding materials to be employed must be outside of the gloveboxes and encased in nonflammable materials. Windows shall use leaded glass or plastic to shield gamma and neutron radiation.

6-C.3 Design for Nuclear Safety

CRIT-1 Engineered controls shall be included in the design of the glovebox system to ensure that the materials, as applicable, are always in a desirable configuration and array to prevent criticality. Configuration control of the material and array using administrative controls shall be allowed only if no other practical control method can be used.

CRIT-2 All glovebox criticality limits will be based on maintaining a system with moderation sufficient to represent operator's arms in the glovebox.

CRIT-3 The equipment shall be designed to remain subcritical if flooded.

CRIT-4 The design of the Stabilization Module will enable the weighing of the incoming container to minimize the likelihood of inserting the wrong container into the system due to a paperwork or human error.

CRIT-5 All gloveboxes shall have designated, fixed-array locations with restraints for unit masses of plutonium, with edge-to-edge spacing in accordance with the (CSER). The receipt area must accommodate up to three incoming material cans to make up furnace batches from low assay items.

CRIT-6 Furnace tray racks shall be designed for edge-to-edge spacing in accordance with the CSER. No more than one furnace tray shall be uncovered at any given time, i.e. outside of a furnace without a cover.

CRIT-7 Furnace tray covers shall be designed and provided to cover the tray when the tray contains oxide and is outside the furnace (to inhibit entrance of water during a DBE or fire).

CRIT-8 Engineered features will be provided to minimize the probability of water ingress into the furnaces during a DBE or other accident.

6-D SPE Process Control and Data Management

6-D.1 Process Control System

PCS-1 The design shall specify stabilization process equipment safety interlocks as required by the PSE for Project W-460, followed by rigorous hazards analysis during definitive design.

PCS-2 The design shall specify components to monitor and control environmental conditions within the stabilization and packaging processes for radiological contamination and inert gas atmosphere integrity.

PCS-3 The design shall specify components to obtain selected data inputs of stabilization and packaging process information, either by keypad entry or by reading data via bar code reader.

PCS-4 The design shall specify the components necessary to control automatic operations within the stabilization and packaging processes.

PCS-5 The design shall specify the components necessary to provide information from the stabilization and packaging processes to the Data Management System for material control and accountability requirements and storage package certification requirements.

PCS-6 The design shall specify the components necessary to weigh the material going into the inner containers, weigh the loaded inner containers, weigh the outer container, and weigh the loaded storage package. Each balance requires a minimum range of 0 to 1.5 times the maximum package weight in grams. Balances shall meet the requirements of DOE Order 5633.3B for accuracy and repeatability. Balances shall have the capability to interface with remote recording equipment.

PCS-7 The design shall specify the components necessary to to alert operators of off normal situations. Alarms and indicators for manual work stations shall be both local and at the process control computer.

6-D.2 Data Management System

DMS-1 The design shall specify the components necessary to accumulate data to support the 3013 storage package certification requirements.

DMS-2 The design shall specify the components necessary to provide system operational information, for trending equipment performance and use.

6-D.3 Control and Data System Security

SEC-1 Control system computer security is provided by password protection to the configuration software.

6.E Construction Considerations

6-E.1 Protective Coatings and Cleaning

COAT-1 The design shall specify that after fabrication and inspections have been completed, all system components shall be thoroughly cleaned, descaled, and degreased. All surfaces shall be cleaned to remove such debris and contaminants as weld flux, oil, grease, shop dust, masking tape, cutting fluids, grinding residue and temporary markings. Cleaning may be accomplished by mechanical means, with non-halogenated solvents, or by using water, steam or non-halogenated detergent cleaning agents or any combination thereof. Caustic or acid cleaning shall not be used. Final wash and rinse shall be accomplished with potable water meeting the requirements of the Public Health Service Drinking Water Standards. Drying after final rinsing shall be accomplished using forced dry air. Compressed air used for drying shall be free of water and oil.

COAT-2 The design shall specify that no stainless steel surfaces, interior or exterior, shall be painted unless specifically called for in this functional design criteria. All unfinished carbon steel components of the equipment shall be specified to be thoroughly cleaned by sandblasting or pickling to remove all chemical contamination, mill scale, rust scale and rust and shall be painted with one coat of epoxy paint. No paint shall be applied within inch of field weld areas.

6-E.2 System Quality Factors

SYS-1 The SPE shall have a design life of 20 years. The equipment used for stabilization and packaging shall be designed to be capable of operating continuously 24 hours a day, 5 days a week for 7 years, and then intermittently for the following 13 years.

SYS-2 The system shall be designed to be easily maintainable as defined by the demonstrated replacement of wear critical parts within two hours. Wear critical parts are defined as any parts, critical to the operation of the SPE, that are expected to require replacement or repair during the initial seven year campaign.

SYS-3 Routine maintenance operations should generate no more waste than an equivalent normal shift operation.

SYS-4 The design shall specify sufficient space be provided adjacent to all equipment and confinement systems to allow easy access for maintenance.

SYS-5 The design shall ensure that equipment and components inside gloveboxes shall be maintainable from the exterior of the glovebox.

SYS-6 The radiation shielding for gloveboxes should be designed to facilitate installation, removal, and decommissioning of SPE equipment.

6-E.3 Environmental Conditions

ENVR-1 All equipment and associated components shall be designed to function at ground level elevations ranging from 0 to 1000 feet above sea level.

ENVR-2 The design shall specify components which will function properly in a nitrogen, helium or argon environment at temperatures 55F to 100F.

6-E.4 Materials of Construction

MATL-1 The design shall specify that gasket materials have low permeation, be compatible with low humidity, argon, and be resistant to radiation and oil.

MATL-2 The design shall specify that special hardware inside the gloveboxes shall be Type 300 series stainless steel, however, galling characteristics of special hardware with respect to 300 series stainless steels shall be evaluated. Commercial stainless steel hardware may be used outside the glovebox for handles and hinges.

6-E.5 Toxic Products and Formulations

TOX-1 The design shall specify that asbestos or asbestos-bearing materials and Polychlorinated biphenyls (PCB) or PCB-bearing materials shall not be used.

TOX-2 The design shall specify that mercury or mercury-bearing materials shall not be used, except in the external, commercial fluorescent lighting on top of the gloveboxes.

TOX-3 Metallic lead, which may be used for radiation shielding purposes, shall be encapsulated.

TOX-4 All materials installed or used in the SPE shall be used in accordance with OSHA Material Safety Data Sheets (MSDS) requirements in reference 29 CFR 1910, Subpart Z.

6-E.6 Use of Standard and Commercial Parts

PART-1 The design shall specify that the mechanical fasteners shall be of either US or metric standard dimensions, materials, and strengths.

PART-2 The design shall specify that electrical components shall be NEMA or equivalent. Motor control shall be IEC. Protective devices shall have Type 2 Coordination, as a minimum.

PART-3 The design shall consider the controls necessary for controlling suspect/counterfeit items per HNF-PRO-301 *Control of Suspect/Counterfeit Items.*

6-E.7 Electromagnetic Radiation

EMR-1 The design shall ensure that non-destructive assay equipment shall be protected from electromagnetic radiation sources.

6-E.8 Nameplates and Product Marking

NAME-1 The design shall specify that all equipment, controls, instruments, and panels included in the SPE shall have unique identification numbers. The equipment numbers shall be obtained from the site specific equipment numbering system and shown on the drawing.

NAME-2 .The design shall provide a Master Equipment List containing the equipment ID numbers, description, part number, and specifications (e.g., range, set point, alarm point).

NAME-3 The design shall comply with PFP labeling standards.

6-E.9 Construction for Ease of Decontamination

DECON-1 Crevices and sharp corners shall be eliminated from the glovebox design, including equipment installed in the glovebox, to prevent the accumulation of contaminated materials that are inaccessible for cleanup. The design of the glovebox and the installation of the equipment in the glovebox shall not create areas that are inaccessible for cleaning. Seals that can collect materials that cannot be removed shall be avoided.

DECON-2 The design shall specify that gloveboxes shall have metal surfaces polished to a #4 finish to promote contamination control and to provide for enhanced cleanup. The objective should be that all interior surfaces are smooth to facilitate cleaning and decontamination.

DECON-3 The design shall specify that porous surfaces in the SPE process area should be sealed or provided with a surface liner to prevent entrapment of contamination to facilitate the cleanup of the process area.

DECON-4 The design shall specify that gloveboxes and large, heavy components should be provided with appropriate lifting lugs to facilitate dismantlement and decontamination activities

DECON-5 Equipment and gloveboxes subject to contamination should be designed for easy and effective decontamination and dismantlement. This enhances the effectiveness of the eventual decontamination, dismantlement, and relocation of process equipment.

6-E.10 Human Factors Engineering

HENG-1 The design shall specify that gloveboxes and hoods may be single wall construction with the main working surface 36 to 38 inches from the floor, where possible. The height and depth shall be determined to provide optimum orientation and access to the equipment in each enclosure.

HENG-2 The design shall ensure that internal supports be placed to minimize interference with normal operation and maintenance.

HENG-3 Human Dimensions Considerations - The dimensions of the human body shall be considered when selecting equipment and designing systems for use on the project. Equipment shall be arranged in a manner to provide easy access for operations, maintenance, and repair. Tools, platforms and other operator aids shall be provided as required. Equipment shall accommodate the fifth to ninety-fifth percentile of population.

HENG-4 Process Controls - The design shall develop a process control strategy and should provide for centralized monitoring and a readily identifiable control hierarchy.

HENG-5 Process Controls - The design shall provide operating procedures that provide clear, concise guidance for manual system operations under normal, abnormal, and emergency operating conditions.

HENG-6 Display Devices - The control system display must be designed to provide the operators with sufficient information to control the process, without compromising their ability to respond to upset conditions due to cognitive overload. Control panel layouts should permit easy access to controls and visual indications. Computer graphics screens should consider the use of color, contrast, and text size in formulating displays. Dynamic process data (process parameters, equipment status) should be readily interpreted, and abnormal conditions should be clearly identifiable to the operator.

HENG-7 Warning Indicators - The design shall ensure that operators be advised of abnormal or potentially hazardous situations in a clear, concise and timely manner. Local and remote indication shall be included as appropriate to notify operators of process alarms.

HENG-8 Labeling - The design shall specify that equipment and instrumentation be labeled to permit proper identification during normal, abnormal, emergency and surveillance operations.

HENG-9 Handicap Access - Fire, criticality, and radiological hazards will require rapid evacuation of the project areas. Due to this constraint, access to the area by handicapped people will be restricted. Specific exemption from the Architectural Barriers Act, Public Law 90-480, shall be addressed in accordance with 41 CFR 101-19.6 during the definitive design phase.

HENG-10 Environmental Conditions - The environmental conditions under which operation and control actions are performed affect the performance that may be expected of operators. To provide operators with conditions to support the proper execution of required tasks, ambient temperature, humidity, air flow, noise level, and illumination should be controlled within acceptable limits. The design shall ensure compliance with UCRL-15763, *Human Factors Design Guidelines for Maintainability of Department of Energy Nuclear Facilities.*

HENG-11 Project designs will minimize equipment located underneath gloveboxes.

6-E.11 Quality Assurance Requirements

QUAL-1 Design, fabrication, and procurement of equipment for the SPE shall meet the requirements of a Quality Assurance Program which meets the requirements of 10 CFR 830.120 and its related Implementation Guide. The preferred standard for the quality assurance program to implement the quality assurance provisions of the rule is ASME NQA-1-1994, *Quality Assurance Program Requirements for Nuclear Facilities Applications.* If a quality assurance standard other than 10 CFR 830.120 is used, a matrix will be necessary to show how the applicable quality assurance criterion are implemented.

QUAL-2 The design work shall comply with all quality and design requirements contained in the contract documents.

6-E.12 Delivery Requirements

TRANS-1 Care shall be taken to package components and subassemblies to ensure minimal breakage en route to the construction site. Electronic components and equipment shall be wrapped in shielded packaging to minimize failure due to static electricity encountered until installation. All items delivered to the Hanford Site are subject to receipt inspection; packaging shall be constructed to allow inspection without destruction of packaging components.

TRANS-2 Delivery methods shall be chosen to minimize cost while meeting required schedules.

TRANS-3 All safety class items shall be prepared for delivery in accordance with the requirements similar to ASME NQA-1-1994, Subpart 2.2, "Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power Plants."

TRANS-4 All equipment will be crated in wood. Any loose items within the gloveboxes or subsystems will be secured. All equipment will be suitably protected from exposure to the natural environment.

TRANS-5 All penetrations and openings in gloveboxes shall be sealed to protect the opening and sealing surfaces.

TRANS-6 Sealing tape in direct contact with stainless steel shall have a chloride content of less than 50 ppm.

7.0 Requirements Documents

APPLICABLE CODES AND STANDARDS

The following documents shall be used to govern the design concepts for Project W-460. In the event of conflict between a general requirement document listed below and specific criteria in this document, the specific criteria shall be considered to supersede the general requirement.

Federal, State, and local laws and regulations, and DOE orders and standards, in effect at the start of the design shall apply to the extent specified in the *Plutonium Finishing Plant Standards/Requirements Identification Document*, SD-MP-SRID-003 Rev. 1. International agreements applicable to the PFP in place at time of publication of this document are also listed. Additional agreements may be negotiated during the detail design and implementation of Project W-460.

International Agreements

IAEA, TS-NO.#3, 1994-04-15, "Safeguards Criteria"

IAEA Information Circular/288, December 1981, "The Text of the Agreement of 18 November 1977 Between the United States Of America and The Agency For The Application Of Safeguards in the United States Of America".

Federal Regulations

10 CFR 830.120, "Nuclear Safety Management Quality Assurance Requirements"
10 CFR 835, "Occupational Radiation Protection"
29 CFR 1910, "Occupational Safety and Health Standards"
29 CFR 1926, "Safety and Health Regulations for Construction"
40 CFR 61, "National Emission Standards for Hazardous Air Pollutants"
40 CFR 262, Standards Applicable to Generators of Hazardous Waste
41 CFR 101-19.6, Accommodations for the Physically Handicapped
49 CFR 178, Specification for Packaging

42 USC §§ 2011, Atomic Energy Act
42 USC §§ 4321, National Environmental Policy Act of 1969
42 USC §§ 6901, Resource Conservation and Recovery Act

Department of Energy National Orders, Standards, Contracts and Guidelines

DOE 5400.5, "Radiation Protection of the Public and the Environment"
DOE 5480.7A, Fire Protection
DOE 5480.11, "Radiation Protection for Occupational Workers"
DOE 5480.24, Nuclear Criticality Safety
DOE 5632.1C, "Protection and Control Of Safeguards and Security Interests"
DOE 5633.3B, "Control and Accountability of Nuclear Material"
DOE O 430.1A, "Life Cycle Asset Management"

DOE 6430.1A, "General Design Criteria"

DOE/EH-0256-T, DOE Radiological Control Manual

DOE/EM/0199, "Plutonium Vulnerability Management Plan"

DOE/EV/1830.T5, "A Guide to Reducing Radiation Exposure to As Low As Reasonable Achievable (ALARA)"

DOE-STD-1020-94, "Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities"
DOE-STD-1021-94, "Natural Phenomena Hazards Performance Categorization Criteria for Structures, Systems and Components"
DOE-STD-1066-97, "DOE Standard Fire Protection Design Criteria"
DOE-STD-3013-96, "Criteria for Safe Storage of Plutonium Metals and Oxides"
DOE STD-1128-98, "Guide to Good Practices for Occupational Radiological Protection in Plutonium Facilities"

National Consensus Standards

ACGIH, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices

ACI-349, Code Requirements for Nuclear Safety Related Concrete Structures

AG-1, Code on Nuclear Air and Gas Treatment Systems, 1991; with Addendum SA of 1993

American Glovebox Society, Guidelines for Gloveboxes

ANSI/AISC N690, Nuclear Facilities -- Steel Safety-Related Concrete Structures for Design, Fabrication and Erection

ANSI B19, Safety Code for Compressed Air Machinery, 1938
ANSI N14.5, Standard for Radioactive Material, Leakage Tests on Packages for Shipment

ANSI Z136.1, Standard for Safe Use of Lasers, 1993
ANSI/ANS-8.1, Guide for Nuclear Criticality Safety in the Storage of Fissile Materials, 1975.

ASCE 4, Seismic Analysis of Safety Related Nuclear Structures and Commentary
ASCE 7, Minimum Design Loads for Buildings and Other Structures

ASME N509-1989, Nuclear Power Plant Air-Cleaning Units and Components
ASME N510-1989, Testing of Nuclear Air Treatment Systems
ASME NQA-1-1994, Quality Assurance Requirements For Nuclear Facility Applications

IEEE-591, IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

NFPA 70, National Electrical Code
NFPA 72, National Fire Alarm Code
NFPA 101, Life Safety Code
NFPA 801, Standard for Facilities Handling Radioactive Materials

Uniform Fire Code

Washington State Regulations

Washington Administrative Code (WAC) 173-303, "Dangerous Waste Regulations"
WAC 246-247, Radiation Protection for Air Emissions

Washington Administrative Code 51, Energy Code

Washington Administrative Code WAC-246-290-490, *Public Water Supplies, Cross-Connection Control*

Hanford Implementing Directives and Manuals

Project W-460 will comply with all Department of Energy, Richland Office, Implementing Directives/Procedures and Project Hanford Management Contract (PHMC) manuals according to the PFP S/RID. All site-wide manuals were re-designated to start with "HNF" in December 1996, and are referred to within this document in that manner for ease of retrieval. The documents shown below are highlighted for special attention during the project:

RLID 5480.7, "Fire Protection"

HSRCM-1, "Hanford Site Radiological Control Manual"

Technical Documents

LA-10860-MS, Critical Dimensions of Systems Containing ^{235}U, ^{239}Pu, and ^{233}U, 1986

SAIC/RFFO-96-003, Loss on Ignition (LOI) Measurements on Plutonium Oxide, 1996

UCRL-15673 (University of California), Human Factors Design Guidelines for Maintainability of Department of Energy Nuclear Facilities, 1985

REFERENCES

DNFSB, 1994, Recommendation 94-1 to the Secretary of Energy, pursuant to 42 U.S. C. 2286 a(5) Atomic Energy Act of 1954, as amended, Defense Nuclear Facilities Safety Board, Washington, D.C.

DOE, 1996c, DOE-STD-3013-96, "Criteria for Safe Storage of Plutonium Metals and Oxides", U. S. Department of Energy, Washington, D.C.

PNL, *Health Physics Manual of Good Practices for Reducing Exposure to Levels that are as Low as Reasonably Achievable,* , PNL-6577, Pacific Northwest Laboratories, 1994, Richland, Washington.

Vogt, E. C., 1996, Letter to J. E. Mecca, "Completion of Dose Estimate for PFP Stabilization Operations", 9652258, from Westinghouse Hanford Company, Richland, Washington, dated May 17, 1996.

FDH, 1997c, *Engineering Design and Evaluation*, HNF-PRO-097, Fluor Daniel Hanford Company.

FDH, 1997a, *Criticality Safety Control Of Fissionable Material*, HNF-PRO-537, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1990, *FDH Occupational ALARA Program*, IP-1043, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1991, *Radiological Design Guide*, SD-GN-DGS-30011, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1997b, *PHMC Engineering Requirements*, HNF-PRO-1819, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1992b, *Plutonium Finishing Plant Operating Specification for Storage of Special Nuclear Material*, OSD-Z-184-00013, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1997c, *Safety Analysis Program*, HNF-PRO-430, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1998, *Plutonium Finishing Plant Essential and Support Drawing List*, H-2-99480, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1994a, *Plutonium Finishing Plant Operational Safety Requirements*, SD-CP-OSR-010, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1998, *Plutonium Finishing Plant Standards/Requirements Identification Document*, HNF-SD-MP-SRID-003 Rev. 1, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1997d, *Electrical Work Safety*, HNF-PRO-088, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1995a, *Component Identifying Standard for the PFP*, SD-CP-RD-024, Fluor Daniel Hanford Company, Richland Washington.

FDH, 1995b, *Plutonium Finishing Plant Final Safety Analysis Report,* SD-CP-SAR-021, Rev. 0, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1997e, *Electrical Installation Safety*, HNF-PRO-089, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1996a, *94-1 Stabilization Project Vulnerability Risk Analysis,* 96-00015, Fluor Daniel Hanford Company, January 1996, Richland, Washington.

FDH, 1996b, *DNFSB Recommendation 94-1 Hanford Site Integrated Stabilization Management Plan*, WHC-EP-0853, Revision 4, September 1996, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1997f, *Occupational Safety & Health Topic*, Project Hanford Policies & Procedures, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1996c, *Location Assessment for the Plutonium Stabilization and Handling Process,* SD-CP-TI-202, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1996d, *Project Hanford Quality Assurance Program Description,* HNF-MP-599, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1996d, *Control of Suspect/Counterfeit Items,* HNF-PRO-301, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1996d, *Computer Software Quality Assurance Requirements,* HNF-PRO-309, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1996d, *Computer Security Within the Procurement Cycle,* HNF-PRO-310, Fluor Daniel Hanford Company, Richland, Washington.

FDH, 1999, ,*Graded Quality Assurance*, HNF-PRO-259, Fluor Daniel Hanford Company, Richland, Washington.

APPENDIX A
2736-Z COMPLEX
BACKGROUND INFORMATION

The 2736-Z Complex is a standalone operating area with its own HVAC systems. Ventilation is on a "once through" basis except for the 2736-ZB administrative area and NDA laboratory where a percentage of the return air is recycled through the supply system for energy conservation.

Within the 2736-Z Complex, ventilation zones conform to standard designations (they are reversed in the other PFP buildings). Zone 1 designates the area having the highest potential for contamination (e.g., gloveboxes), and Zone 4 designates areas where contamination is not normally present.

Redundant supply fans in Room 602 of the 2736-ZB Building ensure that supply ventilation air is provided to the facilities for personnel comfort, process ventilation, contamination control, and for equipment and/or other cooling needs during supply system component failure or scheduled maintenance. Redundant operating exhaust fans (in 2736-ZA and 2736-ZB Buildings) are provided to maintain desired zone pressures and exhaust flows during component failure and/or maintenance.

The 2736-ZA Building, approximately 5 feet west of the 2736-Z Building, consists of two rooms. Room 649 originally housed a diesel generator that provided backup power for operation of the EF-1-1 and EF-1-2 exhaust fans and associated instrumentation and controls, Continuous Air Monitors (CAMs), a stack sampler, and an instrument air compressor. This ventilation equipment now is housed in Room 650. The exhaust fans and other equipment in Room 650 are now supplied with backup power from the backup diesel generators in the 2721-Z Building during a loss of normal power. Ventilation supply air for Room 650 is normally provided by in-leakage; however, if Room 650 air temperature becomes greater than or equal to 35 $^{\circ}$C (95 F), a temperature controller activates a motor-controlled damper that allows filtered room air to be exhausted to the atmosphere through two stages of HEPA filtration by exhaust fans EF-1-1/EF-1-2. Should the room temperature increase to greater than or equal to 41 C (105 F), the temperature controller will activate another motor-controlled damper that allows additional filtered room air to be exhausted to the atmosphere through two stages of HEPA filtration by exhaust fans EF-1-1/EF-1-2. Room air intake for the exhaust system, through either F-3-1 or F-3-2, allows filtered outside air to be drawn into the room. Electric heaters with temperature controls provide winter heating. Supply and exhaust ventilation for Room 649 is provided by wall louvers.

Ventilation air for the 2736-ZB Building is supplied by two systems. One system provides conditioned air (steam heated or refrigeration cooled and filtered) by using supply fans SF-1 and SF-2, located in Room 602 of the 2736-ZB Building. Each fan has the capacity to provide 250 m^3/min (8800 ft^3/min) of supply air for distribution to all areas of the building except that portion housing the NDA laboratory. Normal supply air ventilation requirements are provided by one operating fan with the other on standby. The fan distributes 75 m^3/min (2600 ft^3/min) to ventilation Zone 4 areas (e.g., lunchroom, offices, restrooms), with the remainder to ventilate Zone 2 areas. Approximately 80% of the air supplied to Zone 4 is recycled to the supply system.

Air supplied to the Zone 4 restrooms is exhausted to the atmosphere by exhaust fan EF-3. Air is supplied to the repackaging glovebox in Room 636 (Zone 1) from the dry-air system.

Exhaust air from the repackaging room and glovebox access hoods is filtered through a single-stage HEPA filter (two discharge ports, each filtered). Glovebox exhaust is through a HEPA filter installed on the outlet. These filtered exhausts, together with Zone 2 exhaust air; vacuum-pump exhaust from room air sampling; and exhaust air from the 2736-ZB Building, Room 600 (Zone 3), which houses the ventilation exhaust fans EF-1 and EF-2, HEPA filters, etc., are combined, filtered through two additional stages of HEPA filtration, and discharged to the atmosphere through the 8.4 m (27 ft 7 in.)-tall 296-Z-5 stack. One exhaust fan (EF-1 or EF-2) provides the necessary exhaust ventilation flow (approximately 200 m^3/min (7200 ft^3/min) with the other on standby. Redundant HEPA filtration is provided by four filter banks, two in parallel operation and two on standby. Stack discharge air is continuously sampled and monitored.

A heat exchanger system, consisting of two heat transfer coils, a pump, and interconnecting pipes filled with ethylene glycol, is used for recovery of heat/cold from the 2736-ZB ventilation exhaust. A heat transfer coil upstream of the EF-1/EF-2 exhaust fans is heated or cooled by the exhaust flow. When the outside air temperature is below 20 C (68 F) or above 27 C (80 F), the ethylene glycol is recirculated to the preheater/precooler coil, located in the air supply duct upstream of the steam heater and the refrigeration unit, to provide preheating/precooling to conserve energy.

The second ventilation supply system provides filtered, conditioned air to the NDA laboratory section of the 2736-ZB Building with supply fans SF-3 and SF-4 (one operating, one on standby) at a flowrate of 180 m^3/min (6300 ft^3/min). The supply air is maintained at the required temperature by electric heating in winter and refrigeration cooling during the warmer seasons. Supply air is distributed to the NDA areas through supply ducts and ceiling diffusers.

Exhaust air is collected by three exhaust ducts, each provided with a single stage of HEPA filtration. These filtered exhaust flows are combined, filtered through two additional stages of HEPA filtration, and recycled to the NDA supply system by fans RF-1 and RF-2. Recycled air at approximately 11 m^3/min (400 ft^3/min) is diverted to provide supply air for the mechanical equipment room (Room 600). Redundant HEPA filtration is provided by four filter banks, two in parallel operation and two on standby. The recycled air is continuously sampled and monitored for radioactive content. If radioactive content exceeds the allowable limit for breathing air, the ventilation recycle exhaust air is diverted for discharge to the atmosphere through the 296-Z-5 stack. The NDA ventilation supply and exhaust now becomes a once-through system until the air monitor indicates that recycling of exhaust air can be resumed.

The NDA laboratory is classified as a ventilation Zone 2 with the pressure maintained at 62.3 Pa (-0.20 in w.g.). A local control unit (LCU), located in Room 602 controls the dampers, supply/exhaust fans, and the heating/cooling of the laboratory. Loss of pressure control, temperature control, loss of a supply or exhaust fan, and other trouble situations are alarmed in the 234-5Z Building MICON power control room (Room 714), which is attended at all times. The operator can assume manual operation of the system to provide the necessary corrective action.

Operating Personnel and Services

The personnel necessary for operation of the SPE, NDA laboratory and storage vaults will be increased beyond the current totals at the 2736-Z Storage Complex until completion of packaging for the existing SNM inventory. Additional personnel will be provided from within the PFP staff.

It is important that the definitive design of Project W-460 consider the minimization of radiation dose. The dose levels due to manual handling of inventory in existing containers are high. Minimum staff totals for safe operation are anticipated as follows:

- Six nuclear process operators, a crew supervisor, two health physics technicians, a custodian, a chemist and two NDA technicians comprise the minimum crew for each operating shift. Staging of incoming SNM from the storage vaults to the SPE and back again would be anticipated one shift each day (five shifts each week). The operations crew would be split to handle this task along with operation of the SPE.

- If vault fixtures require modification, inventory shifting will be required to conduct the modification in each room. This task will likely take place over the next three years in periodic activities. The schedule for inventory shifting shall be coordinated with physical inventory movements and other necessary movements to minimize the radiation dose to qualified staff. This task is anticipated to require three nuclear process operators, two health physics technicians and two custodians for concentrated subtasks of one to two weeks each on day shift. Estimates of total dose from these movements shall be conducted during the definitive design phase of Project W-460.

- During SPE operating campaigns, shift maintenance craftsmen would be anticipated to include an instrument technician, pipefitter, mechanic and an electrician. A weekend maintenance schedule would be followed, with a double crew (eight craftsmen and a supervisor) working two shifts each weekend to maintain the SPE fully operational

After the inventory has been packaged and placed in the modified vault storage fixtures, it is anticipated that staffing needs will be reduced due to anticipated reductions in the frequency of performing inventories.

END OF APPENDIX A