

ENGINEERING CHANGE NOTICE

1. ECN **637055**

Page 1 of 4

Proj.  
ECN

2. ECN Category (mark one)  Supplemental <input type="checkbox"/> Direct Revision <input checked="" type="checkbox"/> Change ECN <input type="checkbox"/> Temporary <input type="checkbox"/> Standby <input type="checkbox"/> Supersedeure <input type="checkbox"/> Cancel/Void <input type="checkbox"/>	3. Originator's Name, Organization, MSIN, and Telephone No. H.R. Risenmay, PFP Process Engineering, T5-55, 373-3503		4. USQ Required? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	5. Date OCTOBER 27, 1998
	6. Project Title/No./Work Order No. Thermal Stabilization		7. Bldg./Sys./Fac. No. PFP/73T/234-5Z	8. Approval Designator Q, S, R <i>(initials)</i>
9. Document Numbers Changed by this ECN (includes sheet no. and rev.) 11C-SD-CP-SDD-017, Rev. 2		10. Related ECN No(s). N/A	11. Related PO No. N/A	
12a. Modification Work <input type="checkbox"/> Yes (fill out Blk. 12b) <input checked="" type="checkbox"/> No (NA Blks. 12b, 12c, 12d)	12b. Work Package No. N/A	12c. Modification Work Complete N/A Design Authority/Cog. Engineer Signature & Date		12d. Restored to Original Condition (Temp. or Standby ECN only) N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change The referenced document was changed to delete references to glovebox HA-21I that is not in service. Installation of thermal stabilization furnaces has not been completed.	13b. Design Baseline Document? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
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14a. Justification (mark one)			
Criteria Change <input type="checkbox"/>	Design Improvement <input type="checkbox"/>	Environmental <input type="checkbox"/>	Facility Deactivation <input type="checkbox"/>
As-Found <input checked="" type="checkbox"/>	Facilitate Const <input type="checkbox"/>	Const. Error/Omission <input type="checkbox"/>	Design Error/Omission <input type="checkbox"/>

14b. Justification Details  
 To prevent confusion, the references in the document to the use of the furnaces in HA-21I were deleted. When the installation of the thermal stabilization equipment in HA-21I is complete, the referenced document will be updated.

15. Distribution (include name, MSIN, and no. of copies)  
 See Distribution Sheet

RELEASE STAMP

NOV 10 1998  
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# ENGINEERING CHANGE NOTICE

#2 11/4/98  
4  
Page 2 of 2

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

637055

<b>16. Design Verification Required</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<b>17. Cost Impact</b> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <b>ENGINEERING</b>            Additional <input type="checkbox"/> \$            Savings <input type="checkbox"/> \$ N/A         </td> <td style="width: 50%; border: none;"> <b>CONSTRUCTION</b>            Additional <input type="checkbox"/> \$            Savings <input type="checkbox"/> \$ N/A         </td> </tr> </table>	<b>ENGINEERING</b> Additional <input type="checkbox"/> \$ Savings <input type="checkbox"/> \$ N/A	<b>CONSTRUCTION</b> Additional <input type="checkbox"/> \$ Savings <input type="checkbox"/> \$ N/A	<b>18. Schedule Impact (days)</b> Improvement <input type="checkbox"/> Delay <input type="checkbox"/> N/A																													
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<b>19. Change Impact Review:</b> 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 <input type="checkbox"/> Functional Design Criteria <input type="checkbox"/> Operating Specification <input type="checkbox"/> Criticality Specification <input type="checkbox"/> Conceptual Design Report <input type="checkbox"/> Equipment Spec. <input type="checkbox"/> Const. Spec. <input type="checkbox"/> Procurement Spec. <input type="checkbox"/> Vendor Information <input type="checkbox"/> OM Manual <input type="checkbox"/> FSAR/SAR <input type="checkbox"/> Safety Equipment List <input type="checkbox"/> Radiation Work Permit <input type="checkbox"/> Environmental Impact Statement <input type="checkbox"/> Environmental Report <input type="checkbox"/> Environmental Permit <input type="checkbox"/>	Seismic/Stress Analysis <input type="checkbox"/> Stress/Design Report <input type="checkbox"/> Interface Control Drawing <input type="checkbox"/> Calibration Procedure <input type="checkbox"/> Installation Procedure <input type="checkbox"/> Maintenance Procedure <input type="checkbox"/> Engineering Procedure <input type="checkbox"/> Operating Instruction <input type="checkbox"/> Operating Procedure <input type="checkbox"/> Operational Safety Requirement <input type="checkbox"/> IEFD Drawing <input type="checkbox"/> Cell Arrangement Drawing <input type="checkbox"/> Essential Material Specification <input type="checkbox"/> Fac. Proc. Samp. Schedule <input type="checkbox"/> Inspection Plan <input type="checkbox"/> Inventory Adjustment Request <input type="checkbox"/>	Tank Calibration Manual <input type="checkbox"/> Health Physics Procedure <input type="checkbox"/> Spares Multiple Unit Listing <input type="checkbox"/> Test Procedures/Specification <input type="checkbox"/> Component Index <input type="checkbox"/> ASME Coded Item <input type="checkbox"/> Human Factor Consideration <input type="checkbox"/> Computer Software <input type="checkbox"/> Electric Circuit Schedule <input type="checkbox"/> ICRS Procedure <input type="checkbox"/> Process Control Manual/Plan <input type="checkbox"/> Process Flow Chart <input type="checkbox"/> Purchase Requisition <input type="checkbox"/> Ticker File <input type="checkbox"/> None <input type="checkbox"/>																															
<b>20. Other Affected Documents:</b> (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.																																	
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UNREVIEWED SAFETY QUESTION (USQ)
SCREENING AND EVALUATION

Table with 3 columns: 1. Identification Number: WHC-SD-CP-SDD-017, Rev. 3; USQ SCREENING; Page 1 of 2

2. Title: SYSTEM DESIGN DESCRIPTION PFP THERMAL STABILIZATION

INSTRUCTIONS: Respond to each question and provide justification for each response. A restatement of the question does not constitute a satisfactory justification or basis. An adequate justification provides sufficient explanation such that an independent reviewer could reach the same conclusion based on the information provided [DOE 5480.21, 10.e.1].

The authorization basis documents reviewed included those listed in FSP-PFP-5-8, Section 2.23, Appendix A. These are:

- WHC-SD-CP-SAR-021 Revision 0-J and supplemental ECN's below
ECN-646623 ECN-616618 ECN 649956
ECN-646804 ECN-708423 ECN 649958
ECN-611939 ECN-643207
ECN-191508 ECN-629275
ECN-649765 ECN-649770
ECN-642356 ECN-631022

- WHC-SD-CP-OSR-010, Revision 0-H
DOE/DP-0130, January 1995
HNF-2024, Rev 0-A
Letter FDH-9755047 R2, October 10, 1997
DOE-RL Letter 97-TPD-163, August 22, 1997

QUESTIONS

1.Does the proposed change or occurrence represent a change to the facility or procedures as described in the Authorization Basis?
[] N/A [X] No [] Yes/Maybe

BASIS: Handling of thermally stabilized material is considered normal operations. Section 6.2.2 and 6.4.1.2 of the Authorization Basis (WHC-SD-CP-SAR-021, Rev 0-H) discusses the thermal stabilization process. The changes being made to the SDD document were to delete the references to the use of the furnaces in glovebox HA-21I. The installation of thermal stabilization equipment in HA-21I has not been completed. To avoid potential confusion the references to HA-21I were deleted. Other typos were corrected and clarifications to the design description were made. This document change does not represent any change to conditions described in the Authorization Basis.

2.Does the proposed change or occurrence represent conditions that have not been analyzed in the Authorization Basis?
[] N/A [X] No [] Yes/Maybe

BASIS: Handling of stabilized material does not go beyond any conditions mentioned in

UNREVIEWED SAFETY QUESTION (USQ)  
SCREENING AND EVALUATION

1. Identification Number: WHC-SD-CP-SDD-017, Rev. 3	USQ SCREENING	Page 2 of 2
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2. Title: SYSTEM DESIGN DESCRIPTION PFP THERMAL STABILIZATION

WHC-SD-CP-SAR-021, Rev.0. Spills of plutonium bearing materials are covered in section 9.1.3, Radioisotope-Bearing Powder Spills, and no new accident could be caused by the changes made to the document. Changes to this document do not represent a change to the Authorization Basis.

3. Does the proposed change represent a test or experiment NOT described in the Authorization Basis that may affect the safe operation of the facility?

N/A  No  Yes/Maybe

BASIS: The change to the document does not comprise a test or experiment.

4. Does the proposed change or occurrence represent a change to the Technical Safety Requirements or a reduction in the margin of safety defined in the Technical Safety Requirements?

N/A  No  Yes/Maybe

BASIS: Deleting the references to HA-21I in the SDD does not represent or require any changes to WHC-SD-CP-OSR-010, Rev A-4. No Safety Limits for PFP are specified in OSR-10 so a margin of safety cannot be affected.

USQE #1 H. R. Risenmay  
(Print Name)

H. R. Risenmay  
Signature

Date: October 27, 1998

USQE #2 Mark W Gibson  
(Print Name)

Mark W Gibson  
Signature

Date: 11/3/98

If there is a YES/MAYBE response to questions 1, 2, 3, or 4, then a USQ Evaluation must be completed.

The following guidance should be considered when completing this screening. This guidance should not be considered all-inclusive; additional factors may need to be considered depending on the nature of the proposed change.

Does the proposed change:

- 1) Modify, add, or delete a safety class function of a structure, system or component stated in the authorization basis?
- 2) Alter the design of a structure, system or component as described in the authorization basis?
- 3) Modify, add, or delete the description of operation, operating environment, or analyses of any system or component described in the authorization basis?
- 4) Modify, add, delete or conflict with any of the design bases stated in the authorization basis?
- 5) Conflict with the principle or general design criteria stated in the authorization basis?
- 6) Modify, add, or delete any plant design features described in the authorization basis?
- 7) Modify, add, or delete a flow diagram or facility drawing provided in the authorization basis?
- 8) Create the potential for new system or component interactions (e.g., seismic, electrical breaker coordination)?

# SYSTEM DESIGN DESCRIPTION PFP THERMAL STABILIZATION

H. Rees Risenmay

B&W Hanford Company, Richland, WA 99352  
U.S. Department of Energy Contract DE-AC06-96RL13200

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Key Words: Thermal Stabilization, HC-21C, Plutonium Residues

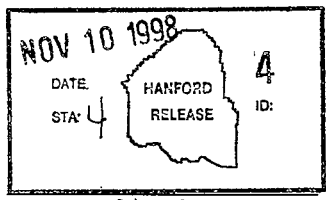
Abstract: The purpose of this document is to provide a system design description and design basis for the Plutonium Finishing Plant (PFP) Thermal Stabilization project. The sources of material for this project are residues scraped from glovebox floors and materials already stored in vault storage that need further stabilizing to meet the 3013 storage requirements. Stabilizing this material will promote long term storage and ~~reduced~~ reduced worker exposure. This document addresses: function design, equipment, and safety requirements for thermal stabilization of plutonium residues and oxides.

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Release Approval Date 11/10/98



Approved for Public Release



HNF-SD-CP-SDD-017

REV. 73  
07/04/11

SYSTEM DESIGN DESCRIPTION  
PPF THERMAL STABILIZATION

TABLE OF CONTENTS

1.0 PURPOSE.....	4
2.0 SUMMARY.....	4
3.0 FUNCTIONS AND DESIGN REQUIREMENTS .....	5
3.1 PROCESS REQUIREMENTS .....	6
3.2 INTERFACES .....	6
4.0 SAFETY INTERLOCKS, SET POINTS, AND ALARMS .....	8
4.1 SAFETY INTERLOCKS.....	8
4.2 SET POINTS/RANGES.....	9
4.3 ALARM RESPONSE.....	9
5.0 OPERATION.....	9
5.1 OPERATING PROCEDURES.....	9
5.2 OPERATING SPECIFICATIONS DOCUMENT .....	10
5.3 PROCESS FLOWSHEET DOCUMENT .....	10
6.0 MAINTENANCE .....	10
6.1 MAINTENANCE PROCEDURES .....	10
6.2 VENDOR INFORMATION FILES.....	10
7.0 SURVEILLANCE.....	11
8.0 SAFETY .....	15
8.1 FIRE SAFETY .....	16
8.2 EXCESSIVE HEAT .....	18
8.3 CRITICALITY .....	18
8.4 RADIATION SAFETY .....	18
9.0 EQUIPMENT SAFETY CLASS ANALYSIS .....	19
9.1 HC-21C GLOVEBOX FURNACE TEMPERATURE CONTROL SYSTEM .....	19
9.2 HC-21C GLOVEBOX FURNACE EMERGENCY SHUTDOWN SWITCH(HS-21C-E).....	20
9.3 HC-21C GLOVEBOX FURNACE EXHAUST PROVIDED BY 26" PROCESS VACUUM SYSTEM.....	20
9.4 HC-21C GLOVEBOX FURNACE CO2 SUPPLY SYSTEM.....	21
9.5 HC-21C GLOVEBOX HIGH TEMPERATURE CONTROL SYSTEM .....	21
9.6 HC-21C GLOVEBOX FURNACES.....	22
9.7 HC-21C CONTROL PANEL HAND SWITCHES.....	22
9.8 HC-21C TEMPERATURE CONTROL ITEMS.....	23
9.9 HC-21A TEMPERATURE SENSOR AND ALARM.....	23



**10.0 REFERENCES.....24**  
**APPENDIX A SYSTEM DRAWING LIST.....25**  
**APPENDIX B MASTER COMPONENT INDEX LIST.....27**

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## 1.0 PURPOSE

The purpose of this document is to provide a system design description (SDD) and design basis for the Plutonium Finishing Plant (PFP) Thermal Stabilization project. The chief objective of the SDD is to document the Structures, Systems, and Components (SSCs) that establish and maintain the facility Safety Envelope necessary for normal safe operation of the facility; as identified in the FSAR, the OSRs, and Safety Assessment Documents (SADs). This safety equipment documentation should satisfy guidelines for the SDD given in WHC-SD-CP-TI-181, Criteria for Identification and Control of Equipment Necessary for Preservation of the Safety Envelope and Safe Operation of PFP.

The basis for operational, alarm response, maintenance, and surveillance procedures are also identified and justified in this document. This document and its appendices address the following elements of the PFP Thermal Stabilization project:

- Functional and design requirements
- Design description
- Safety Envelope Analysis
- Safety Equipment Class
- Operational, maintenance and surveillance procedures

The appendices contain additional data for informational purposes only. The actual data bases and/or supporting documents should be consulted for the most current data.

## 2.0 SUMMARY

The Thermal Stabilization Project is designed to stabilize the plutonium bearing materials currently stored in gloveboxes and plutonium bearing materials in product storage vaults at the PFP to meet interim storage as defined by DOE-HQ Standard DOE-STD-3013. Stabilizing this material will facilitate long term storage and reduce worker exposure.

The sources of plutonium bearing material for this project are residual materials scraped from glovebox floors, glovebox floor sweepings, and vault storage material (Pu-U mixtures) that need further stabilization. These materials accumulated during the production of defense material at the PFP. The plutonium bearing material is currently contained in 1/2 liter capped plastic bottles, called polyjars, small slip-lid cans stored in various gloveboxes, or in cans in the storage vaults. The material will be thermally stabilized in gloveboxes HC-21C (room 230A) and HA-21I (room 235) of the 234-5Z building. Processed material, after cooling, will then be packaged in glovebox HC-18M (room 228C), bagged out and canned for interim storage in vaults at the PFP.

The furnace related equipment installed by the Thermal Stabilization project has been determined not to be Safety Class or Safety Significant based upon the facility safety analysis report WHC-SD-CP-SAR-021 and the safety classification process as driven by PRO-704, Rev. 0, Hazard and Accident Analysis Process, Section 2.4, Table 5 and Appendix F. However, the gloveboxes, ventilation system, and room Continuous Air Monitors (CAM) are safety significant equipment. No accident has been postulated that would affect on site or off-site personnel, however, so there is no requirement for a safety class designation.

### 3.0 FUNCTIONS AND DESIGN REQUIREMENTS

Reactive Plutonium bearing materials (other than metal items), usually stored in polyjars, are first sealed into glovebox HC-21A; where packaging is removed and the material is weighed and placed into a carrier called a boat. The boat is then transferred through conveyor HC-2 to glovebox HC-21C and placed into one of the muffle furnaces.

If the material to be processed originated in the Plutonium Reclamation Facility (PRF), the material potentially contains tributyl phosphate (TBP). The daily operation instruction that designates the items to be processed will also specify when those items require organic analysis. When the analysis shows organic present the amount of organic per furnace batch will be examined to ensure that the 10 gram limit is not exceeded. For this type of material a rotameter is adjusted to provide a specified flow rate of carbon dioxide (CO<sub>2</sub>) purge gas into the furnace. The purpose of the CO<sub>2</sub> is to dilute any butene which could be generated from the degradation of TBP in the PRF material. The off-gas is removed from the furnace via the 26 inch vacuum system at a specified rate.

The next step involves starting the furnace heating cycle from the control panel for glovebox HC-21C. The operator assures that the emergency stop button for glovebox HC-21C is not depressed and that the furnace door is closed. The operator then selects the correct cycle program on the controller or operator display screen for the feed material being processed and depresses the manual start switch.

The controller has been pre-programmed to ramp and hold the furnace temperature at rates and temperature levels specific to the material being processed. The material is then cooled and transported to glovebox HC-18M via conveyors HC-2 and HC-18BS. In HC-18M the product is ground (if needed), blended, sampled (to verify the Loss on Ignition (LOI) meets vault storage specifications), and packaged in the PUREX slip lid can for long term storage. The packaged material is moved to the HC-18BS glovebox for interim storage while waiting for the results of the sample analysis. Samples are analyzed for moisture content in the analytical labs. After the processed material has been analyzed, it is moved back to HC-18M, bagged out to room 228C, and placed in two hermetically sealed cans. The final can is weighed, security seals

applied and either, transported to 175 vault for interim storage before being moved to 2736-ZB or moved directly to 2736-ZB for NDA and storage.

### 3.1 PROCESS REQUIREMENTS

Process requirements for Thermal Stabilization specify what types of material may be processed, process conditions for each type, and what specifications the finished product must meet. An important feed criterion is the percent organic in the material. Important finished product criteria are the amount of volatile compounds in the material (as determined by a percent Loss On Ignition (LOI) analysis), the size of processed particles, and the moisture absorption rate of the material. Process requirements for this system are defined and explained in PFD-Z-109-00004, Thermal Stabilization Process Flow sheet, 234-5Z Building<sup>1</sup> and OSD-Z-184-00006 Thermal Stabilization<sup>2</sup>.

### 3.2 INTERFACES

Materials will be transferred to and from the vaults on a daily basis during normal operations. Vault 175 will be used as a staging area for both feed and product.

Off-gas streams from the furnaces in glovebox HC-21C are removed using the 26" vacuum system.

Gases enter and leave the HC-18M, HC-21A and HC-21C gloveboxes through several systems. HC-21A has inlet streams consisting of E-4 "dry" air supply (Note: The E-4 system no longer supplies dry air, air is supplied at atmospheric humidity). Air will exit the HC-21A glovebox through a local HEPA filter before entering the E-4 exhaust system. Glovebox HC-18M is also supplied by the above "dry" air system and exhausted through the E-4 system. Glovebox HC-21C is also supplied by the dry air system and exhausted through the E-4 system. In addition, CO<sub>2</sub> will enter HC-21C from tanks located in room 230A. CO<sub>2</sub> is supplied directly to the furnaces inside the glovebox and leaves the furnaces and glovebox through the 26" process vacuum system.

#### 3.2.1 Power

Power is supplied to glovebox HC-21C and the Thermal Stabilization control panel through junction box JB-HC-21C. The junction box is located underneath HC-21C and is supplied by power panel "B"; part of the Remote Mechanical 'C' (RMC) electrical system. Power for the system is routed first to the control panel and then relayed to furnaces, thermocouples, etc. Power to the electric can opener, oxygen monitors, and door lock latches, in HC-21A is through panelboard ARS-2 on the 235 mezzanine.

Power to the balance and grinder in glovebox HC-18M is provided by the outlets located in the glovebox. HC-18M is a maintenance glovebox and has power outlets to operate various maintenance devices. Power is supplied by panel board 120B on the mezzanine near column D9.

### **3.2.2 Control**

All of the instrumentation, controls and alarms for HC-21C have been installed in a control panel which is located in room 230A, facing glovebox HC-21C.

#### **3.2.2.1 Furnace Temperature**

Furnace temperature is measured by a thermocouple (TC). The furnaces in glovebox HC-21C have digital temperature controllers with set point programming which will receive input from the TC and, based on a comparison with the set point, send output to a silicon controlled rectifier (SCR). The SCR uses input from the temperature controller to establish an output amperage to the furnace. A deviation band alarm feature in the temperature controller is interlocked with power to the furnace and will disable the furnace when the measured temperature deviates outside the temperature band.

A redundant thermocouple located in each furnace provides input to a high temperature alarm switch (TAS). To prevent "burning out" furnace heating elements the TAS is interlocked to remove power from the furnace if the temperature exceeds a high set point.

When a deviation exists or the set point is exceeded the furnace interlock is accompanied by an audible alarm and a lighted window on an annunciator panel.

#### **3.2.2.2 Glovebox Temperature**

The glovebox temperature for HC-21C is measured by three thermocouples placed throughout the glovebox. The measured temperatures are sent to a high temperature select instrument which digitally displays each temperature for several seconds. When the temperature from any one of the three TCs reaches a setpoint (set well below the 93 C (200 F) trip point of the Halon system), power is removed from the furnaces. When the set point is exceeded it is accompanied by an audible alarm and a lighted window on the annunciator panel.

#### **3.2.2.3 Furnace Door Interlock**

The furnace door is interlocked to disable power to the furnace if the door is open. When the door is closed a red light on the panel lights up or the door of the furnace on the operator display screen closes, indicating that a heating cycle may be started. If the door is opened during a heating cycle, power to the furnace will be removed. This interlock prevents the furnace from inadvertently being turned on when the door is open.

## 4.0 SAFETY INTERLOCKS, SET POINTS, AND ALARMS

### 4.1 SAFETY INTERLOCKS

The safety interlocks described below control power to Furnaces FUR-21C-1 and FUR-21C-2 in glovebox HC-21C. These interlocks are shown in drawing H-2-815184 SH. 1 & 2.

#### Interlocks for Glovebox HC-21C

##### General

Power will be removed from both furnaces (FUR-21C-1, FUR-21C-2) when any of the following conditions occur:

1. Emergency Push-Pull Switch (HS-21C-E) is depressed.
2. High Glovebox Temperature is detected (TAS-21C-C).

#### Interlocks for FUR-21C-1

In addition to the conditions for the General Interlocks 1 and 2 given above, power will be removed from Furnace #1 (FUR-21C-1) when any of the following conditions occur:

- A. High furnace temperature is detected (TAS-21C-A).
- B. Deviation between set point and actual furnace temperature is detected (TIC-21C-A).
- C. Furnace Door #1 is open (Limit Switch LS-21C-1).

#### Interlocks for FUR-21C-2

In addition to the conditions for the General Interlocks 1 and 2 given above, power will

be removed from Furnace #2 (FUR-21C-2) when any of the following conditions occur:

- A. High furnace temperature is detected (TAS-21C-B).
- B. Deviation between set point and actual furnace temperature is detected (TIC-21C-B).
- C. Furnace Door #2 is open (Limit Switch LS-21C-2).

## 4.2 SET POINTS/RANGES

Set points and ranges for furnace temperatures, alarms, etc. have been outlined in OSD-Z-184-00006, the operating specifications document (OSD) for the Thermal Stabilization project<sup>2</sup>. The OSD also identifies off-standard conditions and recovery actions. Specific set points and ranges will not be stated here in order to avoid inconsistencies between this document and the OSD.

## 4.3 ALARM RESPONSE

Alarms associated with thermal stabilization activities will display on an annunciator panel of the control panel in Room 230A. Alarm response operator actions for the Thermal Stabilization process are documented in ZAR-020.

# 5.0 OPERATION

## 5.1 OPERATING PROCEDURES

- **ZO-160-032, HC-21C Muffle Furnace Operation.** This procedure provides instructions for stabilizing inorganic reactive plutonium bearing solid materials by oxidizing/heating these solids.
- **ZO-160-034, Stabilized Material Handling.** This procedure provides instructions for separating different sizes of stabilized plutonium bearing solids that have been processed through the muffle furnace.
- **ZO-160-035, Furnace Charge Preparation.** This procedure provides instructions for loading the thermal stabilization boats with material to be processed in the stabilization furnaces.
- **ZAR-020, HC-21C Muffle Furnace Alarms.** This procedure provides instructions for emergency shutdown and alarm responses for HC-21C furnaces in Rooms 230A.

## 5.2 OPERATING SPECIFICATIONS DOCUMENT

- **OSD-Z-184-00006, PFP Operating Specifications Document, Thermal Stabilization.** This document contains specification limits for feed items, furnace and glovebox temperatures, charge size, and amount of combustible materials in the glovebox. Information detailing detection/control of process variables and recovery actions are also given.

## 5.3 PROCESS FLOWSHEET DOCUMENT

- **PFD Z-190-00004, Thermal Stabilization Process Flowsheet.** The Process Flowsheet Document (PFD) contains detailed information on process parameters and design. It includes equipment description, process technology, control schemes and set points, off-standard conditions, and safety concerns.<sup>13</sup>

## 6.0 MAINTENANCE

### 6.1 MAINTENANCE PROCEDURES

Calibration maintenance activities are initiated using the PMS system and PSCP and other general calibration procedures. Listed below are specific procedures used in the Thermal Stabilization system.

ZCP-4-001	Dwyer Magnehelic Differential Pressure Gauge Series 2000 and Capselic Differential Pressure Gauge Series 4000.
1-ZM-079;	Muffle Furnace Temperature Control System Calibration
2Z-18364	Balances - Product Handling Verification System 74

### 6.2 VENDOR INFORMATION FILES

The vendor information (VI) file is compiled to address all of the components installed for Thermal Stabilization of plutonium bearing materials in gloveboxes HC-21A, HC-21C, and HC-18M. The VI file is:

CVI Number	Description
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22592

Control Panel  
 Temperature Control System  
 Instrumentation  
 Associated Piping and Valves  
 Furnaces  
 Off-gas Filters  
 CO<sub>2</sub> supply manifold  
 Programmable Logic Controller (PLC)  
 Filter housings  
 Grinder  
 Commercial Can Opener  
 Oxygen sensor interlock system

### 7.0 SURVEILLANCE

Surveillance of Safety Class and other equipment is controlled and monitored through the Preventative Maintenance System (PMS). The PMS is a large database which tracks when equipment surveillance needs to occur and what information needs to be recorded. This database also contains historical data (past calibration or functional checks) for the equipment. The following table lists all System 73T equipment in the PMS database and the surveillance interval.

LOOP NUMBER	SEQUENCE NUMBER	INSTRUMENT IDENTIFICATION	FUNCTION	VERIFICATION INTERVAL
BO410	1	TIC-21C-A	TEMPERATURE CONTROLLER FUR-1	12 MONTHS
	2	TR-21C	TEMPERATURE RECORDER, CHANNEL 1, FUR-1 TEMPERATURE	12 MONTHS
	3	TE-21C-5	THERMOCOUPLE FOR FUR-1 CONTROLLER, TYPE K	PRE-CAL/CERT
	4	TA-21C-1	DEVIATION ALARM FUR-1, WINDOW 4-B	12 MONTHS

LOOP NUMBER	SEQUENCE NUMBER	INSTRUMENT IDENTIFICATION	FUNCTION	VERIFICATION INTERVAL
	5	EIC-21C-A	SOLID STATE CONTACTOR FUR-1	PRE-CAL/CERT
	6	HS-21C-A	MANUAL START BUTTON FUR-1	12 MONTHS
	7	HS-21C-B	MANUAL STOP BUTTON FUR-1	12 MONTHS
	8	TAS-21C-A	HIGH TEMPERATURE ALARM SWITCH, FUR-1	12 MONTHS
	A	TE-21C-4	THERMOCOUPLE FOR FUR-1 HIGH TEMPERATURE ALARM, TYPE K	PRE-CAL/CERT
	B	TA-21C-4	HIGH TEMPERATURE ALARM FUR-1, WINDOW 4-A	12 MONTHS
	C	LS-21C-1	DOOR LIMIT SWITCH, FUR-1	12 MONTHS
BO411	1	TIC-21C-B	TEMPERATURE CONTROLLER FUR-2	12 MONTHS
	2	TR-21C	TEMPERATURE RECORDER, CHANNEL 2, FUR-2 TEMPERATURE	12 MONTHS
	3	TE-21C-6	THERMOCOUPLE FOR FUR-2 CONTROLLER, TYPE K	PRE-CAL/CERT
	4	TA-21C-6	DEVIATION ALARM FUR-2, WINDOW 6-B	12 MONTHS
	5	EIC-21C-B	SOLID STATE CONTACTOR FUR-2	PRE-CAL/CERT
	6	HS-21C-C	MANUAL START BUTTON FUR-2	12 MONTHS
	7	HS-21C-D	MANUAL STOP BUTTON	12 MONTHS

LOOP NUMBER	SEQUENCE NUMBER	INSTRUMENT IDENTIFICATION	FUNCTION	VERIFICATION INTERVAL
			FUR-2	
	8	TAS-21C-B	HIGH TEMPERATURE ALARM SWITCH, FUR-2	12 MONTHS
	A	TE-21C-7	THERMOCOUPLE FOR FUR-2 HIGH TEMPERATURE ALARM, TYPE K	PRE-CAL/CERT
	B	TA-21C-7	HIGH TEMPERATURE ALARM FUR-2, WINDOW 6-A	12 MONTHS
	C	LS-21C-2	DOOR LIMIT SWITCH, FUR-2	12 MONTHS
B0412	1	HS-21C-E	EMERGENCY STOP BUTTON	12 MONTHS
B0413	1	TAS-21C-C	HIGH TEMPERATURE ALARM SWITCH FOR GLOVEBOX HC-21C	12 MONTHS
	2	TAH-21C-2	HIGH GLOVEBOX TEMPERATURE ALARM, WINDOW 2	12 MONTHS
	3	TE-21C-1	GLOVEBOX THERMOCOUPLE 1, TYPE J	PRE-CAL/CERT
	4	TE-21C-2	GLOVEBOX THERMOCOUPLE 2, TYPE J	PRE-CAL/CERT
	5	TE-21C-3	GLOVEBOX THERMOCOUPLE 3, TYPE J	PRE-CAL/CERT
B0414	1	DPI-21C-1	DIFFERENTIAL PRESSURE INDICATOR, FILTER ON FUR-1	12 MONTHS
	2	FI-21C-1	FLOW INDICATOR, FUR-1 EXHAUST	12 MONTHS

LOOP NUMBER	SEQUENCE NUMBER	INSTRUMENT IDENTIFICATION	FUNCTION	VERIFICATION INTERVAL
	3	PI-21C-1	VACUUM GAGE	12 MONTHS
	4	PI-21C-2	VACUUM GAGE	12 MONTHS
	5	DPI-21C-3	DIFFERENTIAL PRESSURE INDICATOR ORIFICE ON OFF-GAS FUR-21C-2	12 MONTHS
B0415	1	DPI-21C-2	DIFFERENTIAL PRESSURE INDICATOR, FILTER ON FUR-2	12 MONTHS
	2	FI-21C-2	FLOW INDICATOR, FUR-2 EXHAUST	PRECERT/CAL INDICATION ONLY
	3	DPI-21C-4	DIFFERENTIAL PRESSURE INDICATOR ORIFICE ON OFF-GAS FUR-21C-2	12 MONTHS
B0416	1	FI-21C-3	ROTAMETER, CO <sub>2</sub> SUPPLY FUR-21C-1	PRECERT/CAL INDICATION ONLY
	2	FI-21C-4	ROTAMETER, CO <sub>2</sub> SUPPLY FUR-21C-2	PRECERT/CAL INDICATION ONLY
	3	PRV-21C-1	PRESSURE REDUCING VALVE, CO <sub>2</sub> SUPPLY	12 MONTHS
	3	PI-74-1	VACUUM INDICATOR FOR HEADER	ONE TIME FUNCTIONAL CHECK

LOOP NUMBER	SEQUENCE NUMBER	INSTRUMENT IDENTIFICATION	FUNCTION	VERIFICATION INTERVAL
B0419	1	FI-21A-2	IAC ARGON FLOW INDICATOR	12 MONTHS
B0420	1	TE-21A-1	HC-21A TEMPERATURE RTD	PRECERT/CAL
	2	TI-21A-1	HC-21A TEMPERATURE INDICATOR	12 MONTHS
B0421	1	AI-21A-1	IAC OXYGEN MONITOR/INDICATOR	12 MONTHS
B0422	1	AI-21A-2	AIRLOCK OXYGEN MONITOR/INDICATOR	12 MONTHS

## 8.0 SAFETY

The principle hazards associated with glovebox HA-21A, HC-18M, and HC-21C operations are fire safety, excessive heat, criticality, and radiation. The following section describes the potential hazards associated with thermal stabilization. In addition, glovebox HC-21C was analyzed for a deflagration of butene gas from the presence of TBP. The analysis determined that the deflagration was bounded by an existing safety analysis for glovebox MT-5.

There are no operational safety requirements (OSRs) associated with the PFP Thermal Stabilization System. The equipment installed by the Thermal Stabilization project was determined to be "other equipment important to safety".

Worker safety and accident analysis are documented in the MT-5 Glovebox analysis. The two bounding accident scenarios for the MT-5 system, and thus the Thermal Stabilization system, are: a fire within the glovebox, and the rapid decomposition of tributyl phosphate (TBP) leading to the formation of combustible gases and deflagration of the gas (glovebox HC-21C only).

Calculated consequences for glovebox fires were found to be within risk acceptance guidelines. The rapid decomposition of TBP leading to the formation of combustible gases was

shown to be an incredible event. The probability of a seismically induced deflagration in glovebox MT-5 resulting from a design basis earthquake (DBE) and a small earthquake were quantified and shown to be incredible events.

For further detail on safety criteria, see WHC-SD-CP-SAR-021<sup>11</sup>, PPF Facility Safety Analysis Document section 9.2.2, WHC-SD-CP-PHA-003, HA-211 HAZOP Study.

## **8.1 FIRE SAFETY**

### **8.1.1 Glovebox Fire**

High furnace temperatures and the presence of combustible materials are factors which could lead to a glovebox fire in HC-21C. If such a fire occurs in HC-21C or HC-21A, the Halon fire suppression system is in the glovebox to ensure the fire is extinguished.

### **8.1.2 Combustible Material**

To keep an uncontrolled fire from taking place, combustible material must be kept to a minimum within the gloveboxes. Since high temperatures are involved in this process, extra care must be taken not to damage the gloves by using hot mill gloves when touching hot surfaces. Gloves near the furnace must be pulled out of the glovebox before the heating cycle is started.

### **8.1.3 Glovebox Temperature**

Thermocouples independent of the furnace control system monitor the glovebox temperature continuously. In glovebox HC-21C three thermocouples have been located throughout the glovebox. If the glovebox temperature reaches the set temperature, an interlock in the glovebox temperature monitor removes power to the muffle furnaces. If the glovebox temperature exceeds 93 C (200 F), the Halon fire suppression system is activated.

To aid in maintaining a low temperature in the glovebox, the muffle furnace door will be kept closed when the furnace is at higher temperatures.

### **8.1.4 Flammability of Off-Gas**

Feed items that originated in PRF potentially contain TBP. One of the

decomposition products of TBP is butene. Butene, in certain concentrations, can be flammable. Combustion of large amounts of butene gas could, in a worst case scenario, cause rupture of the glovebox. It is, however, unlikely that a sufficient quantity of gas could be generated to rupture the glovebox. Four independent barriers in glovebox HC-21C are in place to prevent flammable levels of gas. The four barriers are:

- (1) All items originating from PRF (or if origin is uncertain) are sampled for organic content. Material with greater than 10 grams organic will not be used as feed stock.
- (2) Removal and dilution of any flammable gases by continuous gas circulation through the furnace of about 120-125 ft<sup>3</sup>/hr.
- (3) A cover gas of CO<sub>2</sub> will be introduced into the furnaces in glovebox HC-21C in the temperature regime where flammable gas could be generated. The CO<sub>2</sub> will be fed into the furnaces at a flow rate of about 30-35 ft<sup>3</sup>/hr. The amount of CO<sub>2</sub> available will be verified prior to each cycle.
- (4) The material will be slowly heated at a ramp rate of 5 C/minute (9 F/min) to 175 C (347 F) and held at this temperature for 1.5 hours. This will assure that all of the TBP has decomposed prior to reaching the auto-ignition temperature of butene (324 C or 615 F).

### **8.1.5 Plugged Filter**

The filter on the exhaust line may become clogged if there is a release of particulate matter during a heating cycle. This reduces the permeability of the filter, thus decreasing the exhaust flow rate and increasing the probability of butene buildup in the furnaces in glovebox HC-21C.

Prior to each heating cycle in glovebox HC-21C, the pressure differential across the ceramic filter and the exhaust flow rate are checked to assure adequate flow rate. If the exhaust flow rate is not adequate (minimum 120 cfh), or the pressure differential is too high, then the ceramic filter needs to be cleaned or replaced before the cycle is run.<sup>5</sup> While plugging the filters is not a safety concern, plugging will reduce efficiency during cool down.

## **8.2 EXCESSIVE HEAT**

### **8.2.1 Glovebox Windows**

The windows in the gloveboxes are made of Lexan. This material will not warp under heat stress and is shatter resistant.<sup>11</sup>

### **8.2.2 Glovebox Gloves**

Boat handling tools and hot mill over-gloves will be used when moving hot material and equipment. This is to protect the glovebox gloves and hence the operator.

## **8.3 CRITICALITY**

Since plutonium is a fissile material, measures are taken to assure prevention of conditions which could lead to a criticality incident. A criticality prevention specification (CPS) has been prepared for gloveboxes HC-2, HC-18M, HC-18BS, HC-21A, and HC-21C to accommodate the Thermal Stabilization process. Limits on plutonium quantities, container volumes, and material spacings are specified in these CPSs and shall be strictly adhered to during operations.

## **8.4 RADIATION SAFETY**

Operations around the gloveboxes are kept to a minimum to minimize exposures. A control station is located in Room 230A roughly 7 feet from glovebox HC-21C to allow the operator to monitor the operations of this glovebox and still maintain spacing.

### **8.4.1 Foaming**

Plutonium oxycarbonate (from oxalate) forms an intermediate liquid phase above 100 C (212 F). The material boils at about 180 C (356 F) and could foam over the top of the boat. The temperature is held at a lower temperature of 175 C (347 F) for an hour to allow for the majority of the liquid to be driven off. If material does foam over, a scraper and paint brush may be used to scrape and sweep material from the bottom of the furnace once it has cooled. This material is then mixed with the new feed material for the next heating cycle.

## **9.0 EQUIPMENT SAFETY CLASS ANALYSIS**

Due to the remote possibility of hazardous chemicals or radio nuclides being released offsite in any accident scenario of the Thermal Stabilization system, it was determined that no System 73T components would be rated as Safety Class or Safety Significant.



PPF Safety Class and Safety Significant equipment is listed in the PPF Safety Equipment List, WHC-SD-CP-TI-108 under Safety Equipment List (SEL). Items in the Thermal Stabilization system in gloveboxes HC-18M, HC-21C, and HA-21A, which have industrial health and safety or process control functions are discussed below.

## 9.1 HC-21C GLOVEBOX FURNACE TEMPERATURE CONTROL SYSTEM

Item: Temperature Controllers for Furnaces #1 & #2.

TIC-21C-A, TIC-21C-B

Basis: The temperature controllers ramp power supply to the furnaces. Materials originating in PRF potentially contain TBP which produces butene vapor when it is heated. The heating rate controls the rate of gas vaporization in the Pu bearing material. Uncontrolled heating could create large quantities of butene gas, a flammable vapor, in a short period of time. A controlled heating rate is one of the engineered barriers which prevents gas concentration in the furnaces in glovebox HC-21C from reaching the flammability point.

Controlled temperature ramp up rates also prevent boil-over of liquid solutions, thus minimizing cleanup and dose rates.

Item: Temperature Elements (Thermocouples) and Alarm Annunciators

TE-21C-5, TE-21C-6, TA-21C-1 (ANN-2), TA-21C-6 (ANN-5)

Basis: Thermocouples for this system are important because they supply the temperature controllers with information. The alarm annunciator is also important because it notifies operators that furnace temperatures are deviating from program parameters and action may be necessary.

## 9.2 HC-21C GLOVEBOX FURNACE EMERGENCY SHUTDOWN SWITCH (HS-21C-E)

Item: Hand switch for furnace heat emergency stop.

### HS-21C-E

Basis: This manual switch removes power from both furnaces. The emergency shutdown switch allows operators to stop a heating cycle to preclude the following: a Halon Fire Suppression System alarm, a butene gas buildup in a furnace, or any other abnormal condition.

## 9.3 HC-21C GLOVEBOX FURNACE EXHAUST PROVIDED BY 26" PROCESS VACUUM SYSTEM

Item: Flow Indicators on furnace off-gas system.

DPI-21C-3, DPI-21C-4

Basis: The off-gas system is an engineered barrier designed to keep butene concentration in the furnaces low. Differential pressure gages across orifices provide verification of the off-gas flow rate from the furnaces. Verification of off-gas flow prior to initiating a heating cycle is important to ensure the off-gas system is not plugged.

Item: Differential Pressure Indicators in the furnace off-gas system which measure differential pressure on the off-gas filters.

DPI-21C-1, DPI-21C-2

Basis: The off-gas system is designed to keep butene concentration in the furnaces low. The off-gas filters will remove particulates from this system before gas enters the heat exchangers and continues through the 26" process vacuum system. Filters clogged with particulate matter could decrease the off-gas flow rate, causing butene vapor to build up in the furnaces. The differential pressure indicators **provide an indication of when filters are clogged and need to be cleaned or changed out.**

## 9.4 HC-21C GLOVEBOX FURNACE CO<sub>2</sub> SUPPLY SYSTEM

Item: Flow indicators on CO<sub>2</sub> supply system.

FI-21C-3, FI-32C-4

Basis: The CO<sub>2</sub> supply system is an engineered barrier designed to eliminate the possibility of butene deflagration in a furnace. The supply system accomplishes this by keeping butene concentration in the furnaces low and by purging the furnace with a non-flammable gas. Flow indicators provide visual verification of the CO<sub>2</sub> flow rate from storage tanks.

Item: Pressure Reducing Valve on CO<sub>2</sub> supply system.

PRV-21C-1

Basis: The pressure reducing valve on the CO<sub>2</sub> supply system must be functioning properly to ensure the necessary flow of CO<sub>2</sub> to the furnaces.

## 9.5 HC-21C GLOVEBOX HIGH TEMPERATURE CONTROL SYSTEM

Item: Temperature Elements (Thermocouples), High Temperature Select Switch, and Alarm Annunciator

TE-21C-1, TE-21C-2, TE-21C-3, TAS-21C-C, TAH-21C-2 (ANN-3)

Basis: The glovebox high temperature control system ensures that furnace operations do not create high temperatures in the glovebox, thus causing the Halon Fire Suppression System to trip. The high temperature select switch (TAS-21C-C) is wired to an interlock which shuts off power to the furnaces when glovebox temperatures exceed set point limits.

The key component of this system is the high temperature select switch (TAS-21C-C). The switch monitors three thermocouples located in the HC-21C glovebox and alarms if any one thermocouple exceeds the set point limit. Thermocouples for this system are important because they supply the high temperature select switch with information. The alarm annunciator is also important because it notifies operators that glovebox temperatures are high and that the Halon Release Hold Button (HS-21C-HA) may need to be activated to stop Halon from being released.

## 9.6 HC-21C GLOVEBOX FURNACES

Item: Furnaces 1 & 2

FUR-21C-1, FUR-21C-2

Basis: If the furnace fails for any reason the only consequence is that it will no longer be usable for stabilization. Power is supplied to the furnace by controllers and interlocks which have their own safety analysis.

Item: Limit switches on Furnaces 1 & 2.

LS-21C-1, LS-21C-2

Basis: These limit switches are located on the furnace doors and indicate whether the furnace door is open or closed. They are interlocked with the power supply such that power cannot reach the furnace if the furnace door is open. These limit switches are important because a furnace door left open during a heating cycle could cause the temperature in the glovebox to rapidly rise and activate the Halon Fire Suppression system. The limit switch also minimizes the risk of material (gloves, rags, etc.) coming in contact with hot furnace surfaces.

## 9.7 HC-21C CONTROL PANEL HAND SWITCHES

Item: Other Hand switches for process operation.

HS-21C-A, HS-21C-B, HS-21C-C, HS-21C-D

Basis: The other hand switches for manual start/stop of the furnaces are not safety class items because the emergency shutdown switch (HS-21C-E) will remove power from either furnace should these buttons fail.

## 9.8 HC-21C TEMPERATURE CONTROL ITEMS

Item: Temperature Controller Contactor.

EIC-21C-A, EIC-21C-B

Basis: The temperature controller contactors control furnace power based on input from the temperature controllers. Their failure would result in no power feed to the furnaces; thus, the contactors could not be responsible for a power overload to the furnaces.

Item: Other Temperature Elements (Thermocouples), Alarm Switches, and Annunciators.

TE-21C-4, TE-21C-7, TAS-21C-A, TAS-21C-B, TA-21C-4, TA-21C-7

Basis: These thermocouples, alarm switches, and annunciators are designed to prevent burned out furnace heating elements from running at peak furnace power for an extended period of time. This system is also a redundant source of furnace temperature information and safety. The components are process control safeguards.

## 9.9 HC-21A TEMPERATURE SENSOR AND ALARM

Item: Temperature of glovebox HC-21A.

TE-21A-1, TI-21A-1

Basis: The temperature sensor is for monitoring the temperature of the HC-21A glovebox and alarming when the high temperature set point is surpassed.

## 10.0 REFERENCES

- 1 PFD-Z-190-00004, Thermal Stabilization Process Flowsheet
- 2 OSD-Z-184-00006, PPF Operating Specification Document, Thermal Stabilization
- 3 ZO-160-032, HC-21C Muffle Furnace Operations
- 4 WHC-SD-CP-OCD-040, Basis Document for Sludge Stabilization
- 5 WHC-SD-CP-TRP-059, Scrap Stabilization Furnace Test Results, April 5, 1994
- 6 OSD-Z-184-00013, Special Nuclear Material Storage
- 7 CSER 94-007, Criticality Safety Engineering Report for Muffle Furnace Operations in Glovebox HC-21I, Room 230C, 234-5Z Building
- 8 Progress Report NUMEC P-90, Development of Plutonium-Bearing Fuel Materials
- 9 IM 12840-89-CMK-199, Glovebox Selection for Plutonium Button Oxidation. K.E. Parker to C.M. Kronvall, November 2, 1989
- 10 Rockwell International Internal Letter from L.E. Edvalson to J.W. Patterson, February 13, 1986
- 11 WHC-SD-CP-SAR-021, Rev. 0. Plutonium Finishing Plant Final Safety Analysis Report (FSAR).
- 12 WHC-SD-CP-TI-108 Rev 13. PPF Safety Equipment List.
- 13 PFD-Z-190-00004. Thermal Stabilization Process Flowsheet, Room 230A, 234-5Z Bldg. Rodgers, L. H. and W. S. Lewis. 6/23/94.

## APPENDIX A

## SYSTEM DRAWING LIST

THERMAL STABILIZATION IN GLOVEBOXES HC-21C, HC-18M, AND HC-21A		
Drawing Number	Index No.	Title
H-2-81310 SH. 1	7501	GLOVEBOX HC-21C FURNACE CONTROL CONSOLE ARRANGEMENT
H-2-81310 SH. 2	7501	GLOVEBOX HC-21C FURNACE CONTROL CONSOLE PANEL LAYOUTS
H-2-81310 SH. 3	7301	GLOVEBOX HC-21C FURNACE CONTROL PANEL LADDER DIAGRAM
H-2-81310 SH. 4	7301	GLOVEBOX HC-21C FURNACE CONTROL CONSOLE WIRING DIAGRAM
H-2-81310 SH. 5	7301	GLOVEBOX HC-21C FURNACE #2 CONTROL CONSOLE WIRING DIAGRAM
H-2-81310 SH. 6	7301	GLOVEBOX HC-21C FURNACE CONTROL PANEL, MISCELLANEOUS
H-2-140584 SH.1	4700/8518	SLUDGE STABILIZATION ROOMS 230A/230B ARRANGEMENT
H-2-140584 SH.2	4700/8518	SLUDGE STABILIZATION ROOMS 230A/230B PLAN
H-2-140584 SH.3	4700/8518	SLUDGE STABILIZATION ROOMS 230A/230B MEZZANINE PLAN
H-2-140584 SH.4	4700/8518	SLUDGE STABILIZATION ROOMS

<b>THERMAL STABILIZATION IN GLOVEBOXES HC-21C, HC-18M, AND HC-21A</b>		
<b>Drawing Number</b>	<b>Index No.</b>	<b>Title</b>
		230A/230B SECTION & DETAILS
H-2-140585 SH.1	4700/8518	HC-21C & HC-21A SLUDGE STABILIZATION GLOVEBOX ARRANGEMENT
H-2-140585 SH.2	4700/8518	HC-21C & HC-21A SLUDGE STABILIZATION GLOVEBOX ARRANGEMENT
H-2-140585 SH.3	4700/8518	HC-21C & HC-21A SLUDGE STABILIZATION GLOVEBOX ARRANGEMENT
H-2-140588	3902	SLUDGE STABILIZATION MUFFLE FURNACE TOOLS
H-2-815184 SH.1	7004	SLUDGE STABILIZATION P&ID
H-2-815184 SH.2	7004	GLOVEBOX HC-21C SLUDGE STABILIZATION P&ID
H-2-815184 SH.3	7004	GLOVEBOX HC-21A SLUDGE STABILIZATION P&ID



## APPENDIX B

**MASTER COMPONENT INDEX LIST  
PFP THERMAL STABILIZATION SYSTEM**

Thermal Stabilization System Master Component Index						
SYS No.	CID	DESCRIPTION	DRAWING	VENDOR MEGR	COMPONENT DATA	CVI NO.
73T	CV-21C-1	CHECK VALVE ON CO <sub>2</sub> INLET TO FURNACE 1	H-2-815184 SH. 2 H-2-140584	NUPRO	MODEL# SS-CHS8-1	22592 SUPP 11
73T	CV-21C-2	CHECK VALVE ON CO <sub>2</sub> INLET TO FURNACE 2	H-2-815184 SH. 2 H-2-140584	NUPRO	MODEL# SS-CHS8-1	22592 SUPP 11
73T	DPI-21C-1	DIFFERENTIAL PRESSURE INDICATOR, OFF-GAS FILTER 1	H-2-815184 SH. 2 H-2-140585	DWYER	MODEL# 4215	22592 SUPP 12
73T	DPI-21C-2	DIFFERENTIAL PRESSURE INDICATOR, OFF-GAS FILTER 2	H-2-815184 SH. 2 H-2-140585	DWYER	MODEL# 4215	22592 SUPP 12
73T	EIC-21C-A	CONTACTOR	H-2-815184 SH. 2 H-2-81310	EUROTHERM	MODEL# 831	22592 SUPP 2
73T	EIC-21C-B	CONTACTOR	H-2-815184 SH. 2 H-2-81310	EUROTHERM	MODEL# 831	22592 SUPP 2
73T	F-21C-1	OFF-GAS FILTER, FURNACE 1	H-2-815184 SH. 2 H-2-140586	PALL ADVANCED SEPARATION SYSTEMS	MODEL# C-23-40-DCSC	22592 SUPP 13

## Thermal Stabilization System Master Component Index

SYS No.	CID	DESCRIPTION	DRAWING	VENDOR MFR	COMPONENT DATA	CVI NO.
73T	F-21C-2	OFF-GAS FILTER, FURNACE 2	H-2-815184 SH. 2 H-2-140586	PALL ADVANCED SEPARATIO NS SYSTEMS	MODEL# C-23-40- DCSC	22592 SUPP 13
73T	FI-21C-1	FLOW INDICATOR, OFF- GAS AFTER HX-1	H-2-815184 SH. 2 H-2-140584	DWYER	MODEL# RMC- 103, 20-200 SCFH, 0" FNPT PORTS	22592 SUPP 12
73T	FI-21C-2	FLOW INDICATOR, OFF- GAS AFTER HX-2	H-2-815184 SH. 2 H-2-140584	DWYER	MODEL# RMC- 103, 20-200 SCFH, 0" FNPT PORTS	22592 SUPP 12
73T	FI-21C-3	FLOW INDICATOR, CO <sub>2</sub> TO FURNACE 1	H-2-815184 SH. 2 H-2-140584	DWYER	MODEL# RMB- 52-SSV, 5-50 SCFH, 0" FNPT PORTS	22592 SUPP 12
73T	FI-21C-4	FLOW INDICATOR, CO <sub>2</sub> TO FURNACE 2	H-2-815184 SH. 2 H-2-140584	DWYER	MODEL# RMB- 52-SSV, 5-50 SCFH, 0" FNPT PORTS	22592 SUPP 12
73T	FUR-21C-1	MUFFLE FURNACE 1	H-2-815184 SH. 2 H-2-140585	THERMOLY NE	MODEL# FA1630	22592 SUPP 4
73T	FUR-21C-2	MUFFLE FURNACE 2	H-2-815184 SH. 2 H-2-140585	THERMOLY NE	MODEL# FA1630	22592 SUPP 4
73T	HS-21C-A	HAND SWITCH, START FURNACE 1	H-2-815184 SH. 2 H-2-81310	GENERAL ELECTRIC	MODEL# CR104PBT11G1S2 , 120 VAC, GREEN	22592
73T	HS-21C-B	HAND SWITCH, STOP FURNACE 1	H-2-815184 SH. 2 H-2-81310	GENERAL ELECTRIC	MODEL# CR104PBT11R1S2	22592

**Thermal Stabilization System Master Component Index**

SYS No.	CID	DESCRIPTION	DRAWING	VENDOR MFR	COMPONENT DATA	CVI NO.
					, 120 VAC, RED	
73T	HS-21C-C	HAND SWITCH, START FURNACE 2	H-2-815184 SH. 2 H-2-81310	GENERAL ELECTRIC	MODEL# CR104PBT11G1S2, 120 VAC, GREEN	22592
73T	HS-21C-D	HAND SWITCH, STOP FURNACE 2	H-2-815184 SH. 2 H-2-81310	GENERAL ELECTRIC	MODEL# CR104PBT11R1S2, 120 VAC, RED	22592
73T	HS-21C-E	HAND SWITCH, FURNACE EMERGENCY STOP	H-2-815184 SH. 2 H-2-81310	ALLEN BRADLEY	PART# 800T-FXP16RA5	22592 SUPP 6
73T	HS-21C-HA	HAND SWITCH, HALON RELEASE HOLD BUTTON	H-2-815184 SH. 2 H-2-140584	GENERAL ELECTRIC	PART# CN101J-250F RED PUSH BUTTON, 600V, 10 A	22592
73T	LS-21C-1	LIMIT SWITCH, FURNACE 1 DOOR	H-2-815184 SH. 2	THERMOLYNE	COMPONENT OF FURNACE 1	22592 SUPP 4
73T	LS-21C-2	LIMIT SWITCH, FURNACE 2 DOOR	H-2-815184 SH. 2	THERMOLYNE	COMPONENT OF FURNACE 2	22592 SUPP 4
73T	PRV-21A-1	PRESSURE REGULATING VALVE,	H-2-815184 SH. 3 H-2-140584	CONCOA	MODEL# 0405-3001, 0-100 PSI, 1/4" FNPT PORTS	22592 SUPP 11
73T	PRV-21A-2	PRESSURE REGULATING VALVE,	H-2-815184 SH. 3 H-2-140584	CONCOA	MODEL# 0405-3001, 0-100 PSI, 1/4" FNPT PORTS	22592 SUPP 11
73T	PRV-21C-1	PRESSURE REGULATING	H-2-815184 SH. 2 H-2-140584	BYRNE SPECIALTY	COMPONENT OF CO <sub>2</sub> MANIFOLD,	22592 SUPP

Thermal Stabilization System Master Component Index						
SYS No.	CID	DESCRIPTION	DRAWING	VENDOR MFR	COMPONENT DATA	CVI-NO.
		VALVE,		GASES	MODEL# LC-4-2	10
73T	TAS-21C-A	TEMPERATURE ALARM SWITCH,	H-2-815184 SH. 2 H-2-81310	EUROTHERM	MODEL# 93, TEMP ALARM, T/C INPUT, MANUAL RESET	22592 SUPP 5
73T	TAS-21C-B	TEMPERATURE ALARM SWITCH,	H-2-815184 SH. 2 H-2-81310	EUROTHERM	MODEL# 93, TEMP ALARM, T/C INPUT, MANUAL RESET	22592 SUPP 5
73T	TAS-21C-C	TEMPERATURE HIGH SELECT ALARM SWITCH, HC-21C GLOVEBOX	H-2-815184 SH. 2 H-2-81310	OMEGA	MODEL# CN101J-250F, 6-CHANNEL, T/C INPUTS, MANUAL RESET	22592 SUPP 7
73T	TE-21C-1	THERMOCOUPLE ,	H-2-815184 SH. 2 ECN# 605466	OMEGA	MODEL# 4JX20PP	22592
73T	TE-21C-2	THERMOCOUPLE ,	H-2-815184 SH. 2 ECN# 605466	OMEGA	MODEL# 4JX20PP	22592
73T	TE-21C-3	THERMOCOUPLE ,	H-2-815184 SH. 2 ECN# 605466	OMEGA	MODEL# 4JX20PP	22592
73T	TE-21C-4	THERMOCOUPLE ,	H-2-815184 SH. 2 ECN# 605466	OMEGA	MODEL# 4KX20PP	22592
73T	TE-21C-5	THERMOCOUPLE ,	H-2-815184 SH. 2 ECN# 605466	OMEGA	MODEL# 4KX20PP	22592
73T	TE-21C-6	THERMOCOUPLE ,	H-2-815184 SH. 2 ECN# 605466	OMEGA	MODEL# 4KX20PP	22592
73T	TE-21C-7	THERMOCOUPLE ,	H-2-815184 SH. 2 ECN# 605466	OMEGA	MODEL# 4KX20PP	22592
73T	TE-21A-1	RTD IN HC-21A GLOVEBOX	H-2-140584 SH 4	OMEGA	MODEL # PR-13-2-100-3/16-6-E	22592

## Thermal Stabilization System Master Component Index

SYS No.	CID	DESCRIPTION	DRAWING	VENDOR MEQR	COMPONENT DATA	CVI NO.
73T	TI-21A-1	TEMPERATURE INDICATOR AND ALARM FOR HC-21A GLOVEBOX	H-2-140584 SH 4	OMEGA	MODEL # DP461-RTD	22592
73T	TIC-21C-A	TEMPERATURE INDICATOR CONTROLLER, FURNACE 1	H-2-815184 SH. 2 H-2-81310	EUROTHER M	MODEL# 818P15	22592 SUPP 1
73T	TIC-21C-B	TEMPERATURE INDICATOR CONTROLLER, FURNACE 2	H-2-815184 SH. 2 H-2-81310	EUROTHER M	MODEL# 818P15	22592 SUPP 1
73T	TR-21C	TEMPERATURE RECORDER	H-2-815184 SH. 2 H-2-140584	TIGRAPH	MODEL# 200, 2-CHANNEL	22592 SUPP 8
73T	V-21A-1	ARGON ISOLATION VALVE TO ROOM 230B	H-2-815184 SH. 3 H-2-16475	EXISTING		
73T	V-21A-2	GLOBEVALVE FOR ARGON ISOLATION TO HOSE	H-2-815184 SH. 2 H-2-140584	WALWORT	MODEL# 3095, 1/2", CL150	22592 SUPP 12
73T	V-21A-10	ARGON ISOLATION GLOBE VALVE	H-2-16475			22592 SUPP
73T	V-21A-11	BALL VALVE, 2 WAY, 1/2" SWAGELOCK ENDS	H-2-140584, SH 1	WHITEY	MODEL # SS45S8	22592 SUPP
73T	V-21C-1	NEEDLE VALVE,	H-2-815184 SH. 2	WHITEY	MODEL# SS-IRS8-	22592

Thermal Stabilization System Master Component Index						
SYS No.	CID	DESCRIPTION	DRAWING	VENDOR MFR	COMPONENT DATA	CVI NO.
		CO <sub>2</sub> SUPPLY TO FURNACE 1	H-2-140584		SH	SUPP 11
73T	V-21C-2	NEEDLE VALVE, CO <sub>2</sub> SUPPLY TO FURNACE 2	H-2-815184 SH. 2 H-2-140584	WHITEY	MODEL# SS-IRS8-SH	22592 SUPP 11
73T	V-21C-3	GLOBE VALVE, CO <sub>2</sub> SUPPLY AFTER FI-21C-3	H-2-815184 SH. 2 H-2-140584	LADISH CO.	MODEL# 7251, 0", CL200, RENEWABLE DISK	22592 SUPP 11
73T	V-21C-4	GLOBE VALVE, CO <sub>2</sub> SUPPLY AFTER FI-21C-4	H-2-815184 SH. 2 H-2-140584	LADISH CO.	MODEL# 7251, 0", CL200, RENEWABLE DISK	22592 SUPP 11
73T	V-21C-5	BALL VALVE, AFTER DPI-21C-2	H-2-815184 SH. 2 H-2-140584	WHITEY	MODEL# SS-83T54-SH 2 WAY, 1/4" ODT	22592 SUPP 12
73T	V-21C-6	BALL VALVE, BEFORE DPI-21C-2	H-2-815184 SH. 2 H-2-140584	WHITEY	MODEL# SS-83T54-SH 2 WAY, 1/4" ODT	22592 SUPP 12
73T	V-21C-7	BALL VALVE, AFTER DPI-21C-1	H-2-815184 SH. 2 H-2-140584	WHITEY	MODEL# SS-83T54-SH 2 WAY, 1/4" ODT	22592 SUPP 12
73T	V-21C-8	BALL VALVE, BEFORE DPI-21C-1	H-2-815184 SH. 2 H-2-140584	WHITEY	MODEL# SS-83T54-SH 2 WAY, 1/4" ODT	22592 SUPP 12
73T	V-21C-9	GLOBE VALVE, BEFORE FI-21C-3 & FI-21C-4	H-2-815184 SH. 2 H-2-140584	LADISH CO.	MODEL# 7251, 0", CL200, RENEWABLE DISK	22592 SUPP 11
73T	V-21C-10	VALVE, SEPARATES 26"	H-2-815184 SH. 2 H-2-96418	EXISTING		22592 SUPP

**Thermal Stabilization System Master Component Index**

SYS No	CID	DESCRIPTION	DRAWING	VENDOR MFGR	COMPONENT DATA	CVI NO
		VACUUM SYSTEM AND 73T				11
73T	V-21C-11	VALVE, 3-WAY ISOLATES FI-21C-1	H-2-815184 SH. 2 H-2-96418	WHITEY	3 WAY BALL, 1/2" SS-45S8	22592 SUPP 11
73T	V-21C-12	VALVE, 3-WAY ISOLATES FI-21C-1	H-2-815184 SH. 2 H-2-96418	WHITEY	3 WAY BALL, 1/2" SS-45S8	22592 SUPP 11
73T	V-21C-13	VALVE, ISOLATES PI-21C-1	H-2-815184 SH. 2 H-2-96418	WHITEY	2 WAY BALL, 1/4" NPT SS-62TF4	22592 SUPP 11
73T	V-21C-14	VALVE ISOLATES PI-21C-2	H-2-815184 SH. 2 H-2-96418	WHITEY	2 WAY BALL, 1/4" NPT SS-62TF4	22592 SUPP 11
73T	V-21C-15	VALVE, 3-WAY ISOLATES FI-21C-2	H-2-815184 SH. 2 H-2-96418	WHITEY	3 WAY BALL, 1/2" SS-45S8	22592 SUPP 11
73T	V-21C-16	VALVE, 3-WAY ISOLATES FI-21C-2	H-2-815184 SH. 2 H-2-96418	WHITEY	3 WAY BALL, 1/2" SS-45S8	22592 SUPP 11
73T	DPI-21C-3	DPI ACROSS FO-21C-1	H-2-815184 SH. 2 H-2-96418	DWYER	GAGE, 0-8"H2O, 1/8" FNPT, #2008	22592 SUPP 11
73T	DPI-21C-4	DPI ACROSS FO-21C-2	H-2-815184 SH. 2 H-2-96418	DWYER	GAGE, 0-8"H2O, 1/8" FNPT, #2008	22592 SUPP 11
73T	FO-21C-1	ORIFICE FOR OFF GAS FOR FUR-21C-1	H-2-815184 SH. 2 H-2-96418			
73T	FO-21C-2	ORIFICE FOR OFF	H-2-815184 SH. 2			

**Thermal Stabilization System Master Component Index**

SYS No.	CID	DESCRIPTION	DRAWING	VENDOR MEGR	COMPONENT DATA	CVI NO.
		GAS FOR FUR-21C-2	H-2-96418			
73T	PI-21C-1	PRESS INDICATOR FOR 26" VAC SUPPLY (230A)	H-2-815184 SH. 2 H-2-96418	ASHCROFT	GAGE, 0-30" HG 3KA16978-017	22592 SUPP 11
73T	PI-21C-2	PRESS INDICATOR FOR 26" VAC SUPPLY (263)	H-2-815184 SH. 2 H-2-96418	ASHCROFT	GAGE, 0-30" HG 3KA16978-017	22592 SUPP 11



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