

# CCP-TP-137

Revision 1

## CCP

# Operation of the Hanford SuperHENC Assay System

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APPROVED FOR USE

RECORD OF REVISION

Revision Number	Date Approved	Description of Revision
0	09/29/2010	Initial issue.
1	02/24/2011	Revised purpose description to be consistent with text of calibration and validation report for the Super High Efficiency Neutron Counter (SuperHENC).

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## 1.0 PURPOSE

This procedure provides instructions for operation of the Super High Efficiency Neutron Coincidence (SuperHENC) Counter for performing assays of metal standard waste boxes (SWBs) at the Hanford site. Assay measurements are used for nuclear material accountability, criticality safety compliance, and disposal facility Waste Acceptance Criteria (WAC).

The waste matrices are restricted to the following types of waste:

- SWB's with debris waste
- SWB's with four 55-gallon drums of sludge.
- 55-gallon drums of sludge

The SuperHENC discriminates between Transuranic (TRU) Waste and Low Level Waste (LLW). The SuperHENC is a passive neutron system that uses both standard coincidence counting and multiplicity analysis. The multiplicity analysis will only be used for diagnostic purposes.

The SuperHENC is supplemented with a high-purity germanium (HPGe) isotopic assay system, which is used primarily for obtaining measured isotopic ratios for transuranic and other nuclides of interest, and could be used to provide absolute measurements for other selected nuclides of interest, as needed.

### 1.1 Scope

This procedure applies to nondestructive assay (NDA) personnel and addresses the following activities for SuperHENC operations:

- System start-up
- Daily quality control checks
- Routine SWB assays
- System shut down

## 2.0 REQUIREMENTS

### 2.1 References

#### Baseline Documents

- American Society for Testing of Materials (ASTM) Publication No. C1030, *Standard Test Method for Determination of Plutonium Isotopic Composition by Gamma-Ray Spectroscopy*, Annual Book of ASTM Standards, Vol. 12.01
- Browne and Firestone, *Table of Radioactive Isotopes*, 7<sup>th</sup> Edition, Wiley, 1986
- CCP-PO-002, *CCP Transuranic Waste Certification Plan*
- CCP-PO-003, *CCP Transuranic Authorized Methods for Payload Control (CCP CH-TRAMPAC)*
- CCP-PO-005, *CCP Conduct of Operations*
- CCP-PO-011, *CCP/CH2M HILL Plateau Remediation Company Interface Document*

#### Referenced Documents

- CCP-QP-002, *CCP Training and Qualification Plan*
- CCP-QP-005, *CCP TRU Nonconforming Item Reporting and Control*
- CCP-QP-008, *CCP Records Management*
- CCP-TP-058, *CCP NDA Performance Demonstration Program*
- CCP-TP-144, *CCP Hanford SuperHENC Calibration Procedure*
- CCP-TP-148, *CCP SuperHENC Data Reviewing, Validating, and Reporting Procedure*

### 2.2 Training Requirements

- 2.2.1 NDA personnel performing this procedure will be trained and qualified in accordance with CCP-QP-002, *CCP Training and Qualification Plan*, prior to performing this procedure.

### 2.3 Equipment List

- 2.3.1 Quality Control (QC) SWB

### 2.3.2 Background (Empty) SWB

### 2.3.3 Software

- SUPRHENC.EXE
- MAESTRO
- SuperHENC\_QC.xls

### 2.3.4 Sources

- Californium (Cf)-252 Add-A-Source
- Pu-239 Daily Performance Check
- Europium (Eu)-152 or a combined Americium (Am)-241 and Eu-152 Gamma Source

## 2.4 Precautions and Limitations

### 2.4.1 The NDA Operator shall be aware of the following hazards:

- [A] High Voltage (HV) power
- [B] Liquid Nitrogen (LN)
- [C] Radioactive waste containers
- [D] Moving parts (e.g., shield door, loading table, and turntable)
- [E] Cf-252 Add-A-Source.

2.4.2 Any container found to have a Fissile Gram Equivalent (FGE) greater than Host site safety basis limits will be controlled as identified by Host site procedures and Operator postings (Vendor Project Manager [VPM] issued Standing Orders).

## 2.5 Prerequisites

2.5.1 Verification has been made that there are no adverse weather conditions (wind, snow, lightning, etc.) that preclude outside operations.

2.5.2 SuperHENC Neutron vault rails are free of ice and debris to prevent equipment damage.

### 3.0 RESPONSIBILITIES

#### 3.1 NDA Operator

3.1.1 Initiates Batch Data Reports (BDRs).

---

#### NOTE

BDRs will be uniquely numbered according to the following protocol (e.g., RLNDAB10001): RL = location; NDA = process, NDA; B or D to denote the BDR contains SWBs or drums, respectively; 10 = measurement year; 001 = sequential value for both SWB and 100-gallon drum series (e.g., RLNDAB10001, RLNDAB10002, RLNDAB10003, etc., and RLNDAD10001, RLNDAD10002, RLNDAD10003, etc.).

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3.1.2 Maintains SuperHENC Operational Logbook.

3.1.3 Notifies NDA Lead Operator (LO) and VPM of out-of-specification operating conditions.

3.1.4 Reviews and signs the Neutron Cf-252 Source Normalization Check Report (see Attachment 1, Neutron Cf-252 Source Normalization Check Report [EXAMPLE]).

#### 3.2 NDA Lead Operator (LO)

3.2.1 Oversees SuperHENC operations.

3.2.2 Ensures work is performed in a safe manner in accordance with Central Characterization Project (CCP) procedures.

#### 3.3 NDA Expert Analyst (EA)

3.3.1 Reviews collected assay data.

3.3.2 Provides guidance in evaluating equipment concerns.

#### 3.4 Vendor Project Manager (VPM)

3.4.1 Oversees CCP operations.

#### 3.5 Facility Records Custodian

3.5.1 Receives, processes, and transmits records generated by this procedure in accordance with CCP-QP-008, *CCP Records Management*.

4.0 PROCEDURE

NDA Operator

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**NOTE**

Subsections of this procedure may be performed independently or in conjunction with other subsections within this procedure.

---

4.1 System Startup

4.1.1 Ensure both roll-up doors are OPEN, as needed.

4.1.2 Ensure all Emergency Stop (E-stop) buttons are in the OUT position.

4.1.3 Observe as the following are performed at Computer Room Operator Panel:

[A] Ensure SuperHENC Power Distribution Unit (PDU1) Power Controller Switch is ON (green light ON).

[B] Ensure Add-a-Source (AAS status) home light is green.

---

**NOTE**

1 is ON, 0 is OFF. HV light is normally off. It will not illuminate unless an assay is initiated.

---

4.1.4 Observe as the following are performed at Advance Multiplicity Shift Register (AMSR) 150 Display Panel:

[A] Ensure AMSR 150 Alternating Current (AC) power switch is ON.

[B] Ensure AMSR 150 AC Operate/Setup Switch is in SETUP position.

[C] Ensure local mode indicator light is OFF.

4.1.5 Ensure SuperHENC Gamma and SuperHENC Neutron computers are ON.

4.1.6 Ensure monitors are turned on.

4.1.7 Ensure printer power switch is in ON position.

4.1.8 Ensure printer is online and has paper.

## 4.2 Gamma System Startup

4.2.1 Observe Nuclear Chemical Operator (NCO) log on to SuperHENC Gamma Computer.

4.2.2 Ensure turntable is in Home position (turntable home green light illuminated).

4.2.3 Ensure (visually) that turntable is empty.

4.2.4 Ensure Ortec<sup>®</sup> DSPEC Jr. unit is ON.

[A] Ensure NCO checks and reports LN level and temperature.

4.2.5 Observe NCO start MAESTRO software.

4.2.6 Observe NCO Select File – Settings.

4.2.7 Observe NCO Click in the “Sample Description” box to make sure that it is checkmarked.

4.2.8 Observe NCO Click OK.

4.2.9 Observe NCO perform the following in MAESTRO:

[A] Select “Gamma PC MCB130” from drop-down menu.

[B] Select “Acquire MCB Properties.”

[B.1] **IF** no properties are shown,  
**THEN STOP**, AND notify NDA Expert Analyst (EA).

[C] Go to HV tab.

[D] **IF** HV is OFF,  
**THEN STOP**, AND notify NDA EA.

4.2.10 Observe NCO Exit Multi Channel Buffer (MCB) Properties Dialog.

## 4.3 Gamma Background Check

4.3.1 Verify that MAESTRO software is started.

4.3.2 Verify the steel filter is removed from gamma detector, if necessary.

4.3.3 Observe "Services/Job Control" menu is opened from MAESTRO.

4.3.4 Observe the NCO select "Background Check," and click OPEN.

---

**NOTE**

MAESTRO will now acquire gamma spectrum for the preset time (e.g., 300 seconds), and will print a Region of Interest (ROI) report.

---

4.3.5 Ensure steps [A] through [F] are completed.

[A] Click "File→Save As" from MAESTRO menu.

[B] Enter filename in the following manner:

Example:

[GBKG\_YYMMDD\_HHHH]

"Y" represents year, "M" represents month, "D" day,  
"HHHH" time (in 24-hr military format)

[C] Save data as an Integer CHN file type.

[D] **WHEN** the Sample Description box appears,  
**THEN** type in "BACKGROUND CHECK."

[E] Click on "File-ROI Report" on MAESTRO menu.

[F] Click OK to print ROI Report.

[G] Save the ROI report file using the same filename as in  
step 4.3.5[B].

---

**NOTE**

ROI report is submitted as raw data.

---

4.3.6 Print name, sign, and date the ROI report.

4.3.7 Using the SuperHENC\_QC.xls worksheet, select Open Gamma  
Background file option.

[A] **WHEN** prompted,  
**THEN** select the file created in step 4.3.5[C].

4.3.8 Save the SuperHENC\_QC.xls worksheet.

4.3.9 **IF** a fail status appears in the Gamma Background section of the  
SuperHENC\_QC.xls worksheet,  
**THEN** perform the following:

[A] Notify the NDA LO and VPM.

- [B] Investigate the reason for the failure, correct any observed condition that may be causing the failure (i.e., waste containers in vicinity of counter), **AND** note actions taken in the SuperHENC Operational Logbook.
- [C] Repeat steps 4.3.3 through 4.3.8, no more than two additional times.
- [D] **IF** after two additional attempts, the Gamma Background Check indicates a failure,  
**THEN** perform the following:
  - [D.1] STOP WORK, **AND** immediately notify the NDA LO and VPM.
  - [D.2] Initiate a Nonconformance Report (NCR) in accordance with CCP-QP-005, *CCP TRU Nonconforming Item Reporting and Control*, **AND** DO **NOT** resume operations until a corrective action plan is completed.
  - [D.3] Ensure the NCR has been properly dispositioned, **AND** record actions taken in the SuperHENC Operational Logbook.

---

**NOTE**

The Daily Eu-152 Standard Check is performed without a SWB being loaded on the gamma turntable.

---

4.4 Daily Eu-152 Standard Check for Gamma System

4.4.1 Observe as the Eu-152 standard is placed in front of HPGe detector.

4.4.2 Observe as the MAESTRO software is started, if not already started.

4.4.3 Open "Services/Job Control" menu from MAESTRO.

4.4.4 Select "Eu-152 Check," **AND** click OPEN.

---

**NOTE**

MAESTRO will now acquire gamma spectrum for the preset time (e.g., 300 sec).

4.4.5 Ensure that steps [A] through [F] are completed.

[A] Click "File→Save As" from MAESTRO menu.

[B] Enter filename in the following manner:

Example:

[GCHK\_YYMMDD\_HHHH]

"Y" represents year, "M" represents month, "D" day,  
"HHHH" time (in 24-hr format)

[C] Save data as an Integer CHN file type.

[D] **WHEN** the Sample Description box appears,  
**THEN** type in "Eu-152 CHECK."

[E] Click on "File-ROI Report" on MAESTRO menu.

[F] Click OK to print ROI Report.

[G] Save the ROI report file using the same filename as in  
step 4.4.5[B].

---

**NOTE**

ROI report is submitted as raw data.

4.4.6 Print name, sign, and date the ROI Report.

4.4.7 Using the SuperHENC\_QC.xls worksheet, select Open  
Eu-152 Check file option.

[A] **WHEN** prompted,  
**THEN** select the file created in step 4.4.5[C].

---

**NOTE**

This data will result in the HPGe 344.3 kiloelectron Volts (keV) Channel Control Chart and the HPGe 344.3 keV Full Width Half Maximum (FWHM) Control Chart.

4.4.8 Save the SuperHENC\_QC.xls worksheet.

4.4.9 **IF** a fail status appears in the Check Source section of the SuperHENC\_QC.xls worksheet,  
**THEN** perform the following:

[A] Repeat steps 4.4.2 through 4.4.8, no more than two times.

[B] **IF** after two additional attempts, the Gamma Daily Source Check indicates a failure,  
**THEN** perform the following:

[B.1] STOP WORK, **AND** immediately notify the NDA LO and VPM.

---

**NOTE**

A calibration verification must be performed in accordance with CCP-TP-144, *CCP Hanford SuperHENC Calibration Procedure*.

---

[B.2] Initiate an NCR in accordance with CCP-QP-005, **AND DO NOT** resume operations until a corrective action plan and a Calibration Verification in accordance with CCP-TP-144 are completed.

[B.3] Ensure the NCR has been properly dispositioned, **AND** record actions taken in the SuperHENC Operational Logbook.

4.4.10 Observe NCO remove Eu-152 standard from turntable.

4.5 SWB Gamma Assay

4.5.1 Ensure the following prerequisites are complete before beginning this section:

- Section 4.3, "Gamma Background Check," has been completed.
- Section 4.4, "Daily Eu-152 Standard Check for Gamma System," has been completed.

**CAUTION**

Caution will be used when approaching turntable with a SWB to avoid bumping turntable and damaging assay system.

4.5.2 Observe as the SWB is loaded on the SuperHENC Gamma turntable.

- 4.5.3 Verify SWB weight from container traveler.
- 4.5.4 Observe the Operator start MAESTRO software if not already started.
- 4.5.5 Ensure that the steel filter is removed from gamma detector, if necessary.
- 4.5.6 Observe the Operator open "Services/Job Control" menu from MAESTRO.
- 4.5.7 Observe the Operator select "SWB Assay," and click OPEN.
- 4.5.8 **WHEN** the assay starts,  
**THEN** check the dead time in the "Pulse Ht. Analysis" box in the upper right hand corner of the MAESTRO window.
- 4.5.9 **IF** dead time is greater than 50%,  
**THEN** ensure the following steps are performed:
- [A] Select "Services – Job control – Terminate Job" on the MAESTRO menu bar.
  - [B] **WHEN** error box appears,  
**THEN** Press OK.
  - [C] Click on red STOP button directly below MAESTRO menu bar.
  - [D] **IF** the steel filter has NOT been installed,  
**THEN** perform the following:
    - [D.1] Install the steel filter in the holder in front of the gamma detector.
    - [D.2] GO TO step 4.5.6.

---

**NOTE**

MAESTRO will now acquire gamma spectrum for the preset time for one side of the SWB, and will pause displaying a message window instructing the operator to rotate the turntable 180 degrees.

---

- 4.5.10 Observe as the NCO rotates the SuperHENC Gamma turntable to 180 degrees by pressing "Rotate Turntable" button.

4.5.11 Ensure SuperHENC Gamma turntable rotates and stops at 180 degrees position.

4.5.12 Ensure that the NCO has closed the message box.

---

**NOTE**

Upon closing the message box, MAESTRO will now acquire the SuperHENC Gamma Spectrum for the second side of the SWB, and will STOP when it reaches the preset live time.

---

4.5.13 Ensure that steps [A] through [D] are completed.

[A] Click "File→Save As" from MAESTRO menu.

[B] ENTER filename in the format XXXXX-HHMM, where XXXXX is the SWB ID number as read from the SWB barcode, and where HH = hour and MM = minute from MAESTRO start time. Use the time and date displayed in the "Pulse Ht. Analysis" window in the upper right hand corner of the MAESTRO window.

[C] Save data as an Integer CHN file type.

[D] **WHEN** the Sample Description box appears, **THEN** type in SWB Package Identification Number (PIN) Number.

---

**NOTE**

ROI report will be submitted as raw data.

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4.5.14 Print name, sign, and date the ROI report.

4.5.15 Remove the steel filter, if necessary.

4.5.16 Rotate SuperHENC Gamma turntable to "Home" position (0 degrees) by pressing "Rotate Turntable" button.

4.5.17 Ensure SuperHENC Gamma turntable rotates and stops at "Home" position.

4.6 Gamma System Shutdown

4.6.1 Observe the NCO select "File - Exit" from the MAESTRO menu bar.

4.6.2 Observe the NCO log off Gamma computer.

4.6.3 **IF** all trailer operations are complete for the day,  
**THEN** ensure that the following steps are done:

- [A] Switch off cargo area heater.
- [B] Ensure both roll-up doors are closed.
- [C] Lock SuperHENC trailer.

4.6.4 Notify CCP VPM that SuperHENC operations are completed for that day and all-accountable sources are stored and secured in approved storage locations.

#### 4.7 Neutron System Startup

4.7.1 Ensure personnel and equipment are clear of area around the vault door.

4.7.2 Ensure drawbridge and supports are in place.

4.7.3 Ensure vault door is Open as needed (“door open” green light is illuminated).

4.7.4 Ensure cart is extended as needed (“cart unload” is illuminated).

#### 4.8 Neutron Background Check

### **CAUTION**

The rail system must be free of ice and debris to prevent equipment damage.

4.8.1 Observe NCO load the background (empty) SWB on the SuperHENC Neutron cart.

4.8.2 Observe NCO load cart with box into vault by pressing "Cart Load" button (green light illuminated when complete).

4.8.3 Observe NCO close vault door by pressing “Door Close” button.

4.8.4 Observe NCO log on to SuperHENC Neutron computer, if necessary.

4.8.5 Observe NCO start SuperHENC Neutron software by clicking on “SuperHENC” icon at SuperHENC Neutron terminal.

- [A] Click on “Acquire.”
- [B] Click on “Background.”

- 4.8.6 Verify proper entry entered in Comment block: date, background information in the following format: NBKG\_YYMMDD\_HHHH.
- 4.8.7 Ensure user name has been entered in "User ID" field.
- 4.8.8 Ensure the following settings in "Background" dialog box:
- Cycle time (sec) = 40
  - Use number of cycles = checked
  - Number of cycles = 45
  - QC tests = checked
  - Comment at end of measurement = not checked
  - Number of sets of results to print = 1, unless otherwise stipulated by NDA LO.
- 4.8.9 Observe Operator start background measurements by clicking on the OK button.

---

**NOTE**

The background measurement will now begin, and a progress bar will appear on screen. When the measurement is complete, the measurement report will automatically print out and the main pull down menu screen will be displayed.

The computer automatically saves the data to a background file and prints the information.

---

- 4.8.10 Observe Operator close "Background" windows.
- 4.8.11 Print name, sign, and date bottom of background report.
- 4.8.12 Observe NCO copy Background file to flash drive for NDA Operator.
- 4.8.13 Using the SuperHENC\_QC.xls worksheet, select Open Background file option.
- [A] WHEN prompted, select the file created in step 4.8.9.
- 4.8.14 Save the SuperHENC\_QC.xls worksheet.

4.8.15 **IF** a fail status appears in the Neutron Background section of the SuperHENC\_QC.xls worksheet,  
**THEN** ensure that the following steps are performed:

- [A] Notify NDA LO and VPM.
- [B] Investigate the reason for the failure, correct any observed condition that may be causing the failure (i.e., waste containers in vicinity of counter), **AND** note actions taken in the SuperHENC Operational Logbook.
- [C] Repeat steps 4.8.5 through 4.8.14 no more than two additional times.
- [D] **IF** after two additional attempts, the Neutron Background Check indicates a failure,  
**THEN** ensure that the following steps are taken:
  - [D.1] STOP WORK, **AND** immediately notify the NDA LO and VPM.
  - [D.2] Initiate an NCR in accordance with CCP-QP-005, **AND DO NOT** resume operations until a corrective action plan is completed.
  - [D.3] Ensure the NCR has been properly dispositioned, **AND** record actions taken in the SuperHENC Operational Logbook.

4.8.16 Observe NCO open assay chamber door by pressing OPEN button on one of the control panels.

4.8.17 Observe NCO press "Unload" button on cart control panel to bring assay tray out of assay chamber.

#### 4.9 Daily Cf-252 Source Normalization Check for Neutron System

4.9.1 Observe NCO start SuperHENC Neutron software by clicking on "SuperHENC" icon at SuperHENC Neutron terminal, if necessary.

4.9.2 Observe NCO click on "Acquire."

4.9.3 Observe NCO click on "Normalization."

---

**NOTE**

No SWB is required for a Normalization measurement. Normalization measurements should be performed with an empty SuperHENC Neutron vault.

---

- 4.9.4 Observe NCO load empty cart into vault by pressing "Cart Load" button (green light illuminated when complete).
- 4.9.5 Observe NCO close vault door by pressing "Door Close" button.
- 4.9.6 Verify the enter normalization date and time information in the Comment field in the following format: NORM\_YYMMDD\_HHHH.
- 4.9.7 Ensure user name has been entered in "User ID" field.
- 4.9.8 Ensure the following settings in "Normalization" dialog box:
  - Cycle time (sec) = 40
  - Use number of cycles = checked
  - Number of cycles = 5
  - QC tests = checked
  - Comment at end of measurement = not checked
  - Number of sets of results to print = 1, unless otherwise stipulated by NDA LO.

---

**NOTE**

The Cf-252 source will automatically move into assay chamber. Once check source measurement is complete, the Cf-252 source will be automatically returned to its shielded storage box in aft section of trailer. The computer automatically saves data to a quality control file and prints the information. The Cf-252 normalization will now begin, and a progress bar will appear on screen. When assay is complete, the normalization check report will automatically print out and main pull down menu will return to screen.

---

- 4.9.9 Observe the NCO start Normalization measurement by clicking OK button.
- 4.9.10 Observe the NCO close "Normalization" windows.
- 4.9.11 Print name, sign, and date bottom of Neutron Cf-252 Source Normalization Check Report.
- 4.9.12 Check the report for a pass/fail result.

4.9.13 **IF** a fail status appears in the Neutron Cf-252 Source Normalization Check Report,  
**THEN** ensure the following steps are performed:

[A] STOP WORK, **AND** immediately notify the NDA LO and EA.

[B] Investigate the reason for the failure, **AND** repeat steps 4.9.2 through 4.9.12, no more than two times.

[C] **IF** after two additional attempts, the Neutron Cf-252 Source Normalization Check Report indicates a failure,  
**THEN** ensure the following steps are taken:

[C.1] STOP WORK, **AND** immediately notify the NDA LO and VPM.

[C.2] Initiate an NCR in accordance with CCP-QP-005.

[C.3] Remove SuperHENC from service until resolution of the nonconforming item is complete, **AND DO NOT** resume operations until a corrective action plan is completed.

[C.4] Ensure the NCR has been properly dispositioned, **AND** record actions taken in the SuperHENC Operational Logbook.

4.9.14 Observe NCO open assay chamber door by pressing OPEN button at one of the control panels.

4.9.15 Observe NCO press "Unload" button on a control panel to extend assay cart out of neutron vault.

---

#### NOTE

The daily standard must be counted at the beginning of each day of operation to verify that the instrument is operating properly.

---

#### 4.10 Daily Pu Standard Check for Neutron System

4.10.1 Observe NCO click on "Acquire" at the computer to display acquire pull-down menu.

4.10.2 Observe NCO select "Assay."

4.10.3 Observe NCO move appropriate QC SWB from dock or storage area to SuperHENC area.

4.10.4 Check PIN number against source or secondary documentation.

[A] **IF** any PIN discrepancy is found,  
**THEN STOP** work.

[B] Notify the NDA LO and VPM.

4.10.5 Ensure assay chamber door is OPEN.

4.10.6 Ensure assay cart is out of assay chamber.

4.10.7 Observe NCO load QC SWB onto assay cart.

4.10.8 Ensure daily QC SWB is centered on assay cart.

4.10.9 Observe NCO load QC SWB into assay chamber.

4.10.10 Observe NCO close assay chamber door.

4.10.11 Observe NCO enters date and assay information in Item ID block of the SuperHENC software.

4.10.12 Ensure PIN number(s) have been entered correctly in fields titled TID #1 and TID #2, if applicable.

4.10.13 Ensure "User Name" has been entered in "User ID" field.

4.10.14 Enter Item ID information in the "Comments" field.

4.10.15 Ensure the following settings in "Assay" dialog box:

- Cycle time (sec) = 40
- Use number of cycles = checked
- Number of cycles = 25
- QC tests = checked
- Comment at end of measurement = not checked
- Number of sets of results to print = 1, unless otherwise stipulated by NDA LO
- Gross weight entered in "Gross Weight" field
- Correct tare weight in the "Tare Weight" field.
- Material type = SWB001

- IDC = [as directed by LO]

4.10.16 Observe the NCO click "Isotopics" button.

4.10.17 Ensure "Isotopics ID" reads "PuSTD."

---

**NOTE**

Clicking OK button will return user to main assay dialog box.

---

4.10.18 Observe NCO click the OK button to accept isotopic file name.

4.10.19 Observe NCO start assay measurement by clicking OK button.

---

**NOTE**

The assay will now begin, and a progress bar will appear on screen. When the assay is complete, the assay report will automatically print out. The computer automatically saves the data to an assay database file.

---

4.10.20 Observe NCO close "Assay Measurement" dialog boxes.

---

**NOTE**

Pu Standard Assay Report will be submitted as raw data.

---

4.10.21 Print name, sign, and date the Pu Standard Assay Report.

4.10.22 Using the SuperHENC\_QC.xls worksheet, select Open Pu Standard Assay file option.

- [A] **WHEN** prompted,  
**THEN** select the file created in step 4.10.19.

---

**NOTE**

This data will result in the Daily Check Box Pu-240e Mass Control Chart.

---

4.10.23 Save the SuperHENC\_QC.xls worksheet.

---

**NOTE**

The daily standards shall not be measured more than three times total (includes original and two repeats), except as directed by NDA LO during a diagnostic check of the system while troubleshooting and repairing the equipment.

---

4.10.24 **IF** a fail status appears in the Neutron-QC Check section of the SuperHENC\_QC.xls worksheet,  
**THEN** perform the following:

- [A] **IF** the values on the SuperHENC\_QC.xls worksheet exceed  $\pm 2$ -sigma, but are  $\leq$  the 3-sigma boundary as indicated by an In flag,  
**THEN** repeat steps 4.10.1 and 4.10.2, 4.10.11 through 4.10.23, no more than two times.
- [B] **IF** the rerun performance measurement exceeds  $\pm 2$ -sigma after two additional runs,  
**THEN** perform steps 0[D.1] through 0[D.3].
- [C] **IF** the rerun performance measurement results **DO NOT** exceed  $\pm 2$ -sigma,  
**THEN** document the additional performance measurement(s) in the SuperHENC Operational Logbook,  
**AND GO TO** step 4.10.25.
- [D] **IF** the values on the SuperHENC\_QC.xls worksheet exceed  $\pm 3$ -sigma as indicated by an Action (Ac) flag,  
**THEN** perform the following:
  - [D.1] STOP WORK, **AND** immediately notify the NDA LO and VPM.

---

**NOTE**

A Calibration Verification must be performed in accordance with CCP-TP-144.

---

- [D.2] Initiate an NCR in accordance with CCP-QP-005,  
**AND DO NOT** resume operations until a corrective action plan and a Calibration Verification in accordance with CCP-TP-144 are completed.
- [D.3] Ensure the NCR has been properly dispositioned,  
**AND** record actions taken in the SuperHENC Operational Logbook.

4.10.25 **WHEN** QC measurements are complete,  
**THEN** ensure NCO performs the following steps:

- [A] Ensure all assay problems have been corrected and documented.
- [B] Open assay chamber door by pressing OPEN button at one of the control panels.
- [C] Press "Unload" button on a control panel to extend assay cart out of assay chamber.
- [D] Remove QC SWB from loading platform.
- [E] Return QC SWB to source/standard storage area.

#### 4.11 SWB Neutron Assay

4.11.1 Ensure the following prerequisites are complete before beginning this section:

- Section 4.8, "Neutron Background Check," has been completed
- Section 4.9, "Daily Cf-252 Source Normalization Check for Neutron System," has been completed
- Section 4.10, "Daily Pu Standard Check for Neutron System," has been completed.

4.11.2 **IF** not already started,  
**THEN** observe NCO start the SuperHENC software on SuperHENC Neutron computer.

4.11.3 Observe NCO click on "Acquire" to display acquire pull-down menu of the SuperHENC software.

4.11.4 Observe NCO select "Assay."

4.11.5 Observe NCO select OK.

4.11.6 Check PIN number against source or secondary documentation.

4.11.7 **IF** any PIN discrepancy is found,  
**THEN STOP** work **AND** notify supervision.

### CAUTION

Caution is used when approaching loading dock with a SWB to avoid bumping load cell and damaging assay system.

The rail system must be free of ice and debris to prevent equipment damage.

4.11.8 Observe NCO open vault door by pressing "Door Open" button.

4.11.9 Observe NCO press "Cart Unload" button to extend cart.

4.11.10 Observe NCO place SWB on cart using marked area on cart as guide.

---

### NOTE

An SWB is loaded correctly when it is behind line marking the center of loading cart.

---

4.11.11 Ensure SWB is centered on loading platform.

4.11.12 Observe NCO press "Load" button on operator control panel to move cart into assay vault.

[A] **IF** cart does not respond,  
**THEN** press "Unload" button to re-center cart.

[B] Press "Load" button to move tray into assay vault.

[C] **IF** cart still does not respond,  
**THEN STOP AND** notify supervision.

4.11.13 Observe NCO press close button to close assay vault door on operator control panel.

[A] **IF** assay vault door does not respond,  
**THEN** press OPEN button to re-open assay vault door.

[B] Press Close button.

[C] **IF** door does not operate correctly,  
**THEN STOP AND** notify supervision.

4.11.14 Ensure NCO enters SWB PIN number in "Item ID" block.

4.11.15 Ensure NCO enters SWB PIN number in "TID #1" block.

4.11.16 Ensure NCO enters user name in "User ID" field.

---

**NOTE**

Normally, the tare weight and gross weight values will come from a copy of the waste traveler.

---

4.11.17 Ensure the following settings appear in assay dialog box.

- Cycle time (sec) = 40
- Use measurement precision = checked
- Measurement precision (%) = 3.0%, unless otherwise stipulated by NDA LO
- Minimum number cycles = 15
- Maximum number cycles = 45, unless otherwise stipulated by NDA LO
- QC tests = checked
- Comment at end of measurement = not checked
- Number of sets of results to print = 1, unless otherwise stipulated by NDA LO
- Gross weight kilogram (kg) entered in "Gross Weight" field (from container traveler or equivalent documentation).

---

**NOTE**

The weight limit for SWBs is 4,000 pounds or 1,814 kilograms. If the gross weight is greater than 1,300 kilograms obtain the estimated metals mass from either Site or CCP personnel. The estimated metals mass is used to adjust for the increased neutron background resulting from cosmic ray interactions with the metals.

---

- Tare weight (kg) entered in "Tare Weight" field (from a copy of the traveler, SWB tare wt. with liner).
- Material type = SWB001.
- IDC = [as directed by LO]

4.11.18 Observe NCO click "Isotopics" button.

4.11.19 Ensure Isotopics ID reads "PUDAS."

---

**NOTE**

Clicking the OK button will return user to main assay dialog box.

---

4.11.20 Observe NCO click OK button to accept isotopic file name.

4.11.21 Observe NCO click OK button to start assay measurement.

---

**NOTE**

The assay will now begin, and a progress bar will appear on screen. When the assay is complete, the assay report will automatically print out. The computer automatically saves the data to an assay database file.

---

4.11.22 Observe NCO close "Assay Measurement" windows.

4.12 Neutron System Shutdown

4.12.1 Observe NCO exit SuperHENC software.

4.12.2 **IF** an empty SWB is desired in the chamber for subsequent day's background acquisition,  
**THEN** have the NCO perform Section 4.8.1.

4.12.3 Ensure assay cart is inside chamber.

4.12.4 Ensure chamber door is closed.

**CAUTION**

The roll-up door shall be manually stopped to prevent damage to assay system.

4.12.5 **IF** all trailer operations are complete for the day,  
**THEN** observe the NCO perform the following:

- [A] Switch off cargo area heater.
- [B] Ensure SuperHENC Neutron cart is retracted and vault door is closed.
- [C] Raise ramp as needed.
- [D] Ensure both roll-up doors are closed.
- [E] Lock SuperHENC trailer.

---

**NOTE**

Section 4.13 is performed each week, unless otherwise directed by the NDA LO or NDA EA. The Weekly Interfering Matrix container (e.g., SWB) will be determined by a schedule provided by the NDA EA. Every six months a Six Month Interfering Matrix Report will be generated to assess the continued performance of the SuperHENC's matrix correction factors over the operating range of the system.

---

4.13 Weekly Interfering Matrix

4.13.1 Perform steps 4.5.1 through 4.5.17 of the Container Gamma Assay section.

4.13.2 Perform steps 4.11.1 through 4.11.22 of the Container Neutron Assay section.

4.13.3 WHEN assaying the current Weekly Interfering Matrix container, **THEN** enter the assay information in the following manner:

[A] Container ID Number in the Item ID block as Weekly Interfering Matrix.

[B] Additional descriptive information on matrix containers as directed by the NDA EA.

---

**NOTE**

Section 4.15 is performed yearly, unless otherwise directed by the NDA LO or NDA EA. The Performance Demonstration Program (PDP) container (e.g., SWB) will be determined by a schedule provided by the NDA EA.

---

4.14 Performance Demonstration Program

---

**NOTE**

Records produced in section 4.14 will be processed in accordance with CCP-TP-058, *CCP NDA Performance Demonstration Program*. BDR names shall have " PDP" added to their name. Example: RLNAB10123\_PDP.

---

4.14.1 Perform steps 4.5.1 through 4.5.17 of the Container Gamma Assay section.

4.14.2 Perform steps 4.11.1 through 4.11.22 of the Container Neutron Assay section.

4.14.3 **WHEN** assaying the current PDP container,  
**THEN** enter the assay information in the following manner:

- [A] Container ID Number in the Item ID block as PDP.
- [B] Additional descriptive information on matrix containers as directed by the NDA EA.

#### 4.15 Initial Cf-252 Source Normalization Check for Neutron System

---

##### **NOTE**

To be performed when directed by EA.

---

4.15.1 Observe NCO click "View" button to display view pull-down menu.

4.15.2 Observe NCO select "Maintain."

4.15.3 Observe NCO enter password.

4.15.4 Observe NCO click OK.

4.15.5 Observe NCO click "Acquire" button to display acquire pull-down menu.

4.15.6 Observe NCO select "Initial Source."

4.15.7 Ensure following settings are displayed in Initial Source Measurement SWB:

- Source ID
- User ID
- Comment - Type date, Initial Source and Shift information  
Example: 05-19-00 IS-01
- Cycle time = 30s
- Check "Use # of Cycles"
- Number of cycles = 5
- QC tests = checked
- Comment at end of measurement = NOT checked
- Number of sets of results to print = 1

- Data source = shift register
- Check "Use add a source Cf-252 source for normalization test measurements"
- Distance to move Cf-252 = 152 in.

---

**NOTE**

The Cf-252 source will automatically move into assay chamber. Once check source measurement is complete, the Cf-252 source will be automatically returned to its shielded storage box in aft section of trailer. The computer automatically saves data to a quality control file and prints the information. The Cf-252 normalization will now begin, and a progress bar will appear on screen. When assay is complete, the assay report will automatically print out and main pull down menu will return to screen.

---

- 4.15.8 Observe NCO click OK button to start initial source measurement.
- 4.15.9 Observe NCO close "Initial Source" dialog box.
- 4.15.10 Print name, sign, and date bottom of both assay sheets.
- 4.15.11 Forward radioassay data sheets to NDA LO.
- 4.15.12 Observe NCO exit SuperHENC software.

## 5.0 RECORDS

---

### NOTE

The records listed in step 5.1.1 are placed in the BDR Holding File for compilation into the BDR in accordance with CCP-TP-148, *CCP SuperHENC Data Reviewing, Validating, and Reporting Procedure*.

---

- 5.1 Records generated during the performance of this procedure are maintained as Quality Assurance (QA) records in accordance with CCP-QP-008. The records are the following:

#### 5.1.1 QA/Lifetime

- [A] Control Charts
  - [A.1] Gamma Background Check
  - [A.2] HPGe Detector 344.3 keV Channel
  - [A.3] HPGe Detector 344.3 keV FWHM
  - [A.4] Neutron Background Check
  - [A.5] Daily Check Box Pu 240e Mass
- [B] Neutron Cf-252 Source Normalization Check Report
- [C] NDA Radioassay Data Sheet(s)

#### 5.1.2 QA/Nonpermanent

- [A] Six Month Interfering Matrix Report, as required
- [B] Raw Data (includes, but is not limited to, ROI Reports, Pu Standard Assay Report) (flows into CCP-TP-148)
- [C] PDP Batch Data Reports (flows into CCP-TP-058)

Attachment 1 – Neutron Cf-252 Source Normalization Check Report (EXAMPLE)

Super HENC 2.00-beta

Facility: Rocky Flats  
Detector id: Super HENC  
Measurement date: 04.10.02 19:57:09  
Results file name: 4A2T5709.NOR  
Measurement option: Normalization  
Data source: Shift register  
QC tests: OFF  
Veto: Off  
Accidentals method: Measured  
User id: steve  
Passive comment: test  
Predelay: 1.50  
Gate length: 128.00  
High voltage: 1720  
Die away time: 55.0000  
Efficiency: 0.4050  
Multiplicity deadtime: 88.2800  
Coefficient A deadtime: 0.2416  
Coefficient B deadtime: 0.0242  
Coefficient C deadtime: 0.0000  
Doubles gate fraction: 0.7500  
Triples gate fraction: 0.5620  
  
Singles background: 858.595 +- 0.000  
Doubles background: -9.627 +- 0.000  
Triples background: -1.602 +- 0.000  
Scaler1 background: 0.000  
Scaler2 background: 0.000

Summed raw data

Number of good cycles: 10  
Total count time: 50  
Shift register singles sum: 1  
Shift register reals + accidentals sum: 0  
Shift register accidentals sum: 0  
Shift register 1st scaler sum: 0  
Shift register 2nd scaler sum: 0

Summed multiplicity distributions

	R+A sums	A sums
0	1	1

Attachment 1 – Neutron Cf-252 Source Normalization Check Report (EXAMPLE)  
(Continued)

Results

Singles:	-858.575 +- 0.020
Doubles:	9.627 +- 0.000
Triples:	0.000 +- 0.000
Scaler 1:	0.000 +- 0.000
Scaler 2:	0.000 +- 0.000

Normalization results for reference source: NN-111

Current normalization constant:	1.0000 +- 0.0000
Cf252 expected doubles rate:	9.6270 +- 0.0000
Cf252 measured doubles rate:	9.6270 +- 0.0000
Doubles rate expected/measured:	1.0000 +- 0.0000
New normalization constant:	1.0000 +- 0.0000

Normalization test Passed.

Cycle data

Count time (sec): 5

Cycle	Singles	R+A	A	Scaler1	Scaler2	QC Tests
1	0	0	0	0	0	Pass
2	0	0	0	0	0	Pass
3	0	0	0	0	0	Pass
4	0	0	0	0	0	Pass
5	0	0	0	0	0	Pass
6	1	0	0	0	0	Pass
7	0	0	0	0	0	Pass
8	0	0	0	0	0	Pass
9	0	0	0	0	0	Pass
10	0	0	0	0	0	Pass

Cycle	Singles	Doubles	Triples	QC Tests
1	-858.595	9.627	1.602	Pass
2	-858.595	9.627	1.602	Pass
3	-858.595	9.627	1.602	Pass
4	-858.595	9.627	1.602	Pass
5	-858.595	9.627	1.602	Pass
6	-858.395	9.627	1.602	Pass
7	-858.595	9.627	1.602	Pass
8	-858.595	9.627	1.602	Pass
9	-858.595	9.627	1.602	Pass
10	-858.595	9.627	1.602	Pass

Attachment 1 – Neutron Cf-252 Source Normalization Check Report (EXAMPLE)  
(Continued)

Multiplicity distributions

Cycle 1	R+A	A	
0	0	0	
Cycle 2	R+A	A	
0	0	0	
Cycle 3	R+A	A	
0	0	0	
Cycle 4	R+A	A	
0	0	0	
Cycle 5	R+A	A	
0	0	0	
Cycle 6	R+A	A	
0	1	1	
Cycle 7	R+A	A	
0	0	0	
Cycle 8	R+A	A	
0	0	0	
Cycle 9	R+A	A	
0	0	0	
Cycle 10	R+A	A	
0	0	0	

**NDA Operator:**

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Attachment 2 – NDA Radioassay Data Sheet (EXAMPLE)

Radioassay Data Sheet

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Version Information

NGI Version: 1.10  
SUPRHENC Analysis SW Version: 2.00 PCFRAM Analysis Version: 4.3  
Calculation DLL: 1.10, License File DLL: 1.00, Password DLL: 1.10, Report DLL: 1.10  
Neutron Data Import DLL: 1.00, Gamma Data Import DLL: 1.10, Data Archive DLL: 1.00  
ngi.akl Version: 2.1, NGI.GLB Version: 1.60, NGI.MDA Version: 2.0, NGI.TMU Version: 2.0

Identifying Data

Radioassay Procedure: TRU-OP-002 Rev A-3  
Facility: HANFORD PFP  
Neutron Assay Date and Time: 03\01\2005 11:26:34 Gamma Assay Date and Time: 03\01\2005 15:24:21  
SUPRHENC Filename 531L2634.ASA PCFRAM Filename: CON\_MET\_iiib\_2\_BKGSTRIPPED.res  
NGI results File: E:\CON\_MET\_iiib\_2\_BKGSTRIPPED.ngi

Tare Weight: 347.00 kg Gross Weight: 894.00 kg Net Weight: 547.00 kg  
IDC: 821 Is RCRA: No Imported Material Type: SWB001  
Gamma Live Time: 900.00 s Gamma Real Time: 950.00 s Gamma Percent Dead Time: 5.26  
Neutron Cont. ID: CON\_MET\_iiib\_3 Gamma Cont. ID: MET  
Neutron Equipment ID: SHENCA Gamma Equipment ID: CON  
Neutron User ID: TERRY NGI Analyst ID: ALAN\_S  
Imported Pu240e Mass: 9.700000 g Imported Pu240e Mass Uncertainty: 0.290000 g  
Corrected Pu240e Mass: 9.700000 g Corrected Pu240e Mass TMU: 0.408824 g

AAS Correction Factor: 1.020000

PCFRAM Parameter Set: Coax\_wide\_pfp\_200 (2005.02.22 15:34)0 Coax 0.2 kev/ch \*\*\*\*\*

Isotope	Fraction (g/gPu)	Fraction Uncertainty (g/gPu)	Mass (g)	Mass TMU at 1-Sigma (g)	Activity (Ci)	Activity TMU at 1-Sigma (Ci)	Rule Used
Pu238	< LLD						< LLD
Pu239	9.2851e-001	9.0065e-003	1.2943e+002	1.7696e+001	8.1414e+000	1.1131e+000	FRAM
Pu240	6.9584e-002	9.0250e-003	9.7000e+000	4.0882e-001	2.2310e+000	9.4030e-002	FRAM
Pu241	1.4560e-003	1.9656e-005	2.0297e-001	2.7815e-002	2.1108e+001	2.8928e+000	FRAM
Pu242	< LLD						< LLD
Am241	1.4204e-003	7.3861e-005	1.9800e-001	2.8899e-002	6.8707e-001	1.0028e-001	FRAM
Np237	4.9840e-005	8.4329e-006	6.9477e-003	1.5099e-003	4.9537e-006	1.0765e-006	FRAM
U235	< LLD						< LLD
Am243	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	Not In AK
Cs137	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	Not In AK
U233	< LLD						< LLD
U238	< LLD						< LLD
U234	< LLD						< LLD
Sr90	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	0.0000e+000	Not In AK

AK Set Selected: Pu06UH

	Value	TMU at 1-Sigma
Total Thermal Power (Watts):	3.4549e-001	4.8047e-002
Total Plutonium Mass (g):	1.3940e+002	1.9011e+001
Total Pu239 FGE (g Pu239 FGE):	1.3011e+002	1.7789e+001
Total Pu239 Equivalent Activity (PE-Ci):	1.1473e+001	1.5936e+000
Total Alpha Activity (Ci):	1.1060e+001	1.5383e+000
Total TRU Alpha Activity (Ci):	1.1059e+001	1.5382e+000
Total TRU Alpha Activity Concentration (nCi/g):	2.0218e+004	2.8121e+003
MDA (g-Pu240e): 0.019801		
MDC (nCi/g): 49.954307		
FGE For Criticality Control: 164.978174 (g Pu239 FGE)		

Warning Messages

Gamma File Container ID: MET differs from Neutron File Container ID:CON\_MET\_iiib\_3  
Gamma File Equipment ID: CON differs from Neutron File Equipment ID:SHENCA  
Material Type has been Overridden.  
Assay Identification Parameters (SuperHENC User ID and/or Radio-Assay Procedure) have been Overridden.

Operator Name: \_\_\_\_\_ Operator Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Reviewer Name: \_\_\_\_\_ Reviewer Signature: \_\_\_\_\_ Date: \_\_\_\_\_