

CCP-TP-107

Revision 11

Operating the CCP High Efficiency Neutron Counter Using NDA2000

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APPROVED FOR USE

RECORD OF REVISION

Revision Number	Date Approved	Description of Revision
0	01/20/2004	Initial revision.
1	02/27/2004	Revising Sections 2.0 and 4.0 as a result of findings during the LLNL Contractor ORR.
2	04/02/2004	Modified step 4.6.7 and added step 4.6.7 note. Added CCP-TP-105 to references.
3	05/25/2004	Revised to address CBFO comment. Added CCP-LLNL-NDA-001 to step 2.1
4	08/30/2004	Added Section 4.8. Change to document allows adding the filter to the gamma detector. Added NDA Expert Analyst and Facility Records Custodian responsibilities.
5	02/26/2005	Incorporate changes to address HENC operations at the Idaho National Laboratory (INL).
6	04/12/2005	Revised to incorporate changes to address CBFO adequacy comments and new INL fire safety requirements.
7	03/17/2006	Revised to incorporate changes for Daily Performance Check and consistency with data reporting.
8	06/15/2006	Revised to implement changes made in CCP-TP-068, <i>CCP Container Management at Idaho National Laboratory</i> .
9	04/11/2007	Revised to assure that responses to Action, Investigate, Above, and Below flags for background measurements and system performance checks are consistent for procedures Canberra Nondestructive Assay 2000 (NDA2000) as the operating software. Incorporated changes to allow use of automated door closers with the fire suppression system. Addressed Carlsbad Field Office (CBFO) Document Review Record (DRR) comments.
10	02/08/2008	Revised steps to allow for authorized personnel to be in the equipment bay as necessary, and to eliminate dependence on a forklift operator (FO) in order to perform daily background measurements.
11	11/30/2009	Revised to include sections for complete and shift startup, and complete and partial shutdown.

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1.0 PURPOSE

This procedure describes steps for operating the Central Characterization Project (CCP) Mobile High Efficiency Neutron Counter (HENC) system. CCP and authorized personnel are responsible for determining the radioactive content of waste drums intended for shipment to the Waste Isolation Pilot Plant (WIPP). For this purpose, a HENC, with Canberra Nondestructive Assay 2000 (NDA2000) Operations software, is equipped with a High-Purity Germanium (HPGe) Detector for the detection and analysis of gamma-emitting radionuclides and utilizes passive neutron analysis methods to measure the spontaneous fission neutron signal of nuclides contained in 55-gallon drums of contact-handled (CH) Transuranic (TRU) waste. This procedure provides instructions for the operation of the HENC NDA system with Add-A-Source and gamma spectrometry.

This procedure applies to the measurement of waste in TRU waste drums with an expected range of 0 to 200 grams of plutonium (Pu). Most wastes will contain weapons-grade (WG) Pu, but heat source waste and other Pu isotopics are possible. HENC assays will include isotopic analysis to differentiate between these waste types. Data from this procedure is utilized for sorting drums based on the 100 nanocuries per gram (nCi/g) TRU limit, and is also used to confirm radioisotopes identified by acceptable knowledge (AK).

1.1 Scope

This procedure provides specific instructions for operating the HENC, using Canberra NDA2000 Operations software, to assay waste drums for their radionuclide content including startup, use of the system's neutron and gamma components, drum loading, assay of TRU and TRU-mixed drums, and shutdown of the HENC.

2.0 REQUIREMENTS

2.1 References

Baseline Documents

- American Society For Testing of Materials (ASTM) Publication No. C 1030, *Standard Test Method for Determination of Plutonium Isotopic Composition by Gamma-Ray Spectroscopy*, Annual Book of ASTM Standards, Vol. 12.01
- AMWTP-RPT-DSA-02, *Idaho National Laboratory, Advanced Mixed Waste Treatment Project Documented Safety Analysis*

- AMWTP-RPT-TSR-03, *Technical Safety Requirements Advanced Mixed Waste Treatment Project*
- Canberra Industries, Inc., Publication No. 9231594F, *NDA2000 Users Manual* (corresponding to current software version)
- Canberra Industries, Inc., Publication No. 9231595C, *NDA2000 Technical Reference Manual* (corresponding to current software version)
- Document No. 96179, Rev. A, *Model HE-WDAS High Efficiency Waste Drum Assay System W/Add-A-Source Option, Hardware Reference Manual*
- CCP-PO-003, *CCP Transuranic Authorized Methods for Payload Control (CCP CH-TRAMPAC)*
- CCP-INL-HENC-001, *CCP HENC Supplemental Calibration, Confirmation, and Verification Report*

Referenced Documents

- CCP-HSP-010, *CCP Nondestructive Assay System Health and Safety Plan*
- CCP-PO-002, *CCP Transuranic Waste Certification Plan*
- 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-108, *Calibrating the CCP High Efficiency Neutron Counter Using NDA2000*
- CCP-TP-109, *CCP Data Reviewing, Validating, and Reporting Procedure*

2.2 Training Requirements

2.2.1 All 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 Precautions and Limitations

2.3.1 The rollup door is an integral part of the Fire Suppression System. Automatic door closers have been added as part of the Fire Suppression System so the HENC can be operated with the rollup doors in the OPEN position.

2.3.2 The HENC will start without an audible warning. The NDA Operator shall control access to the equipment. The following hazards are addressed in Safety Training for personnel that operate the HENC system:

- Liquid nitrogen (LN)
- Sealed radioactive sources
- Drums containing radioactive and hazardous materials
- Moving parts (e.g., shield doors, conveyors)

2.3.3 The Gamma Detector includes a Dewar that must be filled periodically with LN. Caution will be exercised to prevent injury from the extremely cold temperature as specified in CCP-HSP-010, *CCP Nondestructive Assay Systems Health and Safety Plan*, and the Host site-specific health and safety plan.

2.3.4 Personnel must be qualified radioactive sources handlers to move sources.

2.3.5 HENC NDA Operators will **NOT** load or unload approved TRU waste drums onto the conveyor. HENC NDA Operators may occasionally assist in positioning drums on the conveyor.

2.3.6 The HENC contains heavy moving parts, **AND** the NDA Operator will ensure that unauthorized personnel are **NOT** in the equipment bay during normal operations.

2.3.7 Any drum found to have Fissile Gram Equivalent (FGE) greater than Host site safety basis limits will be controlled as identified by Host site procedures.

2.3.8 Workers who will be working in a radiological control area must have read and signed that they understand the applicable authorized documents (e.g., Advanced Mixed Waste Treatment Plant [AMWTP] Approved Method of Work [AMOW], Radiation Work Permit [RWP], etc.) as implemented by the Host site.

2.3.9 Planning and Coordinating

[A] Ensure the detector has contained liquid nitrogen (LN) for at least eight hours before the high voltage (HV) is applied.

[B] Ensure the detector dewar has been filled with LN within the last seven days.

2.4 Definitions

2.4.1 **Add-A-Source** – A Californium (Cf)-252 source ($\sim 10^5$ neutrons per second [n/s]) introduced during an assay to correct the detected neutron signal for sample moderation. The Add-A-Source is stored in an enclosure and shielded on top of the HENC. It is automatically controlled so it is never exposed while a HENC door is OPEN.

3.0 RESPONSIBILITIES

NOTE

The NDA Operator and the NDA Lead Operator (LO) may be the same individual. The NDA LO may perform NDA Operator tasks and functions at any time.

3.1 NDA Operator

3.1.1 Operates the HENC.

3.1.2 Performs all procedural steps, unless otherwise specified.

3.1.3 Starts documentation for the HENC Batch Data Report (BDR).

3.2 NDA Lead Operator (LO)

3.2.1 Provides the technical supervision for the operation of the HENC.

3.2.2 Provides guidance to the NDA Operator in the event of abnormal conditions.

3.2.3 Consults with the NDA Expert Analyst (EA) to resolve technical problems.

3.3 Forklift Operator (FO)

3.3.1 Supports HENC operation, as required.

3.4 NDA EA

3.4.1 Resolves NDA programmatic technical issues.

3.4.2 Consults with the NDA LO to resolve technical problems.

3.5 Vendor Project Manager (VPM)

3.5.1 Oversees HENC operations.

3.6 Facility Records Custodian

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

4.0 PROCEDURE

NOTE

NDA2000 Operations functions may be accessed through utilizing the mouse or through the keyboard, based on NDA Operator preference.

NDA Operator

4.1 Complete HENC Startup

CAUTION

The rollup door is an integral part of the Fire Suppression System. Automatic door closers have been added as part of the Fire Suppression System so the HENC can be operated with the rollup doors in the OPEN position.

4.1.1 Ensure that power is ON to the following components as applicable:

- [A] Canberra Neutron Multiplicity Counter, Model JSR-14 or equivalent.
- [B] Canberra Digital Signal Analyzers, Model DSA-1000 or equivalent.
- [C] Computer, monitor, and printer.
- [D] Camera monitor system.
- [E] Power conditioner.

4.1.2 Ensure the Main Power switch is ON.

4.1.3 Ensure the Mechanism Control switch is in the MANUAL position.

4.1.4 Turn and hold the Reset/Override key on the Electrical Control Cabinet for approximately one second, **AND** release.

- [A] **IF** the Add-A-Source storage light is flashing, **THEN** ensure that the Mechanism Control switch is in MANUAL, **AND** turn and hold the Reset/Override key again until the Add-A-Source moves to its Storage location and the Add-A-Source light STOPS flashing.

- 4.1.5 Ensure the Mechanism Control switch is in the COMPUTER position
- 4.1.6 Log on to the computer, as necessary.
- 4.1.7 Start NDA2000 Operations.
- 4.1.8 Perform the following operations using NDA2000 Operations:
 - [A] Select HARDWARE SETUP.
 - [B] Select HIGH VOLTAGE SUPPLIES.
 - [C] Select TURN ON.

CAUTION

The DSA units and detectors must warm up and stabilize for at least one hour after the power is applied AND HV is turned ON prior to drum examination and data acquisition.

- 4.1.9 Ensure that the one-hour stabilization requirement has been met.
- 4.2 Shift Startup
 - 4.2.1 Ensure the Main Power switch is ON
 - 4.2.2 Ensure the Mechanism Control switch is in the MANUAL position
 - 4.2.3 Turn and hold the Reset/Override key on the Electrical Control Cabinet for approximately one second, **AND** release.
 - [A] **IF** the Add-A-Source storage light is flashing, **THEN** ensure that the Mechanism Control switch is in MANUAL, **AND** turn and hold the Reset/Override key again until the Add-A-Source moves to its Storage location and the Add-A-Source light STOPS flashing.
 - 4.2.4 Ensure the Mechanism Control switch is in the COMPUTER position.
 - 4.2.5 Turn the computer ON, **AND** start NDA2000 Operations, as required.

4.3 Emergency Shutdown Operations

NOTE

There are three EMERGENCY STOP Buttons on the HENC. One on the electrical control cabinet in the equipment bay; one at the computer station in the Control Room; and one on the conveyor outside of the HENC.

NOTE

There are six EMERGENCY Personnel Bumpers on the HENC. Three are on each door, two on the leading edge of each door (as the door closes) and one on the trailing edge. Any EMERGENCY Personnel Bumper will trigger the EMERGENCY STOP condition and de-energize the HENC motors.

4.3.1 **IF** any of the three EMERGENCY STOP Buttons on the HENC or other safety devices are activated or tripped,
THEN STOP WORK, AND immediately notify the NDA LO and VPM before continuing.

4.3.2 **IF** a problem occurs while the HENC is in operation,
THEN press any one of the EMERGENCY STOP Buttons, STOP WORK, **AND** immediately notify the NDA LO and VPM.

4.3.3 **IF** an electrical problem occurs,
THEN press any one of the EMERGENCY STOP Buttons, **AND** immediately turn OFF the power switch located on the door of the electrical control cabinet.

[A] Turn OFF the power to the following equipment as necessary or applicable:

[A.1] Digital Spectrum Analyzers, Canberra Neutron Multiplicity Counter

[A.2] Computer, monitor, and printer

[A.3] Camera monitor system

[A.4] Power conditioner

[B] Notify the NDA LO, and VPM before continuing.

4.3.4 Record any abnormal conditions in the NDA Operational Logbook.

4.4 Manual Loading/Unloading into HENC Assay Chamber

NOTE

In certain circumstances the need to Load/Unload the drum manually will occur.

4.4.1 Manually Load A Drum

- [A] At the electrical control cabinet, place the Mechanism Control switch in the MANUAL position.
- [B] Turn the Front Door Control switch to the OPEN position **AND** hold until the HENC door is fully OPEN, **AND** the drawbridge has completely lowered.
- [C] Turn the Conveyor Control switch to the LOAD position **AND** hold until the drum is loaded onto the HENC turntable.
- [D] Turn the Front Door Control switch to the CLOSE position **AND** hold until the drawbridge has raised, **AND** the HENC door is fully closed.

4.4.2 Manually Unload A Drum

- [A] At the electrical control cabinet, place the Mechanism Control switch in the MANUAL position.
- [B] Turn the Front Door Control switch to the OPEN position **AND** hold until the HENC door is fully OPEN, **AND** the drawbridge has completely lowered.
- [C] Turn the Conveyor Control switch to the UNLOAD position, **AND** hold until the drum is unloaded and stops at the limit sensor.
- [D] Turn the Front Door Control switch to the CLOSE position, **AND** hold until the drawbridge has raised, **AND** the HENC door is fully closed as necessary.

4.5 Quality Control (QC) Background Check

CAUTION

The rollup door is an integral part of the Fire Suppression System. Automatic door closers have been added as part of the Fire Suppression System so the HENC can be operated with the rollup doors in the OPEN position.

NOTE

At a minimum, the environmental background is performed each day waste drums are analyzed, typically at the beginning of measurement operations. The QC Background Check and the QC Calibration Check (Section 4.6) may be performed in any order.

The NDA2000 OPERATIONS screen will present information about the status of the measurement and how much time is remaining. A STOP ASSAY icon is available to allow the NDA Operator to ABORT the measurement for any reason. The NDA LO will be notified immediately upon the termination of any measurement operation, whether by the NDA Operator or other condition.

- 4.5.1 Verify that nonessential personnel have left the equipment bay.
- 4.5.2 Verify that all waste containers and sources have been moved at least six feet from the HENC.
- 4.5.3 Load an empty drum onto the conveyor as necessary.
- 4.5.4 Ensure the rotator Rotation control is in the ON position.
- 4.5.5 Ensure the Mechanism Control switch is in the COMPUTER position.
- 4.5.6 Begin the QC Background Check assay.
- 4.5.7 On the START ASSAY screen, verify the following:
 - Container Type set to 55-gallon drum
 - The Disable Load/Unload box is **NOT** checked
- 4.5.8 Click the START ASSAY Button at the bottom of the screen.

4.5.9 On the Item Information screen perform the following:

- Check that the Item ID lists Background **OR** equivalent.
- Enter any comment that may be pertinent to the measurement.

4.5.10 Ensure that the rotator is rotating.

NOTE

The amber tower light in the control room **OR** the Rotator light located on the Electrical Control Cabinet indicates rotator motion.

4.5.11 Select DONE.

NOTE

When the assay is complete, the computer will analyze the data and generate a report. The Assay Warning Log window is displayed if any errors or warnings have occurred during the assay. Subsequent operations are automatic with the acquisition results being analyzed, compared to acceptance criteria, and stored.

NOTE

For an example of a QA Last Results Report, see Attachment 1, QA Last Result Report.

4.5.12 **WHEN** the analysis is complete,
THEN select the View Last Assay Report Button on the
NDA2000 Operations screen, **AND** observe the QA Last
Results Report for any deviation/flags (i.e., Investigate [In],
Action [Ac], Above [Ab] or Below [Be]).

4.5.13 **IF** any of the values on the QA Last Results Report indicate a
preset "Ab" (Above) or "Be" (Below) boundary flag,
THEN perform the following:

[A] STOP WORK **AND** notify the NDA LO and VPM.

[B] Note the problem in the NDA Operational Logbook.

NDA LO

- [C] Evaluate the nature of the failure, consulting with an NDA EA as necessary, **AND** determine if a Nonconformance Report (NCR) is required.
- [D] **IF** an NCR is required,
THEN initiate an 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 complete.
- [E] **IF** an NCR is **NOT** required,
THEN instruct the NDA Operator to mitigate the problem, note the resolution in the NDA Operational Logbook, **AND** repeat the QC Background Check.

NDA Operator

4.5.14 Remove the empty drum from the conveyor, if necessary.

4.5.15 Print, sign, and date the QA Last Results Report(s) for inclusion in the BDR.

4.6 QC Daily Performance Check

CAUTION

The rollup door is an integral part of the Fire Suppression System. Automatic door closers have been added as part of the Fire Suppression System so the HENC can be operated with the rollup doors in the OPEN position.

NOTE

The QC Daily Performance Check is performed at a minimum, once each day waste drums are analyzed, typically at the beginning of measurement operations. The Cf-252 Add-a-Source and an instrument performance measurement drum are used for this measurement.

4.6.1 Verify that nonessential personnel have left the equipment bay.

4.6.2 Verify that all waste containers and sources have been removed at least six feet from the HENC.

- 4.6.3 Instruct the FO to load the source drum onto the conveyor.
- 4.6.4 Ensure the Mechanism Control switch is in the COMPUTER position.
- 4.6.5 Begin the QC Daily Performance Check assay.
- 4.6.6 On the START ASSAY screen, verify the following:
- Container Type set to 55-gallon drum
 - The Disable Load/Unload box is **NOT** checked
- 4.6.7 Click the START ASSAY Button at the bottom of the screen.
- 4.6.8 On the Item Information screen, perform the following:
- Enter DPC1999 for the performance check drum in the Item ID Section.
 - Enter Daily Performance Check for Description 2.
 - Enter the percent full in the Percent Full field (e.g., QC Daily Performance Check; 0% Full)
 - Sum the Daily Performance Check drum net weight plus the NDA2000 Operations predetermined container tare weight, **AND** enter the summed value in the Gross Weight field (e.g., QC Daily Performance Check; 0 kilograms [kg] net weight).
 - Ensure that DPC1999 is selected as the certificate/declaration.
- 4.6.9 Ensure that the rotator is rotating.

NOTE

The amber tower light in the control room **OR** the Rotator light located on the Electrical Control Cabinet indicates rotator motion.

- 4.6.10 Select DONE.

NOTE

When the assay is complete, the computer will analyze the data and generate a report, and the NDA2000 OPERATIONS window will close. The Assay Warning Log window will be displayed if any errors or warnings have occurred during the assay. Subsequent operations are automatic with the acquisition results being analyzed, compared against predetermined criteria, and stored.

Results of the measurement may contain several types of flags. The In or Investigative flag indicates a result that is outside of the 2-Sigma limits, but within the 3-Sigma limits. The Ac or Action flag indicates a result that is outside of the 3-Sigma limits. An Ab or Above flag indicates a result is above the boundary or a Be or Below flag indicates a result is below the boundary.

4.6.11 **WHEN** the analysis is complete,
THEN select the View Last Assay Report Button on the NDA2000 Operations screen, **AND** observe the QA Last Results Report for any deviation/flags (i.e., Investigate [In], Action [Ac], Above [Ab] or Below [Be]).

4.6.12 **IF** any of the values on the QA Last Results Report indicate a preset Ab (Above) or Be (Below) boundary flag, or an Ac (Action) flag,
THEN perform the following:

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

[B] Note the problem in the NDA Operational Logbook.

NDA LO

[C] Evaluate the nature of the failure, consulting with an NDA EA as necessary, **AND** determine if an NCR is required.

[D] **IF** an NCR is **NOT** required,
THEN instruct the NDA Operator to mitigate the problem, note the resolution in the NDA Operational Logbook, **AND** repeat the QC Daily Performance Check.

NOTE

Calibration verification is accomplished by completing two consecutive successful Daily Performance Check measurements.

[E] **IF** an NCR is required,
THEN initiate an NCR in accordance with CCP-QP-005,
DO NOT resume operations until a corrective action plan is complete **AND** calibration verification as described in the NOTE above is performed.

[E.1] **IF** the corrective action plan involved any of the following:

- Major system repairs and/or modifications.
- Replacement of the measurement system's components, e.g., detector, neutron generator or supporting electronic components that have the capacity to affect data.
- Significant change to the system's software.
- Relocation of the system.

THEN per the EA's direction perform Calibration Verification in accordance with CCP-TP-108, *Calibrating the CCP High Efficiency Neutron Counter Using NDA2000*.

4.6.13 **IF** any of the values on the QA Last Results Report indicate a 2-sigma "In" or "Investigate flag",
THEN perform the following:

[A] **IF** possible, identify the cause of the failure,
THEN correct the problem.

[B] Notify the NDA LO, **AND** note the problem and resolution in the NDA Operational Logbook.

[C] Following the instruction of the NDA LO, repeat the QC Daily Performance Check and evaluation no more than two times.

NOTE

Calibration verification is accomplished by completing two consecutive successful Daily Performance Check Measurements.

[D] **IF** three successive 2-sigma QC failures occur, **THEN STOP WORK, AND** notify the NDA LO and VPM, **AND** initiate an NCR in accordance with CCP-QP-005, **DO NOT** resume operations until a corrective action plan is complete **AND** calibration verification as described in the NOTE above is performed.

[D.1] **IF** the corrective action plan involved any of the following:

- Major system repairs and/or modifications
- Replacement of the measurement system's components, e.g., detector, neutron generator or supporting electronic components that have the capacity to affect data
- Significant change to the system's software
- Relocation of the system

THEN per the EA's direction perform Calibration Verification in accordance with CCP-TP-108.

4.6.14 Instruct the FO to remove the source drum from the conveyor.

4.6.15 Print, sign, and date the QA Last Results Report(s) for inclusion in the BDR.

4.7 Weekly Interfering Matrix Drum Measurements

4.7.1 Obtain a weekly interfering matrix drum with surrogate matrix, assembled in accordance with Attachment 3, Weekly Measurement Control Standards Used For HENC, such that applicable matrices and source loadings are assayed at least once during a six-month period.

4.7.2 Verify that nonessential personnel have left the equipment bay.

4.7.3 Verify that all waste containers and sources have been moved at least six feet from the HENC.

4.7.4 Instruct the FO to load the source drum onto the conveyor.

4.7.5 Ensure the Mechanism Control switch is in the COMPUTER position.

4.7.6 Begin the QC Weekly Performance Check.

4.7.7 On the START ASSAY screen, verify the following:

- Container Type set to 55-gallon drum
- The Disable Load/Unload box is **NOT** checked

4.7.8 Click the START ASSAY Button at the bottom of the screen

4.7.9 On the Item Information screen, perform the following:

- Enter the Weekly Performance Check drum ID in the Item ID Section (e.g. COM 1).
- Enter Weekly Performance Check for Description 2.
- Enter the percent full in the Percent Full field.
- Sum the Weekly Performance Check drum net weight plus the NDA2000 Operations predetermined container tare weight, **AND** enter the summed value in the Gross Weight field.
- Ensure that the correct certificate/declaration is selected.

4.7.10 Ensure that the rotator is rotating.

NOTE

The amber tower light in the control room **OR** the Rotator light located on the Electrical Control Cabinet indicates rotator motion.

4.7.11 Select DONE.

4.7.12 **WHEN** the analysis is complete,
THEN select the View Last Assay Report Button on the NDA2000
Operations screen, **AND** observe the QA Last Results Report for
any deviation/flags (i.e., Investigate [In], Action [Ac], Above [Ab] or
Below [Be]).

4.7.13 **IF** any of the values on the QA Last Results Report indicate any
deviation/flags (i.e., "In", "Ac", "Ab" or "Be"),
THEN perform the following:

[A] **IF** possible, identify the cause of the failure,
THEN correct the problem.

[B] Notify the NDA LO and VPM, **AND** note the problem and
resolution in the NDA Operational Logbook.

NOTE

The NDA EA will prepare an evaluation report at six month intervals
documenting the interfering weekly matrix drum measurement results. The
report shall summarize the matrices and ranges that have been tested, note any
operational problems and include an evaluation of system performance during
that period.

NDA LO

[C] Confer with the NDA EA to determine whether the assay
results indicate an instrument problem or other condition
detrimental to quality, **AND** note any action taken in the NDA
Operational Logbook.

4.7.14 Instruct the FO to remove the Weekly Performance Check Drum
from the conveyor.

4.7.15 Print, sign, and date the QA Last Results Report(s) for inclusion in
the BDR.

4.8 Waste Drum Assay

NOTE

The Gamma Detector is equipped with a 32 mil cadmium filter for routine assays.

CAUTION

The rollup door is an integral part of the Fire Suppression System. Automatic door closers have been added as part of the Fire Suppression System so the HENC can be operated with the rollup doors in the OPEN position.

NOTE

The NDA2000 OPERATIONS screen will present information about the status of the measurement and how much time is remaining. A STOP ASSAY icon is available to allow the NDA Operator to ABORT the measurement for any reason. The NDA LO will be notified immediately upon the termination of any measurement operation.

NDA Operator

- 4.8.1 Verify that nonessential personnel have left the equipment bay.
- 4.8.2 Verify that all containers and sources have been removed from the HENC assay chamber.
- 4.8.3 Instruct the FO to load the waste drum onto the conveyor.
- 4.8.4 Ensure the Mechanism Control switch is in the COMPUTER position.
- 4.8.5 Begin the appropriate Assay-Passive.
- 4.8.6 On the START ASSAY screen, verify the following:
 - Container Type set to 55-Gallon Drum
 - The Disable Load/Unload box is **NOT** checked
- 4.8.7 Click the START ASSAY Button at the bottom of the screen.

4.8.8 On the Item Information screen perform the following:

- [A] Enter the Item (drum) ID **AND** any other descriptive information.

NOTE

The Batch ID can be obtained from the NDA LO.

- [B] In the block labeled "Description 1:", enter the BDR Number.
- [C] In the block labeled "Description 2:", enter the Waste Matrix Code from the real-time radiography (RTR) or visual examination (VE) data sheet attached to the Container Traveler.
- [D] Enter any comment that may be pertinent to the measurement.
- [E] Verify that the Sample Type is appropriate for the assay.
- [F] Verify that the Matrix Type is appropriate for the assay.
- [G] Sum the Net Weight from the RTR or VE datasheet attached to the Container Traveler, plus NDA2000 Operations pre-determined Container Tare Weight, **AND** enter the summed value in the gross weight field.
- [H] Enter drum percent full from the RTR or VE datasheet attached to the Container Traveler.
- [I] Density of the item is automatically calculated or may be entered as appropriate.
- [J] Ensure that the WGPu is selected as the Certificate/Declaration.

4.8.9 Ensure that the rotator is rotating.

NOTE

The amber tower light in the control room **OR** the Rotator light located on the Electrical Control Cabinet indicates rotator motion.

4.8.10 Select DONE.

NOTE

When the assay is complete, the computer will analyze the data and generate a Radioassay Data Sheet (see Attachment 2, NDA Radioassay Data Sheet for an example). The Assay Warning Log window will be displayed if any errors or warnings have occurred during the assay. Subsequent operations are automatic with the acquisition results being analyzed and stored.

4.8.11 At the completion of the measurement:

NOTE

In cases where the preliminary NDA result exceeds the Host site safety basis limits, authorization is required from the VPM and Host site management personnel prior to moving the drum.

- [A] **WHEN** the analysis is complete,
THEN select the VIEW LAST ASSAY REPORT Button on the NDA2000 Operations screen, **AND** review the preliminary NDA results, **AND** ensure that the Drum ID Number on the analysis report matches the Drum ID Number on the drum.

- [B] **IF** the preliminary NDA result indicates that the drum contents have a FGE value greater than Host site safety basis limits,
THEN notify the VPM and Host site management personnel, **AND** manage the drum in accordance with Host site procedures.
 - [B.1] The drum shall **NOT** be removed without specific authorization from the VPM and Host site management.

- [C] **IF** the Drum ID numbers **DO NOT** match,
THEN notify the NDA LO.

4.8.12 Instruct the FO to unload the drum from the conveyor.

4.8.13 Log any warnings or errors into the NDA Operational Logbook.

4.8.14 Print, sign and date the NDA Radioassay Data for inclusion in the BDR.

4.8.15 Report any problems to the NDA LO and VPM.

4.8.16 Repeat steps 4.8.1 through steps 4.8.15 for additional waste drums.

4.9 Partial Shutdown of HENC

4.9.1 CLOSE NDA2000 Operations.

4.9.2 Shut down the computer and camera monitor system.

4.9.3 Shut down the Electrical Control Cabinet by rotating the Main Power switch to OFF.

4.10 Complete Shutdown of HENC

4.10.1 Perform the following operations using NDA2000 Operations:

[A] Select HARDWARE SETUP.

[B] Select HIGH VOLTAGE SUPPLIES.

[C] Select TURN OFF.

4.10.2 CLOSE all programs, **AND** shut down the computer and camera monitor system, if required.

4.10.3 Shut down the Electrical Control Cabinet by rotating the Main Power switch to OFF.

4.10.4 Ensure all DSA (e.g., DSA1000) power rocker switches are OFF.

4.10.5 Ensure the JSR-14 power rocker switch is OFF.

5.0 RECORDS

- 5.1 Records generated during the performance of this procedure (as listed in Section 5.2.1[A] and 5.2.1[B]) are compiled into the BDR, in accordance with CCP-TP-109, then forwarded to the Facility Records Custodian.
- 5.2 Records generated during the performance of this procedure are maintained as QA records in accordance with CCP-QP-008. The records are the following:

5.2.1 QA/Lifetime

- [A] QA Last Results Report(s)
- [A.1] Background
- [A.2] Performance Check
- [B] NDA Radioassay Data Sheet(s)

5.2.2 QA/Nonpermanent

- [A] Six-Month Weekly Interfering Matrix Report

Attachment 1 – QA Last Results Report (Example)

Page 1 of 2

EXAMPLE

QA LAST RESULTS REPORT: QC CHECK

CCP HENC, Idaho National Laboratory (INL)

QA File name: 7_4_76QC.CAM

Sample ID: QC CHECK
SAMPLE QUANTITY: 1.0000E+00
SAMPLE DATE: 07-04-76
ELAPSED LIVE TIME: 187.2 S
ELAPSED REAL TIME: 300.0 S

PARAMETER DESCRIPTION [MEAN +/- STD. DEV.]	VALUE	DEVIATION/FLAGS <LU:SD:UD:BS>
WT MEAN ACTIVITY [8.355E+01+/-0.621]	7.618E+01	0.234E+00 < : : : >
PEAK CENTROID 122 [1.219E+02+/-0.513]	1.218E02	2.167E-1 < : : : >
PEAK FWHM 122 [0.700E+02+/-0.080]	0.798E00	2.167E-2 < : : : >
PEAK CENTROID 1408 [1.418E+03+/-0.906]	1.408E03	4.123E-1 < : : : >
PEAK FWHM 1408 [0.700E+02+/-0.080]	1.732E00	3.477E-2 < : : : >

FLAGS KEY:

LU = lower/upper bounds test	(Ab=above, Be=below)
SD = sample driven N-sigma test	(In=investigate, Ac=action)
UD = user driven N-sigma test	(In=investigate, Ac=action)
BS = measurement bias test	(In=investigate, Ac=action)

Operator Review:

Print / Sign / Date

Attachment 1 – QA Last Results Report (Example) (Continued)

Page 2 of 2

EXAMPLE

QA LAST RESULTS REPORT: BACKGROUND

CCP-HENC, Idaho National Laboratory (INL)

QA File name: 7_4_76BK.CAM
Sample ID: BACKGROUND CHECK
SAMPLE QUANTITY: 1.0000E+00
SAMPLE DATE: 07-04-76
ELAPSED LIVE TIME: 298.2 S
ELAPSED REAL TIME: 300.0 S

PARAMETER DESCRIPTION [MEAN +/- STD. DEV.]	VALUE	DEVIATION/FLAGS <LU:SD:UD:BS>
TOTAL COUNT RATE [8.355E+01+/-0.621]	7.618E+01	0.234E+00 < : : : >

FLAGS KEY:

LU = lower/upper bounds test	(Ab=above, Be=below)
SD = sample driven N-sigma test	(In=investigate, Ac=action)
UD = user driven N-sigma test	(In=investigate, Ac=action)
BS = measurement bias test	(In=investigate, Ac=action)

Operator Review:

Print / Sign / Date

Attachment 2 – NDA Radioassay Data Sheet (Example)

EXAMPLE

Radioassay Data Sheet
Procedure ID & Rev: CCP-TP-107

Tue 07/04/1776 02:05:04
Software Version: NDA2000 v.4.0

Drum ID : IN164799
Sequence Number : 542
Assay Date : 07/04/1776 08:49:04

Gross Weight (kg) : 59.6
Fill Height (%) : 90.0
Density (g/cc) : 0.11
Net Weight (kg) : 21.20
Waste Matrix Code : S5000
TRUCON : LA225

Batch Number : INA015
Site ID : INL

TRU Alpha Activity Concentration:	Errors at 1.00 Sigma
Total Pu-239 Equiv Activity:	1.19e-07 +/- 2.57e-08 Ci/g
Total Pu-239 Fissile Gram Equiv:	2.30e-03 +/- 4.96e-04 Ci
Decay Heat:	1.21e-02 +/- 2.67e-03 g
Total Pu Mass:	8.45e-05 +/- 1.83e-05 W
TMU:	1.48e-04 +/- 3.19e-05 g
Waste Classification:	16.42%
	TRU

Activity Errors

Isotope	Isotope 1.00 Sigma		Alpha Activity / 1.00 Sigma		MDA
	Mass (g)	Error/Isotope	Isotope (Ci)	Error/Isotope (Ci)	
Pu-238	1.47e-04	3.19e-05	2.52e-03	5.46e-04	4.81e-05
Pu-239	<LLD	0.00e+00	0.00e+00	0.00e+00	2.10e-03
Pu-240	<LLD	0.00e+00	0.00e+00	0.00e+00	4.50e-03
Pu-241	<LLD	0.00e+00	0.00e+00	0.00e+00	2.47e-05
Pu-242	1.96e-07	4.25e-08	7.71e-10	1.67e-10	0.00e+00
Am-241	9.78e-07	1.64e-07	3.34e-06	5.62e-07	8.96e-08
Am-243	<LLD	0.00e+00	0.00e+00	0.00e+00	8.37e-08
Np-237	4.66e-04	7.72e-05	3.28e-07	5.44e-08	9.52e-06
U-235	1.21e-02	2.67e-03	2.61e-08	5.77e-09	8.40e-03
U-238	<LLD	0.00e+00	0.00e+00	0.00e+00	4.34e-01
U-233	<LLD	0.00e+00	0.00e+00	0.00e+00	1.96e-02
CS-137	6.81e-11	1.67e-11	5.92e-09	1.45e-09	4.36e-11
U-234	7.14e-05	1.54e-05	4.44e-07	9.61e-08	0.00e+00
SR-90	4.28e-11	1.05e-11	5.92e-09	1.45e-09	0.00e+00

Operator: _____

Date: _____

ITR: _____

Date: _____

Attachment 3 – Weekly Measurement Control Standards Used For HENC

Drum ID	Source ID	Pu Mass	Source Matrix	Source Position	Drum Matrix
COM1	CEP003	1.98772	Diatomaceous Earth	Tube 3, Ht: 10"	Combustibles PDP* Style Surrogate Drum
	CEP004	2.00861		Tube 2, Ht: 19"	
	CEP005	1.99287		Tube 2, Ht: 10"	
	CEP006	1.99099		Tube 2, Ht: 1"	
	TOTAL	7.98019 g		Fill portion of tubes without standards with combustibles matrix plugs.	
COM2	NTP-0147	30.046	Diatomaceous Earth	Tube 1, Ht: 9"	Combustibles PDP Style Surrogate Drum
	NTP-0155	49.976		Tube 2, Ht: 12"	
	NTP-0139	15.035		Tube 3, Ht: 9"	
	TOTAL	95.057 g		Fill portion of tubes without standards with combustibles matrix plugs.	
COM3	NTP-0123	3.0514	Diatomaceous Earth	Tube 1, Ht: 1"	Combustibles PDP Style Surrogate Drum
	NTP-0102	0.29858		Tube 1, Ht: 11"	
	NTP-0095	0.30376		Tube 1, Ht: 21"	
	NTP-0109	2.9686		Tube 2, Ht: 1"	
	NTP-0139	15.035		Tube 2, Ht: 11"	
	NTP-0116	2.933		Tube 2, Ht: 21"	
	NTP-0155	49.976		Tube 3, Ht: 6"	
	NTP-0163	64.993		Tube 3, Ht: 16"	
	TOTAL	139.559 g		Fill portion of tubes without standards with combustibles matrix plugs.	

Attachment 3 – Weekly Measurement Control Standards Used For HENC (Continued)

Drum ID	Source ID	Pu Mass	Source Matrix	Source Position	Drum Matrix
MET1	CEP003	1.98772	Diatomaceous Earth	Tube 3, Ht: 10"	Metals PDP Style Surrogate Drum
	CEP004	2.00861		Tube 2, Ht: 19"	
	CEP005	1.99287		Tube 2, Ht: 10"	
	CEP006	1.99099		Tube 2, Ht: 1"	
	TOTAL	7.98019g		Fill portion of tubes without standards with metals matrix plugs.	
MET2	NTP-0147	30.046	Diatomaceous Earth	Tube 1, Ht: 9"	Metals PDP Style Surrogate Drum
	NTP-0155	49.976		Tube 2, Ht: 12"	
	NTP-0139	15.035		Tube 3, Ht: 9"	
	TOTAL	95.057 g		Fill portion of tubes without standards with metals matrix plugs.	
MET3	NTP-0123	3.0514	Diatomaceous Earth	Tube 1, Ht: 1"	Metals PDP Style Surrogate Drum
	NTP-0102	0.29858		Tube 1, Ht: 11"	
	NTP-0095	0.30376		Tube 1, Ht: 21"	
	NTP-0109	2.9686		Tube 2, Ht: 1"	
	NTP-0139	15.035		Tube 2, Ht: 11"	
	NTP-0116	2.933		Tube 2, Ht: 21"	
	NTP-0155	49.976		Tube 3, Ht: 6"	
	NTP-0163	64.993		Tube 3, Ht: 16"	
	TOTAL	139.559 g		Fill portion of tubes without standards with metals matrix plugs.	

Attachment 3 – Weekly Measurement Control Standards Used For HENC (Continued)

Drum ID	Source ID	Pu Mass	Source Matrix	Source Position	Drum Matrix
SLU1	CEP006	1.99099	Diatomaceous Earth	Tube 4, Ht: 1"	Sludge PDP Style Surrogate Drum
	CEP005	1.99287		Tube 4, Ht: 10"	
	CEP004	2.00861		Tube 3, Ht: 5"	
	CEP003	1.98772		Tube 3, Ht: 14"	
	TOTAL	7.98019 g		Fill portion of tubes without standards with sludge matrix plugs.	
SLU2	NTP-0147	30.046	Diatomaceous Earth	Tube 4, Ht: 4"	Sludge PDP Style Surrogate Drum
	NTP-0155	49.976		Tube 3, Ht: 13"	
	NTP-0139	15.035		Tube 4, Ht: 13"	
	TOTAL	95.057 g		Fill portion of tubes without standards with sludge matrix plugs.	
SLU3	NTP-0123	3.0514	Diatomaceous Earth	Tube 1, Ht: 1"	Sludge PDP Style Surrogate Drum
	NTP-0102	0.29858		Tube 1, Ht: 11"	
	NTP-0095	0.30376		Tube 1, Ht: 21"	
	NTP-0109	2.9686		Tube 2, Ht: 1"	
	NTP-0139	15.035		Tube 2, Ht: 11"	
	NTP-0116	2.933		Tube 2, Ht: 21"	
	NTP-0155	49.976		Tube 3, Ht: 10"	
	NTP-0163	64.993		Tube 4, Ht: 10"	
	TOTAL	139.559 g		Fill portion of tubes without standards with sludge matrix plugs.	

Attachment 3 – Weekly Measurement Control Standards Used For HENC (Continued)

Drum ID	Source ID	Pu Mass	Source Matrix	Source Position	Drum Matrix
GLA1	CEP003	1.98772	Diatomaceous Earth	Tube 3, Ht: 10"	Glass PDP Style Surrogate Drum
	CEP004	2.00861		Tube 2, Ht: 19"	
	CEP005	1.99287		Tube 2, Ht: 10"	
	CEP006	1.99099		Tube 2, Ht: 1"	
	TOTAL	7.98019 g		Fill portion of tubes without standards with glass matrix plugs.	
GLA2	NTP-0147	30.046	Diatomaceous Earth	Tube 1, Ht: 9"	Glass PDP Style Surrogate Drum
	NTP-0155	49.976		Tube 2, Ht: 12"	
	NTP-0139	15.035		Tube 3, Ht: 9"	
	TOTAL	95.057 g		Fill portion of tubes without standards with glass matrix plugs.	
GLA3	NTP-0123	3.0514	Diatomaceous Earth	Tube 1, Ht: 1"	Glass PDP Style Surrogate Drum
	NTP-0102	0.29858		Tube 1, Ht: 11"	
	NTP-0095	0.30376		Tube 1, Ht: 21"	
	NTP-0109	2.9686		Tube 2, Ht: 1"	
	NTP-0139	15.035		Tube 2, Ht: 11"	
	NTP-0116	2.933		Tube 2, Ht: 21"	
	NTP-0155	49.976		Tube 3, Ht: 6"	
	NTP-0163	64.993		Tube 3, Ht: 16"	
	TOTAL	139.559 g		Fill portion of tubes without standards with glass matrix plugs.	