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CCP-TP-071

Revision 1

CCP
Gamma Energy Assay (GEA) Operating Procedure

EFFECTIVE DATE: 02/17/2011

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PRINTED NAME

APPROVED FOR USE

RECORD OF REVISION

Revision Number	Date Approved	Description of Revision
0	01/11/2010	Initial issue.
1	02/17/2011	Revised to incorporate changes from host site operating procedure and to update baseline and referenced documents.

TABLE OF CONTENTS

LIST OF ATTACHMENTS

1.0 PURPOSE

This procedure provides instructions for startup, operations, and shutdown of the Gamma Energy Assay (GEA) systems using CANBERRA NDA 2000 software.

1.1 Scope

This procedure applies to personnel responsible for operating and/or supervising the operations of the GEA systems.

2.0 REQUIREMENTS

2.1 References

Baseline Documents

- CANBERRA Industries, Inc., Publication No. 9231594F, *NDA 2000 Users Manual* (corresponding to current software version)
- CANBERRA Industries, Inc., Publication No. 9231595C, *NDA 2000 Technical Reference Manual* (corresponding to current software version)
- Document No. 96048, *WRAP Gamma Energy Assay System Installation and Maintenance Manual*.
- CCP-PO-002, *CCP Transuranic Waste Certification Plan*
- CCP-PO-005, *CCP Conduct of Operations*
- CCP-PO-011, *CCP/CH2M-Hill Plateau Remediation Company Interface Document*
- CCP-QP-022, *CCP Software Quality Assurance Plan*
- WRP1-OP-907, *Gamma Energy Assay Operations Using NDA 2000*

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-068, *CCP Standardized Container Management*
- CCP-TP-070, *CCP Gamma Energy Assay (GEA) Calibration, Confirmation, and Verification Procedure*
- CCP-TP-072, *CCP Gamma Energy Assay (GEA) Data Review, Validation, and Reporting Procedure*

2.2 Training Requirements

2.2.1 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 daily and weekly performance check drums contain radioactive sealed sources. The sealed sources contain Plutonium (Pu)-239. If possible, the sources must remain inside the daily performance check drum, and source(s) physical positioning inside the drum must be preserved to ensure repeatability.

2.3.2 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.

2.3.3 Drums containing lead liners should **NOT** be processed without an approved lead liner efficiency calibration.

2.3.4 Personnel working around the conveyor system, door closure, and moving equipment must observe warning devices and postings.

2.3.5 Personnel working in the area of elevated cable trays must maintain awareness of surroundings and tripping hazards.

2.3.6 Temporary radiation shielding may be used in the assay area. Personnel must maintain awareness of surroundings and tripping hazards.

2.3.7 Radioactive calibration sources/standards are to be treated and controlled as sealed radioactive sources in accordance with Host site procedures. Integrity tests MUST be performed on sources/standards per the requirements of Host site procedures.

2.3.8 Workers who will be working in a radiation area must have read and signed that they understand the applicable authorized documents (e.g., Radiation Work Permit [RWP], etc.) as implemented by the Host site.

2.4 Prerequisite Actions

2.4.1 Planning and Coordination

[A] Verify that there is no audible warning indicating detector warm up.

2.5 Software

[A] NDA 2000, Waste Assay

[B] Genie 2000, Gamma Acquisition and Analysis

3.0 RESPONSIBILITIES

NOTE

The Nondestructive Assay (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 Lead Operator

3.1.1 Verify equipment operation prerequisites are met prior to startup.

3.1.2 Verify Operator qualification and training is current.

3.2 NDA Operator

3.2.1 Verifies routine startup and normal operations of the assay systems.

3.2.2 Notifies the NDA LO of abnormal or nonconforming conditions.

3.3 NDA Expert Analyst (EA)

3.3.1 Evaluates conditions detrimental to quality.

3.3.2 Provides technical supervision and data evaluation for radioassays.

3.3.3 Prepares and issues weekly performance check six month reports.

3.4 Facility Records Custodian

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

4.0 PROCEDURE

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

NOTE
The NDA Operator need NOT be continuously present at the assay station during operation and may move to other stations, as required.

4.1 General

NDA Operator

4.1.1 Verify all prerequisites have been met.

NOTE
The motion warning horn will sound briefly prior to any command mechanism movement. The yellow light will be on during conveyor or shield door movement. If the system detects an error in the Programmable Logic Controller (PLC) operation, the yellow light will flash ON and OFF repeatedly.

NOTE
Complete system start-up and shut-down will be performed by the Host site Maintenance group.

4.2 Shift Startup

NOTE
The motion warning horn will sound briefly prior to any command mechanism movement. The yellow light will be on during conveyor or shield door movement. If the system detects an error in the PLC operation, the yellow light will flash ON and OFF repeatedly.

NDA Operator

4.2.1 Verify the mechanism mode key is switched to the REMOTE position.

4.2.2 Verify that the computer is ON, **AND** NDA 2000 Operations has been started, as required.

4.3 Background/Transmission Check

NOTE
A background/transmission check is performed at least once a day at the beginning of the operational day prior to assaying.

NOTE
The background/transmission check is performed with the shield enclosure empty of any drums.

NOTE
Criteria used to develop the background acceptance boundaries are documented in the calibration, confirmation, and verification report (e.g., CCP-RL-GEA-001).

NDA Operator

4.3.1 Verify that the Nuclear Chemical Operator (NCO) performs the following operations using NDA 2000 Operations, as applicable:

[A] Select MANUAL.

[B] Select LOAD/UNLOAD/TRANSPORT.

[C] Select PREPARE FOR BACKGROUND.

[D] Select ASSAY.

[E] Select ROUTINE ASSAY.

[F] Select the Quality Control (QC)-Background/Transmission Check.

[G] Select START ASSAY at the start assay screen.

[H] **IF** necessary,
THEN enter comments in the comment field of the ITEM INFORMATION screen, **AND** the Item ID will default as Background.

[I] Select DONE.

NOTE

The red light is illuminated when the transmission source shutter is OPEN. If the system detects an error in the PLC operation, the yellow light will flash ON and OFF repeatedly.

4.3.2 Monitor control tower lights.

[A] **IF** the red light fails to come ON, **OR** other error conditions occur during the count,
THEN verify that the count is aborted, **AND** notify the NDA LO.

4.3.3 **WHEN** the analysis is complete,
THEN observe the QA Last Results, Report for any deviation/flags (i.e., Investigate [In], Action [Ac], Above [Ab], or Below [Be]).

4.3.4 **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] SUSPEND WORK, **AND** notify the NDA LO and Vendor Project Manager (VPM).

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

NDA LO

[C] Evaluate the nature of the failure, consulting with the EA as necessary, **AND** determine if a Non-conformance 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 verify the problem was mitigated, note the resolution in the NDA Operational Logbook, **AND** verify that the QC Background/Transmission Check is repeated.

NDA Operator

4.3.5 Sign, and date the QA Last Results Report(s) for inclusion in the Batch Data Report (BDR).

4.4 Daily Performance Check

NOTE
The background/transmission check is normally performed prior to the required performance check.

NOTE
A daily performance check is performed at least once per day at the beginning of the operational day, prior to assaying.

NOTE
Criteria used to develop the acceptance boundaries are documented in the Calibration, Confirmation, and Verification report (e.g., CCP-RL-GEA-001).

4.4.1 Verify the performance check drum is positioned correctly onto the conveyor.

4.4.2 Verify the mechanism mode key switch is in the REMOTE position.

4.4.3 Verify that the NCO performs the QC – Daily Performance Check using NDA 2000 Operations by performing the following steps:

[A] Select ASSAY.

[B] Select ROUTINE ASSAY.

[C] Select QC-DAILY PERFORMANCE CHECK.

[D] Select START ASSAY at the start assay screen.

[E] Enter NDA-QC1 for the performance check drum in the Item ID section of the Item Information screen.

[F] Enter Daily Performance Check for Description 2 on the Item Information screen.

[G] Enter the Percent Full (e.g., 100%) and Gross Weight (e.g., 45.8) kilogram in the appropriate sections of the Item Information screen.

[H] Ensure that the appropriate certificate/declaration, (e.g., DAILY PERFORMANCE CHECK) is selected.

[I] Select DONE.

NOTE

The yellow light is illuminated when there is any motion during the load or unload process. The red light is illuminated when the transmission source shutter is OPEN. If the system detects an error in the PLC operation, the yellow light will cycle ON and OFF repeatedly.

4.4.4 Monitor control tower lights.

[A] **IF** any of the lights fail to come on **OR** other problems occur during the count,
THEN verify that the count is stopped, **AND** notify the NDA LO.

4.4.5 **WHEN** the analysis is complete,
THEN observe the QA Last Results Report for any deviation/flags (i.e., Investigate [In], Action [Ac], Above [Ab], or Below [Be]).

NDA Operator

4.4.6 **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 instructions of the NDA LO, verify the QC measurement and evaluation is repeated 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 verify that SUSPEND WORK is issued, **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:

(a) Major system repairs and/or modifications

(b) Replacement of the measurement system's components, (e.g., detector, neutron generator, or supporting electronic components) that have the capacity to affect data

(c) Significant changes to the system's software

(d) Relocation if the system

THEN verify that a Calibration Verification is performed in accordance with CCP-TP-070, *CCP Gamma Energy Assay (GEA) Calibration, Confirmation and Verification Procedure*.

4.4.7 **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 verify the following:

[A] SUSPEND WORK is issued, **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 verify the problem is mitigated, note the resolution in the NDA Operational Logbook, **AND** verify the QC-Daily Performance Check is repeated.

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

NDA Operator

[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:

(a) Major system repairs and/or modifications

(b) Replacement of the measurement system's components, (e.g., detector, neutron generator, or supporting electronic components) that have the capacity to affect data

(c) Significant changes to the system's software

(d) Relocation of the system

THEN verify the Calibration Verification is performed in accordance with CCP-TP-070.

4.4.8 Verify the performance check drum is removed from the conveyor, as necessary.

4.4.9 Sign, and date the QA Last Results Report(s) for inclusion in the BDR.

4.5 Weekly Performance Check

NOTE
Criteria used to develop the acceptance criteria are documented in the calibration, confirmation, and verification report (e.g., CCP-RL-GEA-001).

NDA Operator

4.5.1 Verify that an Interfering Matrix Drum (IMD) has been source loaded per Attachment 3, Weekly Measurement Control Standards Used for GEA , and is available.

4.5.2 Verify the weekly test drum is loaded correctly onto the conveyor.

4.5.3 Verify the Mechanism Mode Key Switch is in the REMOTE position.

4.5.4 Verify that the NCO performs the QC - Weekly Performance Check using NDA 2000 Operations by performing the following steps:

[A] Select ASSAY.

[B] Select ROUTINE ASSAY.

[C] Select QC-WEEKLY PERFORMANCE CHECK.

[D] Select START ASSAY at the start assay screen.

[E] Enter the Weekly Performance Check Drum ID number (e.g., IMD-3).

[F] Enter Weekly Performance Check for Description 2 on the Item Information screen.

[G] Enter the Percent Full in the Percent Full Field.

[H] Enter gross weight.

[I] Ensure that the correct certificate/declaration is selected.

[J] Select DONE.

NOTE

The yellow light is illuminated when there is any motion during the load or unload process. The red light is illuminated when the transmission source shutter is OPEN. If the system detects an error in the PLC operation, the yellow light will cycle ON and OFF repeatedly.

4.5.5 Monitor control tower lights.

[A] **IF** any of the lights fail to come on **OR** other problems occur during the count,
THEN verify that the count is stopped, **AND** notify the NDA LO.

4.5.6 **WHEN** the analysis is complete,
THEN observe the QA Last Results Report for any deviation/flags (i.e., Investigate [In], Action [Ac], Above [Ab], or Below [Be]).

4.5.7 **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 verify the problem is corrected.

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

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.

NOTE

The NDA EA will prepare an evaluation report at six month intervals documenting the interfering weekly matrix drum measurement results. This 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.

4.5.8 Verify the weekly test drum is removed from the conveyor, as necessary.

4.5.9 Sign, and date the QA Last Results Report(s) for inclusion in the BDR.

4.6 Routine Drum Assaying

NDA Operator

4.6.1 Verify Sections 4.3 and 4.4 have been completed during the operational day.

4.6.2 Verify the following information is available (e.g., Container Traveler, Real-Time Radiography [RTR] or Visual Examination [VE] data sheet):

[A] Drum ID Number.

[B] Waste Stream Code.

[C] Net Weight.

[D] Percent (%) Full.

4.6.3 Verify the drum is loaded on the conveyor.

4.6.4 Verify the mechanism mode key is in the REMOTE position.

4.6.5 Verify that the following assay measurement steps are followed:

[A] Select the Green “Count Type” Icon on the NDA2K screen.

[B] Select count type (e.g., DEBRIS or DEBRIS SHIELDED) according to the Waste Matrix Code located on the RTR or VE datasheet attached to the Container Traveler or Criticality Prevention Specification (CPS) Container Type attached to the container, as applicable.

[C] Select START ASSAY at the start assay screen.

[D] Enter the Drum ID Number at the Item ID field of the ITEM INFORMATION screen.

[E] Enter the BDR number in the Description 1 field.

[F] Enter the Waste Matrix Code from the RTR or VE datasheet attached to the Container Traveler in the Description 2 field.

[G] Enter the PERCENT FULL from the RTR or VE datasheet attached to the Container Traveler in the Percent Full field.

[H] Sum the Net Weight from the RTR or VE datasheet attached to the Container Traveler, plus NDA 2000 Operations pre-determined Container Tare Weight, **AND** enter the summed value in the Gross Weight field.

[I] Verify that the applicable certificate/declaration has been selected.

[J] Select DONE.

NOTE
The density is automatically calculated by NDA 2000 Operations for each assay.

4.6.6 Monitor control tower lights.

[A] **IF** any of the lights fail to come on, **OR** other problems occur during the count,
THEN verify that the count is aborted, **AND** notify the NDA LO.

4.6.7 **WHEN** the analysis is complete,
THEN verify that the Drum ID Number on the analysis report matches the Drum ID Number on the drum.

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

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

4.6.8 **IF** the preliminary NDA results indicates that the drum contents have a FGE greater than Host site safety basis limits,
THEN notify the VPM and Host site management personnel,
AND Host site will manage the drum in accordance with Host site procedures.

[A] The drum SHALL NOT be removed without specific authorization from the Host site management personnel prior to moving the container.

4.6.9 Verify the waste drum is unloaded, as needed.

4.6.10 Repeat steps 4.6.1 through 4.6.9 as necessary.

4.7 Partial Shutdown, As Required

4.7.1 Verify NDA 2000 Operations is closed.

4.7.2 Forward all records generated by this procedure to the Facility Records Custodian.

Facility Records Custodian

4.7.3 Receive, process, and transmit all records generated by this procedure in accordance with CCP-QP-008.

5.0 RECORDS

5.1 Records generated during the performance of this procedure (as listed in step 5.2.1) will be compiled into the BDR in accordance with CCP-TP-072.

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

[B] NDA Radioassay Data Sheet

Attachment 1 – Last Measurement QA Report (Example)


```
Last Measurement Q.A. Report        11/4/09    8:17:52 AM         Page  1

*************************************************************************
*****          G E N I E   Q U A L I T Y   A S S U R A N C E          *****
*************************************************************************

                            Last Results Report
                            11/4/09    8:17:52 AM


QA File:                C:\CANBERRA\NDA2K\QA\CNTR0001_DC
Sample ID:              NDA-QC-1
Sample Quantity:         1.0000E+000
Sample Date:            3/17/05    4:02:45 PM
Measurement Date:       11/4/09    7:57:08 AM
Elapsed Live Time:          1130.7 seconds
Elapsed Real Time:          1200.0 seconds


Parameter Description            Value                Deviation/Flags
 [Mean +/- Std. Dev.]                                < LU : SD : UD : BS >

DPC Pu-239                     1.1353E+001              -1.8345E+000
 [UD: 1.1632E+001+/- 0.152]                          <    :    :    :    >


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/Date:_____________________________________________________
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Attachment 2 – Radioassay Data for Container (Example)

Radioassay Data for Container #1 11/4/2009 8:44:11 AM Page 14

********** Radioassay Data Sheet **********

Engine Version: TMU Gamma 1.5

Assay Instrument: GEA Location: Hanford
Analysis Method: CCP-TP-071 Rev 1 Software Version: NDA 2000 V.4.0
Item ID: Container #1 Analysis Date: 11/4/2009

NID identified fiducial nuclide Pu-239
Source of isotopics: MEASURED

Net Weight	157000.0 g
Pu mass	2.79E+000 +- 8.62E-001 g
TRU Alpha Activity	2.60E-001 +- 5.82E-002 Ci
TRU Activity Concentration	1.65E+003 +- 3.71E+002 nCi/g
Pu-239 Equivalent Activity	2.63E-001 +- 5.82E-002 Ci
Pu-239 FGE	2.63E+000 +- 8.61E-001 g
Decay heat	8.20E-003 +- 1.82E-003 W

Nuclide	Mass g	Activity Ci	Activity Uncert. Ci	MDA Ci
SR90	<LLD	<LLD	0.00E+000	0.00E+000
CS137	<LLD	<LLD	0.00E+000	3.88E-008
U233	<LLD	<LLD	0.00E+000	1.55E-003
U234	<LLD	<LLD	0.00E+000	0.00E+000
U235	0.00E+000	0.00E+000	0.00E+000	1.32E-007
NP237	2.44E-002	1.74E-005	5.73E-006	2.29E-007
PU238	2.64E-004	4.57E-003	1.89E-003	6.02E-005
U238	<LLD	<LLD	0.00E+000	2.22E-006
PU239	2.63E+000	1.65E-001	5.41E-002	2.17E-003
PU240	1.64E-001	3.76E-002	1.24E-002	4.95E-004
AM241	1.51E-002	5.23E-002	1.75E-002	3.92E-005
PU241	1.66E-003	1.73E-001	5.80E-002	2.28E-003
PU242	8.73E-004	3.46E-006	1.20E-006	0.00E+000

Errors quoted at 1.000 sigma

Operator:_____ Date:_____

ITR:_____ Date:_____

Attachment 3 – Weekly Measurement Control Standards Used for GEA

Drum ID	Source ID	Pu Mass	Source Matrix	Source Position	Drum Matrix
IMD-1	WRAP 3-5.0GPU **TOTAL**	4.99736 **4.99736 g**	Diatomaceous Earth	Tube 1, Ht: 10” Fill portion of tubes without standards with matrix plugs.	Low Density Salt/Poly/Lead PDP Style Surrogate Drum
IMD-3	WRAP-50GPU WRAP-40GPU WRAP-30GPU WRAP-20GPU **TOTAL**	50.018 40.002 30.008 20.009 **140.037 g**	Diatomaceous Earth	Tube 1, Ht: 5” Tube 1, Ht: 15” Tube 3, Ht: 0” Tube 3, Ht: 20” Fill portion of tubes without standards with matrix plugs.	High density Salt/Poly/Lead PDP Style Surrogate Drum