

CCP-TP-115

Revision 4

CCP

SWEPP Gamma-Ray Spectrometer (SGRS) Operating Procedure

EFFECTIVE DATE: 06/24/2009

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PRINTED NAME

APPROVED FOR USE

RECORD OF REVISION

| Revision Number | Date Approved | Description of Revision |
|-----------------|---------------|---|
| 0 | 02/27/2005 | Initial issue. |
| 1 | 04/15/2005 | Revised to address Carlsbad Field Office (CBFO) Document Review Record (DRR) adequacy review comments. |
| 2 | 06/12/2006 | Revised to implement changes made in CCP-TP-068, <i>CCP Container Management at Idaho National Laboratory (INL)</i> . |
| 3 | 12/08/2006 | Revised to assure that responses to Action, Investigate, Above, and Below flags for background measurements and system performance checks are consistent for procedures using NDA2000 Operations as the operating software. Addressed Carlsbad Field Office (CBFO) Document Review Record (DRR) comments. |
| 4 | 06/24/2009 | Modified step order in startup and shutdown sections for flow. Operator postings no longer contain Host site criticality requirements; requirements are in Host site documents. Minor wording changes for clarification, flow of procedure, and other editorial corrections. |

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1.0 PURPOSE

This procedure provides instructions for startup, operations, and shutdown of the Stored Waste Examination Pilot Plant (SWEPP) Gamma-Ray Spectrometer (SGRS) using the Canberra Nondestructive Assay 2000 (NDA2000) software.

1.1 Scope

This procedure applies to personnel responsible for operating and/or supervising the operations of the SGRS. This document applies to operation of the SGRS.

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)
- ASTM C1030-03, *Standard Test Method for Determination of Plutonium Isotopic Composition by Gamma-Ray Spectroscopy*, Annual Book of ASTM Standards, Vol. 12.01
- CCP-PO-002, *CCP Transuranic Waste Certification Plan*
- CCP-TP-010, *CCP Waste Assay Gamma Spectrometer (WAGS) and SWEPP Gamma-Ray Spectrometer (SGRS) Calibration Procedure*

Referenced Documents

- CCP-HSP-013, *CCP Waste Assay Gamma Spectrometer (WAGS) and SWEPP Gamma Ray Spectrometer (SGRS) Nondestructive Assay Systems Health and Safety Plan*
- CCP-INL-SGRS-001, *CCP SGRS Calibration, Confirmation and Validation Report*
- 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-109, *CCP Data Reviewing, Validating, and Reporting Procedure*
- CCP-TP-010, *CCP Waste Assay Gamma Spectrometer (WAGS) and SWEPP Gamma-Ray Spectrometer (SGRS) Calibration Procedure.*
- MP-RS&C-6.16, *Radioactive (Non-Nuclear) Source Control*

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.
- 2.2.2 Personnel must have read CCP-HSP-013, *CCP Waste Assay Gamma Spectrometer (WAGS) and SWEPP Gamma Ray Spectrometer (SGRS) Nondestructive Assay Systems Health and Safety Plan* prior to performing this procedure.
- 2.2.3 Personnel must be qualified source handlers.

2.3 Precautions and Limitations

NOTE

Job or location-specific cautions, limitations or requirements are contained in the Approved Method of Work (AMOW).

- 2.3.1 The daily and weekly performance check drums contain radioactive sealed sources. The sealed sources contain Plutonium (Pu)-239. The sources must remain inside the daily performance check drum, and source physical positioning inside the drum must be preserved to ensure repeatability.
- 2.3.2 The tamper seal on the daily performance check drum must be verified intact before using the drum for quality control (QC) purposes.

- 2.3.3 Any container found to have Fissile Gram Equivalent (FGE) greater than Host site safety basis limits will be controlled as identified by Host site procedures.
- 2.3.4 Drums containing lead liners should **NOT** be processed through SGRS.
- 2.3.5 Containers may be stored in designated storage grids on the east and north sides of the SGRS while the spectrometer is operating. Containers may **NOT** be stored on the west side of the spectrometer since the penetration into the shield would be a leakage path to the detectors.
- 2.3.6 Workers who will be working in a radiation area must have read and signed that they understand the applicable authorized documents (e.g., Advanced Mixed Waste Treatment Project [AMWTP], AMOW, Radiation Work Permit [RWP], etc.) as implemented by the Host site.
- 2.3.7 Personnel working around the SGRS door closure and moving equipment must observe warning devices and postings.
- 2.3.8 Temporary radiation shielding may be used in the SGRS areas. Personnel must maintain awareness of surroundings and tripping hazards.
- 2.3.9 Radioactive calibration sources/standards are to be treated and controlled as sealed radioactive sources in accordance with MP-RS&C-6.16, *Radioactive (Non-Nuclear) Source Control*. Integrity tests **MUST** be performed on sources/standards per the requirements of MP-RS&C-6.16.
- 2.3.10 Planning and Coordination
- [A] Ensure the detectors have contained liquid nitrogen (LN) for at least four hours before the high voltage (HV) is applied.
 - [B] Ensure the detector dewars have been filled with LN within the last five days.

3.0 RESPONSIBILITIES

3.1 Nondestructive Assay (NDA) Lead Operator (LO)

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.

3.1.1 Ensures equipment operation prerequisites are met prior to startup.

3.1.2 Ensures NDA Operator qualification and training is current.

NOTE

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

3.2 NDA Operator

3.2.1 Performs routine startup, normal operations, and shutdown of the SGRS.

3.2.2 Notifies the NDA LO and Vendor Project Manager (VPM) of abnormal or nonconforming conditions.

3.3 NDA Expert Analyst (EA)

3.3.1 Provides consultation on NDA matters, such as measurement control activities, instrument operations, upset conditions, and troubleshooting.

3.4 Forklift Operator (FO)

3.4.1 Supports SGRS operations, as required.

3.5 Facility Records Custodian

3.5.1 Receives, processes and transmits the records identified in Section 5.2 of 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.

4.1 General

NDA Operator

4.1.1 Ensure all prerequisites have been met.

4.2 Complete SGRS Startup

NDA Operator

4.2.1 Ensure power is ON to the uninterruptible power supply (UPS) unit(s).

4.2.2 Ensure applicable surge protector power strips are ON as necessary.

4.2.3 Ensure the reference pulser power toggle is ON.

4.2.4 Ensure all four Digital Spectrum Analyzer (DSA) (e.g., DSA1000) power rocker switches are ON.

4.2.5 Ensure power is ON to the computer **AND** log on, as necessary.

4.2.6 Start NDA2000 Operations.

4.2.7 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.

4.2.8 Ensure that the one-hour stabilization requirement has been met.

4.3 Shift Startup

NDA Operator

4.3.1 Ensure power is ON to the computer **AND** log on, as necessary.

4.3.2 Start NDA2000 Operations, as required.

4.4 Background Check of SGRS

NOTE

A Background Check is performed at least once per day, at the beginning of the operational day, prior to assaying.

NOTE

The Background Check of SGRS is performed with the shield enclosure empty of any drums.

NOTE

Criteria used to develop the background acceptance boundaries are documented in CCP-INL-SGRS-001, *CCP SGRS Calibration, Confirmation and Verification Report*.

NDA Operator

4.4.1 Perform QC Background Check using NDA2000 Operations.

[A] Select ASSAY.

[B] Select ROUTINE ASSAY.

[C] Select BACKGROUND.

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

[E] Enter comments in the comment field of the Item Information screen, if necessary. The Item ID will default as Background.

[F] Select DONE.

4.4.2 **WHEN** the analysis is complete,
THEN select the View Last Assay Report Button on NDA2000 Operations screen, **AND** observe the Quality Assurance (QA) Last Results Report (see Attachment 1, Example QA Last Results Report, for example) for any deviation/flags (i.e., Investigate [In], Action [Ac], Above [Ab], or Below [Be]).

4.4.3 **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

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

4.4.5 Place into BDR Holding File.

4.5 Daily Performance Check of SGRS

NOTE

The Background Check is normally performed prior to the required Daily Performance Check.

NOTE

A Daily Performance Check (DPC) 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 CCP-INL-SGRS-001.

NDA Operator

- 4.5.1 Request that the FO load the DPC drum onto the SGRS.
- 4.5.2 Ensure the rotator is ON, as necessary, **AND** press the drum rotator switch to ensure the drum rotates freely.
- 4.5.3 Manually CLOSE the door, **AND** ensure the rotator is on as necessary.
- 4.5.4 Perform QC Daily Performance Check using NDA2000 Operations.
 - [A] Select ASSAY.
 - [B] Select ROUTINE ASSAY.
 - [C] Select DAILY PERFORMANCE CHECK.
 - [D] Select START ASSAY at the start assay screen.
 - [E] Enter the barcode (DPC9999) for the DPC 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 as 65% and Gross Weight as 118 kilograms (kg) in the appropriate sections of the Item Information screen.

[H] Ensure that "DPC9999" is selected as the certification/declaration.

[I] Select DONE.

4.5.5 **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]).

4.5.6 **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 check 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.

[F] **DO NOT** resume operations until a corrective action plan is complete **AND** calibration verification check as described in the above note above is performed.

[F.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 capability to affect data
- Significant changes to the system's software.
- Relocation of the system

THEN perform Calibration Verification in accordance with CCP-TP-010, *CCP Waste Assay Gamma Spectrometer (WAGS) and SWEPP Gamma-Ray Spectrometer (SGRS) Calibration Procedure*.

NDA Operator

4.5.7 **IF** any of the values on the QA Last Results Report indicate a 2- sigma "In" or "Investigative" 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 measurement and evaluation no more than two times.

NOTE

Calibration verification check 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.

[E] DO **NOT** resume operations until a corrective action plan is complete, **AND** calibration verification check, as described in the above note 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 capability to affect data
- Significant changes to the system's software
- Relocation of the system

THEN perform Calibration Verification in accordance with CCP-TP-010.

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

4.5.9 Place into BDR Holding File.

4.5.10 Instruct the FO to remove the DPC drum from SGRS.

4.6 Weekly Performance Check of SGRS

NOTE

At least once per operational week (normally on Wednesday), an interfering matrix drum (referred to as a Weekly Performance Check drum) must be assayed to assess the long-term stability of the instrument matrix correction. Surrogate waste containers reflect the type of waste (e.g., debris sludge), correctly being assayed. The standards are selected such that, over a six-month period, the operating range of the assay system is tested in each applicable surrogate waste matrix.

NOTE

Criteria used to develop the acceptance criteria are documented in CCP-INL-SGRS-001.

NDA Operator

- 4.6.1 Ensure a Weekly Performance Check drum has been source loaded per Attachment 3, Weekly Measurement Control Standards Used for SGRS Systems, and is available.
- 4.6.2 Request that the FO load the Weekly Performance Check drum onto the SGRS.
- 4.6.3 Press the drum rotator switch to ensure the drum rotates freely.
- 4.6.4 Manually CLOSE the door, **AND** ensure the rotator is ON, as necessary.
- 4.6.5 Perform QC-Weekly Performance Check using NDA2000 Operations.
 - [A] Select ASSAY.
 - [B] Select ROUTINE ASSAY.
 - [C] Select WEEKLY PERFORMANCE CHECK.
 - [D] Select START ASSAY at the start assay screen.
 - [E] Enter the Weekly Performance Check Drum ID (e.g., COM1).

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

[G] Enter the percent full in the Percent Full field.

[H] 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.

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

[J] Select DONE.

4.6.6 **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]).

4.6.7 **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** correct the problem.

[B] Notify the NDA LO and the 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.

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

4.6.9 Place into BDR Holding File.

4.6.10 Instruct the FO to remove the Weekly Performance Check drum from SGRS.

4.7 Routine Drum Assaying

NDA Operator

4.7.1 Ensure Sections 4.4 and 4.5 have been completed during the operational day.

4.7.2 Request that the FO load a drum onto the SGRS.

4.7.3 Ensure the Container Traveler and the following information is available (e.g., from the Real Time Radiography [RTR] or Visual Examination [VE] datasheet):

[A] Drum ID Number

[B] Waste Matrix Code

[C] Net Weight

[D] Percent (%) Full

4.7.4 Press the drum rotator switch to ensure the drum rotates freely.

4.7.5 Manually CLOSE the door, **AND** ensure the rotator is ON, as necessary.

4.7.6 Perform Assay-Passive using NDA2000 Operations:

[A] Select ASSAY.

[B] Select ROUTINE ASSAY.

- [C] Select ASSAY – PASSIVE.
- [D] Select START ASSAY at the start assay screen.
- [E] Enter the Drum ID number in the Item ID field of the Item Information screen.
- [F] Enter the BDR number in the Description 1 field.
- [G] Enter the Waste Matrix Code from either the RTR or VE data sheet attached to the Container Traveler in the Description 2 field.
- [H] Enter the Percent Full from either the RTR or VE data sheet attached to the Container Traveler in the Percent Full field.
- [I] Sum the net weight from either the RTR or VE data sheet attached to the Container Traveler plus the NDA2000 Operations predetermined container tare weight, **AND** enter the summed value in the gross weight field.
- [J] Ensure that weapons-grade (WG) Pu is selected as the certification/declaration.

NOTE

The net weight and density are automatically calculated by the NDA2000 Operations software for each assay.

- [K] Select DONE.

4.7.7 **WHEN** the analysis is complete,
THEN select the View Last Assay Report Button on the NDA2000 Operations screen **AND** ensure 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.

- [B] Print, sign, and date the Radioassay Data Sheet (RDS) for inclusion in the BDR.

- [C] Place RDS into BDR Holding File.

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 container.

4.7.8 **IF** the preliminary NDA result 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** manage the drum in accordance with Host site procedures.

[A] **DO NOT** remove the drum without specific authorization from the VPM and Host site management.

4.7.9 Request that the FO unload assayed drums as needed.

4.7.10 Repeat steps 4.7.2 through 4.7.9 for the remaining drums.

4.8 Partial Shutdown of SGRS

NDA Operator

4.8.1 CLOSE the NDA2000 Operations software.

4.8.2 Shutdown the computer.

4.8.3 Ensure rotator is OFF.

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

Facility Records Custodian

4.8.5 Receive, process, and transmit the records identified in Section 5.2 of this procedure in accordance with CCP-QP-008.

4.9 Complete Shutdown of SGRS

NDA Operator

4.9.1 Perform the following operations using the NDA2000 Operations program:

[A] Select HARDWARE SETUP.

[B] Select HIGH VOLTAGE POWER SUPPLIES.

[C] Select TURN OFF.

4.9.2 CLOSE all programs, **AND** shutdown the computer, if required.

4.9.3 Ensure the Reference Pulser power toggle is OFF.

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

4.9.5 Ensure applicable surge protector power strips are OFF, as necessary.

4.10 Abnormal Conditions Procedure

4.10.1 **IF** a loss of commercial power occurs,
THEN perform the following:

[A] Immediate Actions

[A.1] STOP the count in progress.

[A.2] Notify the NDA LO and VPM.

[B] Follow-up Action

[B.1] Proceed as directed by the NDA LO.

4.10.2 **IF** a detector loss occurs,
THEN perform the following:

[A] Immediate Actions

[A.1] STOP the count.

[A.2] Notify the NDA LO and VPM.

[B] Follow-Up Action

[B.1] Proceed as directed by the NDA LO and VPM.

4.10.3 **IF** a DSA module has any FAULT light illuminated during normal operations,

THEN perform the following:

[A] Immediate Actions

[A.1] STOP the count if in progress.

[A.2] Notify the NDA LO and VPM.

[B] Follow-Up Action

[B.1] Proceed as directed by the NDA LO and VPM.

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-109, *CCP Data Reviewing, Validating, and Reporting Procedure*.

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 Reports

[B] NDA Radioassay Data Sheet(s)

5.2.2 QA/Nonpermanent

[A] Six Month Interfering Matrix Report

Attachment 1 – Example QA Last Results Report

Page 1 of 1

EXAMPLE

Last Measurement Q.A. Report

04/05/05

12:15:09 PM

Page 1

GENIE QUALITY ASSURANCE

Last Results Report
04/05/05 12:15:09 PM

QA File: C:\temp\QA\CNTR0001_DCAT0001_PRO
Sample ID: DPC9999
Sample Quantity: 1.0000E+000
Sample Date: 03/14/05 4:42:30 PM
Measurement Date: 04/05/05 10:17:59 AM
Elapsed Live Time: 1188.0 seconds
Elapsed Real Time: 1200.0seconds

| Parameter Description [Mean +/- Std. Dev.] | Value | Deviation/Flags |
|---|-------------|---------------------------|
| DPC Pu-239 [UD: 1.0686E+001 +/- 0.099] | 1.0614E+001 | -7.2239E-001 < : : : > |

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: _____

Attachment 2 – Example NDA Radioassay Data Sheet

EXAMPLE

Radioassay Data for 38g CONF 3/28/2005 9:47:55 AM Page 17

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

Engine Version: TMU Gamma 1.4

Assay Instrument: WMF-610 Q2 Location: INL
Analysis Method: CCP-TP-115 rev 0 Software Version: NDA 2000 V.4.0
Item ID: 38g CONF Analysis Date: 3/22/2005

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

Net Weight 50500.0 g
Pu mass 4.88E+001 +- 7.95E+000 g
TRU Alpha Activity 3.75E +000 +- 5.16E-001 Ci
TRU Activity Concentration 7.42E+004 +- 1.02E+004 nCi/g
Pu-239 Equivalent Activity 3.89E +000 +- 5.17E-001 Ci
Pu-239 FGE 4.57E+001 +- 7.93E+000 g
Decay heat 1.17E-001 +- 1.60E-002 W

| Nuclide | Mass g | Activity Ci | Activity Uncert. Ci | MDA Ci |
|---------|-----------|----------------|---------------------------|-----------|
| SR-90 | 4.38E-009 | 6.04E-007 | 6.73E-007 | 0.00E+000 |
| CS-137 | 6.26E-009 | 5.49E-007 | 9.96E-008 | 2.34E-008 |
| U233 | <LLD | <LLD | 0.00E+000 | 2.47E-003 |
| U234 | <LLD | <LLD | 0.00E+000 | 0.00E+000 |
| U235 | 0.00E+000 | 0.00E+000 | 0.00E+000 | 2.21E-007 |
| NP237 | 2.41E-003 | 1.72E-006 | 4.30E-007 | 2.40E-009 |
| PU238 | 6.40E-003 | 1.11E-001 | 2.34E-002 | 1.55E-004 |
| U238 | <LLD | <LLD | 0.00E+000 | 1.07E-006 |
| PU239 | 4.55E+001 | 2.86E+000 | 4.99E-001 | 3.99E-003 |
| PU240 | 3.23E+000 | 7.44E-001 | 1.30E-001 | 1.04E-003 |
| AM241 | 9.66E-003 | 3.35E-002 | 6.24E-003 | 1.16E-005 |
| PU241 | 7.57E-002 | 7.87E+000 | 1.38E+000 | 1.10E-002 |
| PU242 | 1.35E-002 | 5.34E-005 | 1.07E-005 | 0.00E+000 |

Errors quoted at 1.000 sigma

Operator Signature _____

Date _____

ITR Signature _____

Date _____

Attachment 3 – Weekly Measurement Control Standards Used for SGRS Systems

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

Attachment 3 – Weekly Measurement Control Standards Used for SGRS Systems
(Continued)

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

Attachment 3 – Weekly Measurement Control Standards Used for SGRS Systems
(Continued)

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

Attachment 3 – Weekly Measurement Control Standards Used for SGRS Systems
(Continued)

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