APPENDIX E

FCT DOCUMENT COVER SHEET [1]

Name/Title of Deliverable/Milestone/Revision No. Thermomechanical Testing of Intact Salt Results for FY14 M3FT-14SN0818017

Work Package Title and Number DR Salt R&D - SNL FT-14SN081801

Work Package WBS Number 1.02.08.18

Responsible Work Package Manager Christi Leigh (Name/Signature)

Date Submitted

Quality Rigor Level for Deliverable/Milestone[2]	☒ QRL-3	☐ QRL-2	☐ QRL-1 Nuclear Data	☐ Lab/Participant QA Program (no additional FCT QA requirements)

This deliverable was prepared in accordance with Sandia National Laboratories
(Participant/National Laboratory Name)

QA program which meets the requirements of

☒ DOE Order 414.1 ☐ NQA-1-2000 ☐ Other

This Deliverable was subjected to:

☒ Technical Review ☐ Peer Review

Technical Review (TR)
Review Documentation Provided

☐ Signed TR Report or,
☒ Signed TR Concurrence Sheet or,
☐ Signature of TR Reviewer(s) below

Peer Review (PR)
Review Documentation Provided

☐ Signed PR Report or,
☐ Signed PR Concurrence Sheet or,
☐ Signature of PR Reviewer(s) below

Name and Signature of Reviewers

Frank Hansen (Review authenticated and documented on SNL FCT QAP 6-1 Document Review and Comment Form)

NOTE 1: *Appendix E should be filled out and submitted with the deliverable. Or, if the PICS:NE system permits, completely enter all applicable information in the PICS:NE Deliverable Form. The requirement is to ensure that all applicable information is entered either in the PICS:NE system or by using the FCT Document Cover Sheet.*

NOTE 2: *In some cases there may be a milestone where an item is being fabricated, maintenance is being performed on a facility, or a document is being issued through a formal document control process where it specifically calls out a formal review of the document. In these cases, documentation (e.g., inspection report, maintenance request, work planning package documentation or the documented review of the issued document through the document control process) of the completion of the activity, along with the Document Cover Sheet, is sufficient to demonstrate achieving the milestone. If QRL 1, 2, or 3 is not assigned, then the Lab / Participant QA Program (no additional FCT QA requirements) box must be checked, and the work is understood to be performed and any deliverable developed in conformance with the respective National Laboratory / Participant, DOE or NNSA-approved QA Program.*

IMPORTANT NOTE: The current official version of this document is available on the Sandia National Laboratories FCT SharePoint site. A printed copy of this document may not be the version currently in effect.

Sandia National Laboratories*
Fuel Cycle Technology (FCT) Program

Adjunct Laboratory Tests in Support of US/German Salt Characterization Program

Revision 0

Effective Date: July 14, 2014

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FIGURES

1. ABBREVIATIONS, ACRONYMS, AND INITIALISMS

DAS	Data Acquisition System
DOE	Department of Energy
ES&H	Environmental Safety and Health
HA	Hazard Analysis
LVDT	Linear Variable Differential Transformer
NIST	National Institute of Standards and Technology
MPa	Megapascal
FCT	Fuel Cycle Technology
PHS	Primary Hazard Screening
PI	Principal Investigator, or Deputy
QA	Quality Assurance
SNL	Sandia National Laboratories
SP	Activity/Project Specific Procedure
WIPP	Waste Isolation Pilot Plant

2. REVISION HISTORY

This is the initial issuance of this Test Plan. Future revisions will be documented and appear in this section, as applicable. Changes to this Test Plan, other than those defined as editorial changes per Sandia National Laboratories, shall be reviewed and approved by the same organization that performed the original review and approval.

3. PURPOSE AND SCOPE

This Test Plan describes scientific procedures for completing confined, triaxial, constant strain rate strength tests of intact salt at temperatures ranging from about 27°C to about 100°C. Laboratory studies allow generic salt properties (mechanical, thermal, hydrological, and chemical) to be measured in a controlled environment. There is a large body of laboratory data that describes the phenomenology of salt across a broad range of temperatures expected in a heat-generating waste disposal system. Laboratory studies currently underway in Germany are being conducted using salt samples provided by Sandia National Laboratories that were obtained from the WIPP site and those test results will add substantively to that body of knowledge. When combined, the total database of laboratory results will be used to develop input parameters for models, to assess adequacy of existing models, and to predict material behavior. These laboratory studies are also consistent with the aims of international salt repository research programs.

The focus of the activity in this Test Plan is to complete a limited number of independent, adjunct laboratory tests in the United States to assist in validating the results being provided by the German facilities. Assuming the adjunct tests substantially agree with the German test results, the overall database of test results will be considered more robust and confidence in the bases for assessing adequacy of heat-generating waste disposal systems will be enhanced. This adjunct testing program will represent a subset of the extensive test matrix being completed in Germany and it will aid in reducing uncertainties that remain in the technical bases for a generic safety case for disposal of heat-generating waste in salt.

In summary, the goal of this activity is to complete a subset of a test matrix on salt from the Waste Isolation Pilot Plant (WIPP) undertaken by German research groups. The work will be performed at RESPEC in Rapid City, South Dakota, and is divided into three tasks.

Task 1. RESPEC will prepare a Test Plan that meets Quality Assurance requirements imposed by the Department of Energy as outlined in the Fuel Cycle Technologies (FCT) Quality Assurance Program Document dated December 20, 2012. The Contractor shall satisfy training requirements, write, review and approve a Test Plan within 30 calendar days after start of the contract. In the event Sandia does not retrieve WIPP core and provide it to the Contractor for test specimen preparation by the delivery date of the Test Plan, a day-to-day schedule slippage will be implemented.

Task 2. RESPEC will conduct laboratory experiments. A preferred sub matrix from the complete list being undertaken by German laboratories includes four tests at a strain rate of $10^{-5}s^{-1}$ and temperature of 27°C and four tests at a strain rate of $10^{-5}s^{-1}$ and temperature of 100°C. Samples for testing will be provided by the Sandia Delegated Representative (SDR) with Quality Assurance chain of custody. RESPEC will prepare test specimens to final test dimensions and tolerances. RESPEC will commence testing within 10 calendar days after approval of the Test Plan. The precise stress conditions to be applied in these tests will be defined after consultation among RESPEC, the SDR, and laboratory personnel leading the testing effort in Germany.

Task 3. A RESPEC representative will attend a meeting scheduled to be held in Albuquerque, New Mexico, on May 28–29, 2014 (the SDR will notify the RESPEC PI if meeting dates change). RESPEC will present results available from their testing at that meeting.

Depending upon the outcome of these tests, additional tasks could be undertaken if funding, resources, and schedule allow. Two additional tasks that could be authorized include additional quasi-static triaxial compression tests and constant stress triaxial compression creep tests. The precise scope of such additional testing including quantity, test conditions, and schedule would be defined before authorizing such a task. Another optional task that will be considered is the preparation of a Technical Letter Memorandum to document the test results and data analysis performed within the amended scope of this Test Plan.

This Test Plan is prepared in accordance with FCT QAP-20-1because a test/activity plan has been included as a deliverable (milestone) in the applicable work package. Deliverables described in the work package are as follows:

1. Submit a Test Plan acceptable to FCT Quality Assurance Program Description.
2. Conduct laboratory experiments.
3. Attend a meeting to present testing results.

The additional deliverables if the optional tasks are authorized would include (a) performance of quasi-static tests, (b) performance of creep tests, and (c) preparation of a technical report to document all test results and data analysis.

4. EXPERIMENTAL PROCESS DESCRIPTION

4.1 Specimen Preparation

To prepare a testable specimen, intact core is sawn to an approximate length-to-diameter ratio of two (L:D ~ 2). The walls and ends of the cylinder are then machined in a horizontal lathe to produce a finished right-circular cylinder whose ends are flat, parallel, and perpendicular to the specimen sides. A typical machining setup is shown in Figure 1 where the carbide tooling is visible next to the specimen surface. The finished specimens are measured to determine their length and diameter. The specimens are also weighed and a bulk density determined using the specimen dimensions.

Figure 1. Typical Machining Setup for Preparing Cylindrical Specimens.

These specimen machining processes are standard laboratory operations at RESPEC. Bedded salt acquired and finished in this manner may exhibit pockets of moisture as the walls of the specimen are being trimmed to final dimension. Such observations would indicate that some isolated brine inclusions exist within the specimen. A photograph of a typical machined specimen of WIPP salt is shown in Figure 2 and the wet brine spots are visible as dark round circles scattered on the surface of the specimen.

Figure 2. Bedded Salt Specimen Brine Inclusions (darker ovoid areas are wet).

4.2 Test Equipment

The testing will be completed using a universal test system with two reaction columns referred to as the UTS2 system. The UTS2 is a computer-controlled, servohydraulic system manufactured by MTS Systems of Eden Prairie, Minnesota. The computer control allows for controlling the loading in either of two modes, a stress rate mode using the load cell output as a feedback signal or strain rate mode that uses a Linear Variable Differential Transformer (LVDT) output or a direct-contact extensometer output to control loading. The triaxial chamber is equipped with electrical resistance heaters and insulation to provide the high-temperature environment required to perform tests at elevated temperatures.

A picture of the test system is provided in Figure 3. The photograph illustrates the triaxial chamber mounted in the test frame with the vessel raised for easy viewing of the interior of the chamber. A specimen instrumented with direct-contact extensometers is visible below the raised vessel. An in-vessel load cell is located out of view above the specimen. Both the load cell and the extensometers are pressure-compensated devices rated for use in chamber confining pressures up to 150 MPa. Also not shown in the figure are the thermocouples located in the chamber wall for monitoring test temperature and an LVDT mounted inside the axial force actuator that can be used to track axial displacements.

Figure 3. Uniaxial Test System Equipped With High-Temperature Environmental Chamber.

All sets of instrumentation including the load cell, the LVDT, the extensometers, and the thermocouples were calibrated against in-house standards that are certified traceable to National Institute of Standards and Technology (NIST) references. Calibration records indicate that the mechanical readings are accurate to within ± 1 percent of reading, and the thermocouple temperatures are accurate to within ± 2°C.

4.3 Test Procedure

The test procedure is based on generally accepted approaches documented in national (ASTM) and international (ISRM) laboratory guidelines developed for investigating the stress-strain behavior of rock.

The planned test procedure is defined by the following steps:

1. Bring the specimen to temperature at a rate of 1°C/minute. Thermal stabilization at the target test temperature will occur overnight.
2. Apply a small preload to the specimen (say about 0.2 MPa) to establish a reliable position for defining the origin of the stress-strain measurements.
3. Using the extensometer output, calculate axial strain in real time and apply deformation (load) at a strain rate of 10^{-5} s^{-1} until reaching an axial strain level of 1 percent. This same procedure would be used if other strain rates are applied.
4. Perform an unload/reload cycle. This step provides data for estimating a value for Young's modulus and Poisson's ratio. The unload/reload cycle is performed in load control and is completed quickly so the measured strain will be dominated by elastic deformation. At the end of the reload, resume loading at the original strain rate of 10^{-5} s^{-1}.
5. The controlled strain rate loading will continue until one of the following test termination criteria is met: (1) the specimen fails, (2) the specimen exhibits a flat stress-strain response (perfectly plastic), or (3) the specimen becomes malformed to an extent that cylindrical geometry assumptions become grossly inadequate and the extensometer range is exceeded.
6. Test termination simply entails removal of all load and heating. When the specimen has cooled, it will be preserved for possible posttest analyses.

4.4 Test Program

The precise confining stress levels between 0.2 and 20 MPa to be used in the testing will be decided after consultation with the SDR and the German investigators. While all test conditions are subject to change during the course of the testing based on results as they are acquired, it is reasonably expected that the eight tests in this Test Plan will be performed at two distinct temperatures as outlined in Table 1.

Table 1. Test Matrix

Test Number	Temperature °C
1	27
2	27
3	27
4	27
5	100
6	100
7	100
8	100

4.5 Modifications to Experimental Process

Modifications to test procedures outlined in Section 4 may be required during test deployment. These modifications will be conducted at the direction of a PI, and will be documented in the scientific notebook(s) as part of the QA records. Such modifications are not deviations and will not be reported as nonconformances that require corrective action.

If test conditions deviate appreciably from the anticipated execution of the current version of this Test Plan, the Test Plan will be revised.

5. REPORTING RESULTS

The reporting of results is defined as a deliverable in this Test Plan and requires a RESPEC representative to attend a meeting where the results can be presented to an audience comprised of representatives from the international salt program; i.e., predominantly Sandia personnel and German researchers. It is expected that this meeting will be held in Albuquerque, New Mexico, and details of the venue and schedule will be established by the SDR.

6. DATA ACQUISITION PLAN

Data collected during the test will be obtained by electronic data acquisition that is an integral part of the MTS TestStar test system that provides both data acquisition and test control functions. The acquired data are automatically recorded to a datafile on the host computer and after the test is completed the datafile is archived via local area network to the operator's work station. Thus, the datafile is actually stored in duplicate locations. The types of data collected electronically include transducer signals from the LVDT, the load cell, the pressure transducer, the extensometers, and the thermocouple. Acquired data are recorded with a time stamp using the clock in the electronic data acquisition system.

Pretest and posttest data may be acquired manually. This type of data includes specimen dimensions, specimen weight, and photographs. The manual data will be archived as electronic files on the test operator's work station.

6.1 Scientific Notebook(s)

A scientific notebook(s) will be used in accordance with FCT QAP 20-2 (see Subsection 9.4) to document all activities and decisions during the Test Plan. Specific information that may be entered in the scientific notebook(s) consists of:

- a statement of the objectives and description of work to be performed, as well as a reference to this Test Plan;
- a written account of all activities associated with the development and implementation that differ from this Test Plan;
- documentation of safety meetings;
- a list of equipment used during each activity, including make, model, and operating system (if applicable);
- traceable references to calibration information for instruments and/or gauges calibrated elsewhere; and
- discussions of the information and/or observations leading to decisions to initiate, terminate, or modify test activities.

All entries in the scientific notebook(s) will be signed and dated by the person making the entry. The scientific notebook(s) for this Test Plan will be reviewed by an independent, technically-qualified individual at a minimum of every six months to verify that sufficient detail has been recorded to retrace the activities and confirm the results.

6.2 Electronic Data Acquisition

The DAS will be used to record instrumentation data during the test. Electronic data file-management information will be documented in the scientific notebook(s) for these activities.

6.3 Manual Data Acquisition

Manual data collection may be carried out during the test using a scientific notebook(s) or forms designed specifically for each activity or data type. Information will be documented such that duplication of information will be minimized. The PI will determine the means of documenting manually-acquired data and will ensure that all quality-affecting information is documented.

6.4 On-Site Validation

During the test activities, the PI will evaluate the data, as they are acquired. The data will be diagnosed for any equipment failure and/or procedure-induced effect that may degrade the data quality. The PI will take immediate action (if required) to make any necessary changes to the equipment configuration or the procedures to assure the data quality is consistent with the objectives of these activities.

The PI will use real-time evaluation of the acquired data during test activity to assure that the data are useable in a detailed interpretation, the conditions can be maintained over the planned duration of the activity, and an activity will not be terminated before the minimum objectives can be achieved under the given time restraints. The PI may use some or all of the following procedures and analytical tools:

- real-time inspection of signal quality to assure useable data
- real-time analysis of the acquired data to assess transducer functioning and proper operation of the DAS.

If at any time the PI determines that a test activity objective cannot be accomplished due to time constraints, problems concerning the performance of the equipment, or unsuitability of initial conditions, the PI will consult with cognizant personnel to terminate the activity, or develop a recovery plan. The PI will document all real-time evaluation of data and conditions in the scientific notebook(s).

7. SAMPLING AND SAMPLE CONTROL

Sample handling and transport will be controlled following requirements in FCT QAP 13-1 *Control of Samples.*

8. TRAINING

All personnel who will perform quality-affecting activities under this Test Plan will have training in the SNL QA program and relevant procedures according to FCT QAP 2-1 *Qualification and Training.* Personnel requiring training include Stuart Buchholz, PI, and Rodger Arnold, Deputy PI, both of whom are employees of RESPEC. Training will be accomplished using the FCT Share Point site to access and review the Quality Assurance Program Document and document Training requirements.

9. QUALITY ASSURANCE

9.1 Quality-Affecting Activities

Activities performed under this Test Plan are quality affecting.

9.2 Quality Assurance Program Description

Activities are conducted in accordance with the requirements specified in the FCT Quality Assurance Program Document. A complete discussion of this integration is given in Appendix A.

9.3 QA Procedures

The QAPs and SPs that may apply to work performed under this Test Plan include:

FCT **QAP 2-1** Qualification and Training
FCT **QAP 5-1** Implementing Procedures
FCT **QAP 6-1** Document Review Process
FCT **QAP 6-2** Document Control
FCT **QAP 9-1** Analysis
FCT **QAP 13-1** Control of Samples and Standards
FCT **SP 13-1** Chain of Custody
FCT **QAP 20-1** Test Plans
FCT **QAP 20-2** Scientific Notebooks

Modification to these procedures may be required during testing activities. Such modifications are not deviations and will not be reported as nonconformances that require corrective action. However, the PI will document modifications in the scientific notebook(s) as they occur as part of the QA records.

9.4 Manufacturers QA Procedures

Manufacturers' QA procedures that may apply to work performed under this Test Plan:

None.

9.5 Data Integrity

Data acquisition and storage occur in real time. Only electronic data files are acquired during testing, including real-time interrogation and evaluation.

9.6 Records

Records will be maintained as described in this Test Plan and applicable FCT QA implementing procedures. These records may consist of bound scientific notebook(s), photographs, forms, printouts, or information stored on storage media. The PI or designee will ensure that the required records are maintained and submitted to the designated storage location. Published technical documents and FCT deliverables constitute transparent and open records of this work.

9.6.1 Required QA Records

As a minimum, QA records will include:

- Scientific notebook(s) if used;
- Calibration records for all controlled equipment;
- Equipment-specification sheets or information (if available);
- Chain-of-Custody Forms.

9.6.2 Miscellaneous Non-QA Records

Additional records that are useful in documenting the history of the activities, but are considered non-QA records may be maintained and submitted to the SNL FCT Quality Assurance SharePoint Site or EIMS FileNet, if requested. These records include:

- safety briefings;

- ES&H documentation;
- as-built diagrams of equipment;
- equipment manuals and specifications;
- equipment manifests.

These records do not support regulatory compliance and, therefore, are not quality-affecting information.

9.6.3 Submittal of Records

QA records generated through the implementation of this Test Plan shall be prepared and submitted to the SNL FCT Quality Assurance SharePoint site and submitted to EIMS Filenet in accordance with the SNL Records Management Manual and IM 100.2.2 Control of Records (Manage and Protect Information).

10. HEALTH AND SAFETY

The safety practices and policies will meet the requirements of the SNL ES&H Manual. Operational safety will be addressed through an ES&H Primary Hazard Screening (PHS), a Hazard Analysis (HA), and a Pressure Safety Data Package (if required) developed by SNL. Work planning and controls will be implemented and records will be maintained by and in accordance with Division 6000 corporate policy.

11. PERMITTING/LICENSING

There are no special licenses or permitting requirements for the work described in this Test Plan.

12. REFERENCES

None

APPENDIX A SDI TEST ACTIVITIES QUALITY ASSURANCE

Organization

Sandia National Laboratories' organization is fully described on the Sandia Internal Website (Techweb). The activities described in this Test Plan are the responsibility of Organization 06212 (Repository Performance), within SNL's Nuclear Energy and Fuel Cycle Programs (06200. Figure A-1 shows the QA requirements interfaces for the activity.

This R&D activity, managed as Work Package FT-14SN081801, is conducted by Sandia National Laboratories under contract to U.S. DOE as part of the DOE-NE Fuel Cycle Technologies (FCT) program Used Fuel Disposition (UFD) Campaign. As an FCT UFD R&D activity, it is conducted in accordance with the FCT QAPD[1], SNL's DOE approved QA Program Description (SNL-QAPD)[2] and SNL's UFDC Preliminary Quality Assurance Implementation Plan[3] (SNL-UFCD-QAIP). Management decided to augment basic requirements for this QRL3 activity, based on the potential utility of the results. Hence, this Appendix to the activity Test Plan is provided in compliance with the provisions of SNL-UFCD-QAIP Section 4.

Quality Assurance Program

To summarize the minimum requirements for this QRL3 activity, as described in SNL-UFCD-QAIP, the activity is to be conducted in compliance with the SNL-QAPD, with the additional requirement that deliverables receive a technical review in accordance with the FCT QAPD Appendix B.

Management decided that certain quality assurance improvements would be beneficial to the conduct of this activity. Table A-1 reflects the outcome of QA grading considerations.

1 U.S Department of Energy, Office of Nuclear Energy, Fuel Cycle Technologies Quality Assurance Program Document, Washington, D.C., December 20, 2012.
2 Sandia's Quality Assurance Program Description SNL-QAPD-2014-05-30, Rev:4.0 May, 30, 2014
3 Sandia National Laboratories Used Fuel Disposition Campaign Quality Assurance Implementation Plan; Fuel Cycle Research & Development; Prepared for U.S. Department of Energy Used Fuel Disposition Campaign December 2010 FCR&D-USED-2011-000019 Revision 1; February 15, 2013.

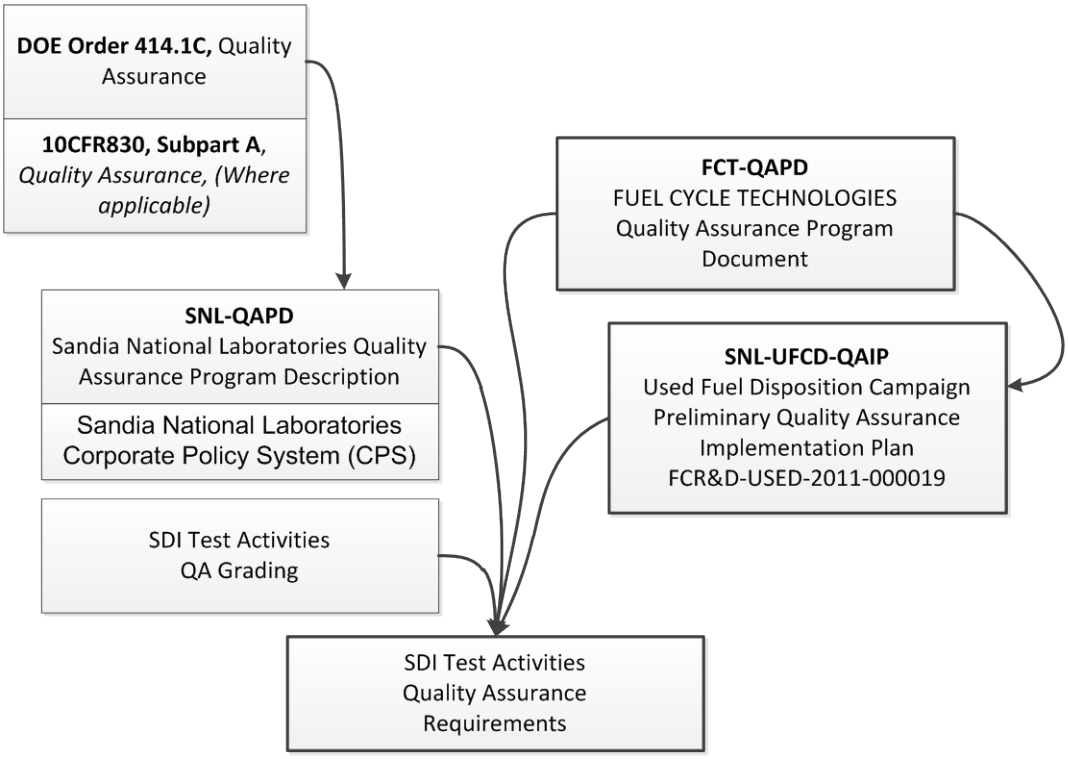

Figure A-1. General QA Requirements Flow Down for SDI Activities.

Quality Assurance requirements flow down from the FCT QAPD, the SNL-QAPD and SNL-UFCD-QAIP, as illustrated in Figure A-1. Predominantly, procedures from the Sandia Corporate Policy System (CPS) apply to this activity's quality elements, consistent with the approved SNL-QAPD. In selected instances, specific procedures were developed to improve quality to approximate NQA-1 levels for certain quality elements. Table A-1 identifies the CPS procedures that are generally applicable as well as the specific procedural augmentations that apply.

Table A-1. Graded Quality Assurance Requirements for SDI Activity

NQA-1 (2008) Requirement Excerpt[4]	Summary of Grading	Procedures as Appropriate
Organization - Responsibilities for the establishment and implementation of the quality assurance program shall be defined. The organizational structure, functional responsibilities, levels of authority, and lines of communications for activities affecting quality hall be documented.	A description of performing organizations placement within laboratory organization, including interfaces, is provided above. Rely on CPS procedures, including those listed in adjacent column, as appropriate.	**CG 100.1** - Establish the Decision-Making Framework **CG 100.1.1** - Create and Maintain the Mgmt. Structure **CG 100.1.2** - Create or Change a Policy - Process - or Procedure **CG100.6.19** - Conduct Management Review
Quality Assurance Program - The program shall identify the activities and items to which it applies. The program shall provide control over activities affecting quality to an extent consistent with their importance.	A description of the Quality Assurance Program, requirements flow down, relationships between FCT QA, NNSA/SSO QA and laboratory QA organizations, is provided above. Rely on CPS procedures, including those listed in adjacent column, as appropriate. Specific qualifications and training required of MOW involved in the activity are addressed by the specific FCT QAP identified.	Multiple CPS procedures in **HR100.2**. **FCT QAP 2-1** Qualification and Training
Design Control - The design shall be defined, controlled, and verified. Design inputs shall be specified on a timely basis and translated into design documents. Design interfaces shall be identified and controlled. **(Note: Includes provisions applicable to use of computer programs.)**	Rely on CPS procedures, including those listed in adjacent column, as appropriate. Related controls are addressed by the specific FCT QAP identified. Note: Requirements specifically identified for software determined to be N/A, because no software is designed as part of this activity.	**CG100.8.1** - Perform Work **CG100.8.2 –** Manage Projects Throughout Their Lifecycle **CG100.8.3** - Apply Configuration Management Principles to Documents and Physical Items **FCT QAP 20-1** Test Plans

4 Refer to ASME NQA-1-2008 (Revision of ASME NQA-1-2004) Quality Assurance Requirements for Nuclear Facility Applications for complete description of requirement.

Procurement Document Control - Applicable design bases and other requirements necessary to assure adequate quality shall be included or referenced in documents for procurement of items and services. To the extent necessary, procurement documents shall require Suppliers to have a quality assurance program consistent with the applicable requirements of NQA-1.	Rely on CPS procedures, including those listed in adjacent column, as appropriate.	Multiple procedures in **SCM100** – Manage Property, Material and Services through the Supply Chain
Instructions, Procedures and Drawings - Activities affecting quality and services shall be prescribed by and performed in accordance with documented instructions, procedures, or drawings that include or reference appropriate quantitative or qualitative acceptance criteria for determining that prescribed activities have been satisfactorily accomplished.	Rely on CPS procedures, including those listed in adjacent column, as appropriate. Specific controls are addressed by the FCT QAP identified.	**CG100.1.2** - Create or Change a Policy - Process - or Procedure **FCT QAP 5-1** Implementing Procedures
Document Control - The preparation, issue, and change of documents that specify quality requirements or prescribe activities affecting quality such as instructions, procedures, and drawings shall be controlled to ensure that correct documents are being employed.	Rely on CPS procedures, including those listed in adjacent column, as appropriate. FCT QAPs listed will be modified to rely mostly on CPS, to provide explicit information for the task.	**IM100.2.1** - Control of Documents **IM100.2.2** - Control of Records **HR100.2.15** - Maintain Training Records in TEDS LMS **HR100.5.7** - Manage Corporate Human Resources Records **FCT QAP 6-1** Document Review Process **FCT QAP 6-2** Document Control

Control of Purchased Items and Services - The procurement of items and services shall be controlled to ensure conformance with specified requirements.	Rely on CPS procedures, including those listed in adjacent column, as appropriate.	**ME100.3.1CG100.8.1** - Perform Work **SCM100.2.2** - Acquire Property (Requirements and Instructions - Inspect and Return Property section)**SCM100.3.10** - Do's and Don'ts for Requesters and SDRs During Contract Management Activities (Requirements and Instructions - step 3)
Identification and Control of Items - Controls shall be established to assure that only correct and accepted items are used or installed.	Rely on CPS procedures, including those listed in adjacent column, as appropriate.	**ME100.3.1 CG100.8.1** - Perform Work **SCM100.2.2** - Acquire Property (Requirements and Instructions - Inspect and Return Property section) **SCM100.3.3** – Manage Property **SCM100.3.10** - Do's and Don'ts for Requesters and SDRs During Contract Management Activities (Requirements and Instructions - step 3) **SCM100.3.13** – Manage Suspect or Counterfeit Items **SCM100.3.14** - Store General Materials at Sandia National Laboratories
Control of Special Processes - Special processes that control or verify quality, such as those used in welding, heat treating, and nondestructive examination, shall be performed by qualified personnel using qualified procedures in accordance with specified requirements.	Rely on CPS procedures, including those listed in adjacent column, as appropriate. Additional controls are addressed by the FCT QAP identified.	**ME100.3.1 CG100.8.1** - Perform Work **FCT QAP 9-1** Analysis

Inspection - Inspections required to verify conformance of an item or activity to specified requirements or continued acceptability of items in service shall be planned and executed.	Rely on CPS procedures, including those listed in adjacent column, as appropriate.	**ME100.3.1 CG100.8.1** - Perform Work **SCM100.2.2** - Acquire Property (Requirements and Instructions - Inspect and Return Property section) **SCM100.3.10** - Do's and Don'ts for Requesters and SDRs During Contract Management Activities (Requirements and Instructions - step 3) **SCM100.3.13** – Manage Suspect or Counterfeit Items
Test Control - Tests required to collect data such as for siting or design input, to verify conformance of an item or computer program to specified requirements, or to demonstrate satisfactory performance for service shall be planned and executed. **(Note: Applicable to testing of computer programs, hardware and operating systems.)**	Activity specific controls are addressed by the FCT QAPs identified. Note: Requirements specifically identified for software determined to be N/A, because of the nature and use of data recording and later processing.	**FCT QAP 20-1** Test Plans **FCT QAP 20-2** Scientific Notebooks
Control of Measuring and Test Equipment - Tools, gauges, instruments, and other measuring and test equipment used for activities affecting quality shall be controlled, calibrated at specific periods, adjusted, and maintained to required accuracy limits.	Rely on CPS procedures, including those listed in adjacent column, which requires a measurement assurance plan consistent with Primary Standards Lab (PSL) practices.	**ME100.3.1 CG100.8.1** - Perform Work
Handling, Storage and Shipping - Handling, storage, cleaning, packaging, shipping, and preservation of items shall be controlled to prevent damage or loss and to minimize deterioration.	Rely on CPS procedures, including those listed in adjacent column, as appropriate. Additional controls are addressed by the FCT QAP / FCT SPs identified.	**SCM100.3.3** – Manage Property **SCM100.3.14** - Store General Materials at Sandia National Laboratories **FCT QAP-13-1** Control of Samples **FCT SP-13-1** Chain of Custody

Inspection, Test, and Operating Status - The status of inspection and test activities shall be identified either on the items or in documents traceable to the items where it is necessary to ensure that required inspections and tests are performed and to ensure that items that have not passed the required inspections and tests are not inadvertently installed, used, or operated.	Rely on CPS procedures, including those listed in adjacent column, as appropriate.	**ME100.3.1 CG100.8.1** - Perform Work **CG100.5.5** - Control Item and Process Nonconformances **SCM100.3.13** - Manage Suspect or Counterfeit Items
Control of Nonconforming Items – Items that do not conform to specified requirements shall be controlled to prevent inadvertent installation or use.	Rely on CPS procedures, including those listed in adjacent column, as appropriate.	**SCM100.3.13** - Manage Suspect or Counterfeit Items **CG100.6.6** - Perform Corrective Action **CG100.6.9** - Conduct Root Cause Analysis and Extent of Condition Reviews **CG100.5.5** - Control Item and Process Nonconformances
Corrective Action - Conditions adverse to quality shall be identified promptly and corrected as soon as practicable. In the case of a significant condition adverse to quality, the cause of the condition shall be determined and corrective action taken to preclude recurrence.	Rely on CPS procedures, including those listed in adjacent column, as appropriate.	**CG100.6.6** - Determine and Take Action

Quality Assurance Records - The control of quality assurance records shall be established consistently with the schedule for accomplishing work activities. Quality assurance records shall furnish documentary evidence that items or activities meet specified quality requirements. Quality assurance records shall be identified, generated, authenticated, and maintained, and their final disposition specified.	Rely on CPS procedures, including those listed in adjacent column, as appropriate. Transitory working information and non-record materials will be managed in the ANEP SharePoint site. The ANEP SharePoint site will be used for interim storage of records for convenience FCT deliverables and associated records will be managed in accordance with the FCT Records Management Plan upon finalization of the deliverable. (Submittal of records to the Fuel Cycle Research and Development Document Management System will maintain the associations between deliverables and supporting documentation, to the extent practicable.)	**IM100.2.1** - Control of Documents **IM100.2.2**- Control of Records **IM100.2.3** - Prepare and Release Information **IM100.2.5**- Identify and Protect Unclassified Information
Audits - Audits shall be performed to verify compliance to quality assurance program requirements, to verify that performance criteria are met, and to determine the effectiveness of the program. Audit results shall be documented and reported to and reviewed by responsible management. Follow-up action shall be taken where indicated.	Rely on CPS procedures, including those listed in adjacent column, as appropriate. Note: It was determined that auditing the activity was not considered as value added, surveillance/assessment was considered adequate.	**CG100.6.3** - Plan and Perform Assessments **CG100.6.7** - Conduct and Manage Audits