ENGINEERING CHANGE NOTICE

Page 1 of 21. ECN **652253**Proj.
ECN5

2. ECN Category (mark one)		3. Originator's Name, Organization, MSIN, and Telephone No.		4. USQ Required?	5. Date
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12a. Modification Work		12b. Work Package No.	12c. Modification Work Completed		12d. Restored to Original Condition (Temp. or Standby ECNs only)
☐ Yes (fill out Blk. 12b)		N/A	N/A		N/A
☒ No (NA Blks. 12b, 12c, 12d)			Design Authority/Cog. Engineer Signature & Date		Design Authority/Cog. Engineer Signature & Date

13a. Description of Change
Total document revision to reflect updated SNF Project plans and preliminary repository acceptance guidelines.

13b. Design Baseline Document? ☐ Yes ☒ No

Major changes include:

Addition of Appendices B,C,& D to provide additional detail.

Update of each chapter in Sections 4 & 5 to reflect updated project plans, including deletion of hot conditioning system.

14a. Justification (mark one)	14b. Justification Details
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Design Improvement	☐
Environmental	☐
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As-Found	☐
Facilitate Const.	☐
Const. Error/Omission	☐
Design Error/Omission	☐
Revision required to reflect current project plans and preliminary repository acceptance guidelines.	

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Page 2 of 2

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16. Design Verification Required

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19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specification	☐	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐
Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐
Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
FSAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐
Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐	Tickler File	☐
Environmental Report	☐	Inspection Plan	☐		☐
Environmental Permit	☐	Inventory Adjustment Request	☐		☐

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision

Document Number/Revision

Document Number/Revision

21. Approvals

Signature	Date	Signature	Date
Design Authority <u>R. L. McCormack</u>	<u>2/2/99</u>	Design Agent	
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Cog. Mgr.		QA	
QA <u>R. J. [Signature]</u>	<u>2/4/99</u>	Safety	
Safety		Design	
Environ.		Environ.	
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<u>Manager Tech Integration</u>			

RL McCormack for DW Bergmann 2/14/99

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

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Application of the Office of Civilian Radioactive Waste Management QA Requirements to the Hanford Spent Nuclear Fuel Project

9

R. L. McCormack

Fluor Daniel Hanford, Inc.

Richland, WA 99352

U.S. Department of Energy Contract DE-AC06-96RL13200

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Abstract: This document identifies, at a high-level, the Hanford SNF Project systems, structures, and components and activities that must implement to some degree the OCRWM QARD requirements to ensure compliance with RL direction. This document will also be used to support development of a QARD requirements matrix for the implementation of QARD requirements.

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APPLICATION OF THE
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
QUALITY ASSURANCE REQUIREMENTS
TO THE
HANFORD SPENT NUCLEAR FUEL PROJECT

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ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
CSB	Canister Storage Building
CVD	Cold Vacuum Drying
DOE	U.S. Department of Energy
DNFSB	Defense Nuclear Facilities Safety Board
EM-67	Office of Spent Fuel Management
FRS	Fuel Retrieval System
HCS	Hot Conditioning System
HVAC	Heating, Ventilating, and Air Conditioning
HLW	High-Level Waste
IPS	Integrated Process Strategy
ISA	Interim Storage Area
LWR	Light Water Reactor
MCO	Multi-Canister Overpack
NRC	U.S. Nuclear Regulatory Commission
OCRWM	Office of Civilian Radioactive Waste Management
OSU	Oregon State University
PWR	Pressurized Water Reactor
QA	Quality Assurance
QARD	Quality Assurance Requirements and Description
RL	U.S. Department of Energy, Richland Operations Office
SNF	Spent Nuclear Fuel
SSC	Systems, structures and components

APPLICATION OF THE
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
QUALITY ASSURANCE REQUIREMENTS
TO THE
HANFORD SPENT NUCLEAR FUEL PROJECT

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) has established the *Quality Assurance Requirements and Description* (QARD) (RW-0333P) (DOE 1997a) of the Office of Civilian Radioactive Waste Management (OCRWM) as the principal Quality Assurance (QA) document for the Civilian Radioactive Waste Management Program. All affected organizations must comply with the QARD requirements for work performed for, or to be accepted by, OCRWM.

To enable OCRWM's future acceptance of the Hanford Site inventory of DOE-owned SNF for final disposition, as currently planned, the U.S. Department of Energy, Richland Operations Office (RL) has established requirements for application of the QARD to the Hanford Spent Nuclear Fuel (SNF) Project. RL has directed application of the QARD, as a minimum, to the following SNF activities, as they relate to disposal in the repository (Sellers 1995):

- Characterization or data collection for input or use;
- Conditioning into final form; and
- Handling, packaging, and transportation.

RL has also provided additional clarification on the above direction, which identifies that the quality program identified in the QARD is not applicable to the fabrication or procurement of the Multi-Canister Overpacks (MCOs) for K Basins SNF inventories (DOE 1998).

This document identifies, at a high-level, the Hanford SNF Project systems, structures, and components (SSCs) and activities that require application of the OCRWM QARD requirements to ensure compliance with the above RL direction. Subprojects and other responsible organizations will define items belonging on the RW-0333P Q-List¹ at a detailed level based on the SSCs and activities identified in this document. AP-11-012, "Development and Maintenance of OCRWM QARD Q-Lists," describes the procedures for developing, documenting, and maintaining the subproject RW-0333P Q-Lists using the information and criteria established in this document.

OCRWM QARD requirements will be executed for items on the RW-0333P Q-List. These requirements have been identified in applicable SNF Project procedures. For on-going or completed non-compliant work, backfitting procedures will be implemented to attain compliance.

Section 2.0 of this document provides the approach for selecting items and activities that require application of the QARD. Section 3.0 identifies high-level SNF Project SSCs and activities requiring application of the QARD. Section 4.0 provides the assessment results for application of the QARD for high-level SSCs and activities associated with the K Basins SNF. Section 5.0 provides the assessment results for application of the QARD for high-level SSCs and activities associated with SNF at locations on the Hanford Site other than the K Basins and for National Program activities, including final

The QARD, Section 2.2.2, requires a Q-List, but it does not specifically define the term Q-List. The term is generally interpreted to mean a comprehensive list of quality affecting items.

disposition related activities.

2.0 ASSESSMENT METHODOLOGY

The assessment of QARD applicability to SNF Project SSCs and activities was completed in two phases, as follows (see Figure 2-1):

1. Activities requiring application of the QARD by RL (Sellers 1995) were mapped against SNF Project functions to identify areas of the project for assessment. The high-level SSCs and activities in these functional areas, as defined in performance specifications and project plans, were then assessed using a checklist derived from preliminary requirements (DOE 1995). This assessment identified those high-level items and activities selected for an initial SNF Project Q-List. The results of the initial phase were reflected in Revision 0 of this document.
2. The assessment was updated to reflect modifications to the project plan and to the preliminary repository requirements modifications which occurred since issuance of the initial SNF Project Q-List. The earlier assessment was reviewed to identify whether previous assumptions remained valid and the current project plans were then assessed against an updated checklist of preliminary requirements for repository acceptance of DOE SNF. The assessment was performed with representatives from affected subprojects, operations, and the technical integration organization. The updated checklist is identified in Section 2.1. The results of the assessment are summarized in Table 3-1.

Table 3-1 will be used as the basis for identifying detailed SSCs and activities for the SNF Project RW-0333P Q-List. Table 3-1 will be reviewed and updated, if necessary, for the applicable subproject at the time the subproject Q-List is being developed. The review will use the checklist and guidance identified in Section 2.1 and will consider changes to the subproject since development of the most recent revision of Table 3-1. The detailed subproject SSCs and activities requiring application of the OCRWM QARD requirements will be identified based on the updated Table 3-1 and will be documented in an appendix to this document. The appendix will also provide the rationale for their identification. The RW-0333P Q-Lists will then be defined, documented, and maintained commensurate with AP-11-012, "Development and Maintenance of OCRWM QARD Q-Lists."

Additional detailed assessment of SNF Project activities for application of the QARD will be necessary, as SNF Project and OCRWM activities mature. In particular, assessments should be performed as each of the following activities are completed to further delineate activities requiring application of the QARD:

- A process validation plan is developed and approved that identifies the approach for ensuring adequacy of process performance for particulate removal, validating calculated surface area requirements, controlling temperatures, and drying K Basins fuel within the Fuel Retrieval System (FRS), and the Cold Vacuum Drying (CVD) system.
- Safety bases are finalized for activities to achieve staging and interim storage of K Basins fuel.

Figure 2-1 Methodology Flow Chart

- Post-conditioning monitoring requirements for Multi-Canister Overpacks (MCOs) at the Canister Storage Building (CSB) and interim storage monitoring and inspection requirements for site-wide SNF inventories are finalized.
- Requirements for OCRWM acceptance of DOE SNF are established, including those developed as a result of repository performance assessment, site characterization of the viability assessment activities, National Environmental Policy Act review, and license application activities.
- A final disposition compliance plan, including actions to satisfy OCRWM data records requirements, is developed for Hanford Site inventories of DOE SNF.

2.1 ASSESSMENT CHECKLIST

2.1.1 Checklist Questions

The assessment checklist below asks three questions based on the RL direction (Sellers 1995) to incorporate OCRWM QA requirements into the SNF Project baseline. These questions together with the table in Appendix A, which was derived from the "Guidelines for Meeting Repository Requirements for Disposal of U.S. Department of Energy Spent Nuclear Fuel (Draft)," DOE/SNF/REP-009 (DOE 1997b), are used to aid in determining if an item or activity relates to disposal in the repository. Such determination will in turn invoke the OCRWM QA requirements for that item or activity.

1. Does the SSC or activity involve characterization or data collection of the fuel for input or use in establishing properties or behavioral characteristics that could affect acceptance of the SNF by OCRWM? Consider the draft guidelines identified in Appendix A of this document. [Note: Data requiring application of the QARD are not yet formally identified for DOE-Owned SNF by OCRWM and the National SNF Program. It is assumed that once defined, those data requiring application of the OCRWM QARD will be formally identified to the SNF Project by RL based on guidance from the National SNF Program. The Hanford SNF Project Q-List will be modified to incorporate the RL direction.]
2. Does the SSC or activity involve the conditioning of fuel into final form for disposal such that it could affect acceptance of the fuel by OCRWM? Consider the draft requirements identified in Appendix A.
3. Does the SSC or activity involve handling, packaging, or transportation of the fuel such that it could affect acceptance of the fuel by OCRWM? Consider the draft requirements identified in Appendix A.

2.1.2 Additional Guidance

During assessment of the SSCs and activities requiring application of the OCRWM QARD requirements, the following will be considered for applying the assessment checklist to N Reactor fuel:

- Input to the license application for the Yucca Mountain Project will be based on direct disposal of N Reactor SNF within Multi-Canister Overpacks.
- Input to the license application for the Yucca Mountain Project will

be based on the nominal and maximum values for particulate and total water content as established in the safety basis for interim storage of N Reactor SNF at the Canister Storage Building. SNF Project activities that establish or confirm these limits will be performed commensurate with OCRWM QARD requirements.

- Measures to ensure that safety basis limits for particulate and total water content within an MCO are satisfied for interim storage will also be used, as a minimum, to ensure that limits for repository acceptance are satisfied. Any additional requirements required to satisfy repository requirements, such as OCRWM inspections, will also be performed commensurate with OCRWM QARD requirements.
- Data required to satisfy OCRWM data needs are currently under review by the National SNF Program and OCRWM personnel. RL will provide formal direction on data requiring application of the QARD pending guidance from the National SNF Program. Data acquired during SNF Project execution (including technical analyses, design, operations, characterization, etc.) that are also needed to satisfy OCRWM data needs will be acquired and maintained commensurate with OCRWM QARD requirements.
- Input to the license application for the Yucca Mountain Project are based on SNF Project flowsheets issued before January 1999. Introduction of materials into an MCO other than those identified in the flowsheets at that time must be evaluated to ensure they do not affect repository acceptance. Materials that are RCRA regulated, affect MCO or waste package integrity, result in increased pressure within an MCO, or affect fuel behavior (i.e., reactivity, degradation, etc.) are of particular importance.

2.2 ASSUMPTIONS

The following assumptions are inherent in the conclusions and recommendations:

- SSCs and activities required for OCRWM acceptance of the final product must comply with the QARD. The data input to the 1998 Total System Performance Assessment and the Yucca Mountain Project Environmental Impact Statement do not require application of the QARD unless the data input will also be used for the license application.
- K Basins SNF and unirradiated fuel will ultimately be stored in the national repository within MCOs. Additional overpacks may be required for the MCO to meet the repository requirements.
- All K Basins fuel will undergo cold vacuum drying and not hot conditioning. Conditioning activities that affect particulate content, the amount of reactive material within an MCO, and/or the amount of water remaining within an MCO constitute conditioning into final form.
- Potential accidental releases from MCOs during off-site transport, receipt, interim storage, and emplacement at the repository, and storage during the pre-closure and post-closure periods will require development of analyses specific to the expected conditions for those activities.
- Interim storage for Shippingport Pressurized Water Reactor (PWR) Core 2, 324 Building Light Water Reactor (LWR) SNF, and Oregon State University (OSU) TRIGA SNF will be canistered for interim storage in a manner that does not result in the need to recanister or further condition the fuel for final disposition.

- NRF TRIGA casks will not be accepted by OCRWM.
- FFTF SNF will be repackaged from Core Component Containers prior to repository acceptance.
- Sodium-bonded FFTF SNF will be transferred to the Idaho National Environmental and Engineering Laboratory for treatment and will not be direct disposed at the repository.
- Recommendations regarding compliance with the QARD are independent of the need to comply with Title 10, Code of Federal Regulations (CFR) 830.120, *Quality Assurance Requirements*, 10 CFR 71, *Packaging and Transportation of Radioactive Material*, 10 CFR 72, *Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High Level Radioactive Waste*, or other documents specified by the SNF Project.
- Where application of the QARD is not possible because an activity is completed or substantially completed, then the QARD will be applied to records related to the activity.

3.0 SSCS AND ACTIVITIES REQUIRING QARD APPLICATION

Table 3-1 identifies, at a high-level, the SSCs and activities within the SNF Project that require application of the QARD. Detailed activities (training, etc.) that must be addressed to execute QARD requirements for the identified high-level SSCs and activities are identified in the QARD. These activities must be delineated in the detailed Q-List. Where an activity has been completed, the QARD will be applied to validate the activity was adequately performed.

Applicability of the QARD to Hanford Site SNF management activities outside of the scope of the SNF Project are not included within Table 3-1, but are discussed in Section 5.0.

The SSCs and activities identified in Table 3-1 are not intended to direct baseline technical scope for the various subprojects, but to identify QARD applicability to existing or anticipated scope. Refinements to subproject technical baselines that may occur after the most recent revision of Table 3-1 must be considered when defining the subproject level Q-Lists.

Some of the items below may have sub-components that, on close examination, may not need to comply with the QARD. Details associated with Table 3-1 are provided in Sections 4.0 and 5.0. Table 3-1 takes precedence over information provided in Sections 4.0 and 5.0, if any discrepancies are identified.

Table 3-1 SSCs and Activities Requiring Application of the QARD

Activity	Area	SSCs & Activities
Characterization	SSCs	! K Basins Fuel
	Activities & Documentation	! Tests and analyses that provide information to be used directly (measurement, etc.) or indirectly (establishes or confirms acceptable range of process conditions, etc.) to establish or validate: <ul style="list-style-type: none"> - The amount, composition and characteristics of fuel, particulate, and other materials that will be within an MCO after CVD; - The maximum pressure and hydrogen generation rate within an MCO after CVD; - The free and bound water content within an MCO after CVD; - The chemical reactivity of materials within an MCO under off-site transport or repository conditions after CVD (fuel surface area, etc.); - The presence of materials within the MCO that could affect the MCO or repository waste package integrity due to material incompatibility; - The presence of materials potentially regulated under the Resource Conservation and Recovery Act (RCRA) or Toxic Substance Control Act (TSCA) within the MCO. <p>Including part or all of the following tests and analyses:</p> <ul style="list-style-type: none"> - Sub-surface sludge tests - Surface coating tests - Small furnace fuel drying and ignition tests - Whole element drying tests - Fuel surface area analysis - In-situ fuel examinations used to provide bases for fuel surface area or amount of particulate for MCO safety bases - Sludge particle size distribution measurements for MCO safety bases - Metallographic examinations of fuel - Thermo-gravimetric analysis tests for oxidation - Validation of reaction rate of exposed surfaces in MCO <p>! For SNF elements and pieces that will be returned from the 300 Area for loading into MCOs, record of changes to fuel incurred during characterization (i.e., chemical contamination, etc.)</p> <p>! Other data collected during characterization needed by OCRWM, as identified in formally transmitted data requirements from RL.</p>
Process Engineering	SSCs	! None
	Activities & Documentation	! Analyses significant in definition of the form of spent nuclear fuel (as stored in the Canister Storage Building), in particular: radionuclide inventory and related parameters; fuel element reactive behavior; MCO particulate inventory; hydrogen generation and inventory; MCO water inventory; MCO thermal and pressure (end of storage life); hydride inventory; <p>! Data obtained by Process Engineering needed by OCRWM, as identified in formally transmitted data requirements from RL.</p>
Operations	SSCs	! K Basins Fuel; <p>! FRS equipment that ensures safety bases are satisfied for fuel particulate loading;</p> <p>! FRS weighing system;</p> <p>! Systems that monitor pressure/temperature within an MCO at the CSB, or monitor hydrogen generation within an MCO during storage;</p> <p>! Equipment that ensures safety bases requirements are satisfied for removal of water during cold vacuum drying.</p>
	Activities &	! Activities to load fuel, particulate, and other material

Table 3-1 SSCs and Activities Requiring Application of the QARD

Activity	Area	SSCs & Activities
	Activities & Documentation	<ul style="list-style-type: none"> Activities to load fuel, particulate, and other material into each MCO, where necessary to: satisfy safety bases for particulate inventory, fuel surface area, and criticality; maintain nuclear material accountability; or satisfy OCRWM data needs identified by formal RL direction; Controls that ensure foreign materials are not introduced into MCOs; Corrective actions for physical damage to the MCOs or other non-conformances to QARD SSCs; Control of changes to MCO payload after loading, which affect MCO integrity or particulate generation of fuel within MCO; Activities within FRS operational tests/process validation tests, where necessary to satisfy safety bases for adequacy of fuel cleaning (particulate removal) and fuel inspection; Activities within CVD operational tests/process validation tests used to establish adequacy of HCS process, where necessary to satisfy safety bases requirements for particulate generation, hydrogen generation, MCO pressurization, and fuel reactivity; Operations to maintain process conditions within FRS, where necessary to satisfy safety bases requirements for particulate removal, and fuel drying; Activities to assure adequacy of HCS process during operations, where necessary to satisfy safety basis requirements for particulate generation, hydrogen generation, MCO pressurization, and fuel reactivity; Record of MCO pressure and temperature at CSB and post-closure monitoring of MCOs to assess hydrogen generation and/or pressurization; Maintenance of SSCs (calibration, etc.), where necessary to ensure adequacy of SSCs to satisfy safety bases requirements for particulate loading and generation, drying, hydrogen generation, MCO pressurization, and hydride removal;
Fuel Retrieval System	SSCs	<ul style="list-style-type: none"> Equipment that ensures safety bases requirements are satisfied for fuel particulate loading Fuel weighing system.
	Activities & Documentation	<ul style="list-style-type: none"> FRS process validation testing, where necessary to ensure safety bases satisfied for fuel particulate loading within an MCO; Equipment acquisition and acceptance (specification, calibration, etc.), where necessary to ensure equipment satisfies safety bases requirements for fuel particulate loading within an MCO, and equipment acquisition and acceptance for the fuel weighing system. FRS process design specifications, design, design analyses, and design verification, to the specifications, where necessary to assure adequacy of particulate removal;
MCO	SSCs	<ul style="list-style-type: none"> None (including components and baskets).
	Activities & Documentation	<ul style="list-style-type: none"> Data acquired by the MCO project that is needed by OCRWM, based on formally transmitted data requirements from RL.
Cask/Transportation System	SSCs	<ul style="list-style-type: none"> None
	Activities & Documentation	<ul style="list-style-type: none"> Operations and Maintenance document(s) for MCO loading, and handling; Data acquired that is needed by OCRWM, based on formally transmitted data requirements from RL.
Canister Storage Building	SSCs	<ul style="list-style-type: none"> Systems that monitor hydrogen generation and MCO pressure/temperature during storage.

Table 3-1 SSCs and Activities Requiring Application of the QARD

Activity	Area	SSCs & Activities
	Activities & Documentation	<ul style="list-style-type: none"> ! Analysis of maximum MCO temperature during storage at CSB and verification that conditions identified in the analysis are met. ! Acquisition, acceptance, and testing of systems that monitor hydrogen generation and MCO pressure/temperature during storage.
Cold Vacuum Drying System	SSCs	<ul style="list-style-type: none"> ! Equipment that ensures adequacy of water removal from an MCO at the CVDF, and that site safety bases requirements are satisfied for limiting particulate generation.
	Activities & Documentation	<ul style="list-style-type: none"> ! Process validation tests/operational tests, where necessary to demonstrate adequacy of process conditions for removal of water from the MCO and for limiting particulate generation. ! Equipment acquisition, and acceptance (specification, calibration, etc.), where necessary to ensure adequacy of water removal from the MCO and that site safety bases requirements are satisfied for limiting particulate generation. ! CVD process design specifications, design, design analyses, and design verification, to the specifications, where necessary to assure adequacy of water removal from the MCO and that site safety bases limits are satisfied for particulate generation. ! Measures to ensure non-approved materials are not introduced into MCO ! Data developed by CVD that are also needed by OCRWM, based on formally transmitted data requirements from RL.
Hot Conditioning System	SSCs	<ul style="list-style-type: none"> ! None, project cancelled
	Activities & Documentation	<ul style="list-style-type: none"> ! None, project cancelled
LLBG SNF (OSU TRIGA)	SSCs	<ul style="list-style-type: none"> ! None
	Activities & Documentation	<ul style="list-style-type: none"> ! Maintain OCRWM data records

T Plant SNF (PWR Core 2)	SSCs	! PWR Core 2 SNF ! Fuel drying system
	Activities & Documentation	! Fuel drying specification, drying system verification to specification, and drying system testing; ! Record of canister damage or other non-conformances and corrective actions after receipt by SNF Project; ! Maintain OCRWM data records.
PNL 324/325/327 Buildings SNF (324 Building LWR)	SSCs	! 324 Building LWR SNF
	Activities & Documentation	! Record of fuel or canister damage or other non-conformances and corrective actions after acceptance by SNF Project ! Record of inspections/leak tests after acceptance by SNF Project ! Maintain OCRWM data records
308 SNF (NRF TRIGA)	SSCs	! NRF TRIGA SNF
	Activities & Documentation	! Record of inspections/leak tests after acceptance by SNF Project ! Record of fuel or other non-conformances and corrective actions after acceptance by SNF Project ! Maintain OCRWM data records
FFTF SNF	SSCs	! FFTF SNF
	Activities & Documentation	! Record of inspections/leak tests after acceptance by SNF Project ! Record of fuel damage or other non-conformances and corrective actions after acceptance by SNF Project ! Maintain OCRWM data records
BFP SNF (LAMPRE)	SSCs	! None
	Activities & Documentation	! Develop and maintain OCRWM data records
National Program	SSCs	! None
	Activities & Documentation	! SNF Data Input to YMP License Application

4.0 K BASINS SNF ASSESSMENT

The SNF Project was formed in 1994 to provide integrated management of SNF at the Hanford Site and to address the urgent need to move fuel from the degraded storage conditions in the K Basins to stabilized, interim storage. The path forward for fuel and sludge removal from the K Basins was then established. The current project technical baseline includes several major activities for achieving interim storage of the SNF, but that could also affect later acceptance of this SNF at the repository. These activities are as follows:

- Characterization of the physical composition and reactive nature of the fuel through scientific investigation to help understand the nature and behavior of the fuel.
- Process engineering to develop and evaluate the scientific and engineering assumptions associated with design/safety analysis inputs and the design process for interim storage.
- K Basins modifications to facilitate fuel handling.
- Acquisition of MCOs and baskets to accommodate handling and processing of fuel and maintain a safe array during storage.
- Retrieval, desludging, and repackaging of fuel from current K Basins storage into storage baskets and MCOs.
- K Basins water treatment to maintain clarity during fuel removal.
- MCO loading into shipping casks for transfer to CVD.
- Cold vacuum drying the fuel within each MCO at the CVD to eliminate free water.
- Transferring the MCOs from the CVD to the CSB in shipping casks.
- Interim storage of the MCOs in the CSB storage vault.
- Removal and disposal of debris and sludge from K Basins storage pools.

These activities were assessed based on the assessment methodology identified in Section 2.0 of this document to determine areas of QARD applicability to K Basins SNF management. The results of the assessment for each area is summarized in the following paragraphs.

4.1 Characterization

The Characterization work scope includes activities to: collect samples of fuel and sludge from the K Basins; provide fuel and sludge samples to analytical laboratories and hot cells for analysis; conduct analyses to determine physical, chemical, and radiological characteristics of the fuel and sludge; and document results of analyses.

The K Basins SNF characterization is providing data on fuel oxidation, extent of fuel corrosion, reaction rates, fuel whole element drying, and ignition temperatures that collectively will enable process design, establishment of safety bases, and operation of fuel retrieval, CVD, CSB, and transport systems. The K Basins sludge characterization is providing data required for fuel cleaning, sludge particulate characteristics, sludge drying and disposition, including data required to complete waste profile data sheets for sludge acceptance by the Tank Waste Remediation System or the Solid Waste

Disposal Project.

Characterization, as it relates to repository disposal, is specifically identified by RL as requiring application of the requirements in the QARD. The plan for characterizing the fuel (FDH 1998) identifies in situ and laboratory examinations. Those examinations, evaluations, or analyses that provide information necessary for repository acceptance require application of the QARD. This includes, but is not limited to, all information that is used directly (measurement, etc.) or indirectly (establishes or confirms acceptable range of process conditions, etc.) to establish or validate:

- The amount, composition and characteristics of fuel, particulate, and other materials that will be within an MCO after CVD;
- The maximum pressure and hydrogen generation rate within an MCO after CVD;
- The free and bound water content within an MCO after CVD;
- The chemical reactivity of materials within an MCO under off-site transport or repository conditions after CVD (fuel surface area, etc.);
- The presence of materials within the MCO that could affect the MCO or repository waste package integrity due to material incompatibility;
- The presence of materials potentially regulated under the Resource Conservation and Recovery Act (RCRA) or Toxic Substance Control Act (TSCA) within the MCO.

As such, part or all of the following tests and analyses associated with fuel characterization require application of the QARD, as a minimum:

- Fuel surface area analysis, which provides total fuel surface area per MCO and per tier and scrap baskets for safety basis;
- Examination of fuel, where used to support safety bases for fuel surface area or particulate inventory, including documented results of video surveys to determine extent of fuel damage;
- Metallographic examinations of fuel;
- Thermo-gravimetric analysis tests for oxidation;
- Sub-surface sludge characterization tests, including validation of enabling assumptions for process/safety bases for particulate;
- Whole element drying tests;
- Small sample furnace testing for fuel drying and ignition;
- Surface coating tests;
- Validation of reaction rate of exposed surfaces in an MCO;
- Sludge particle size distribution for MCO safety bases;
- Other Characterization activities that develop data that is needed by OCRWM, as identified in formal direction from RL.

The K Basins fuel elements and pieces returned from the 300 Area for loading into MCOs will ultimately be accepted by OCRWM. A record of the changes to

the fuel incurred during characterization, where repository acceptance could be impacted (i.e., chemical contamination, etc.), also requires application of the OCRWM QARD.

Where characterization has been completed, the QARD will be applied to the validation of the final report documenting the results of the characterization activity.

A list of documents providing characterization test results that require application of the OCRWM QARD is provided in Appendix C.

4.2 PROCESS ENGINEERING

The Process Engineering work scope is to develop, coordinate, and administer the SNF Project baseline in a manner which is cost-effective, consistent with the DOE SNF disposition plans and in compliance with state and federal regulations. The scope includes process engineering, and technology acquisition necessary to achieve safe interim storage of the K Basins SNF.

The Process Engineering activities include developing or evaluating many of the basic scientific and engineering assumptions for both design and safety analysis inputs related to fuel removal, cold vacuum drying, on-site transport, staging, hot vacuum conditioning, and interim storage. Those evaluations or analyses which will be needed to support OCRWM acceptance of the K Basins SNF will require application of the QARD, as follows:

- Radionuclide inventory and related parameters;
- Fuel element reactive behavior;
- MCO particulate inventory;
- Hydrogen generation and inventory;
- MCO water inventory;
- MCO thermal and pressure (end of storage life);
- Hydride inventory;
- Data obtained by Process Engineering that is needed by OCRWM, as identified in formal direction from RL.

A list of Process Engineering documents requiring application of the OCRWM QARD is provided in Appendix D.

4.4 OPERATIONS

The Operations work scope encompasses the activities to maintain SNF Project facilities in a safe, environmentally sound conditioning, including: facility operations and maintenance; handling and storage of SNF; and operational support of the SNF Project. This includes startup, testing, readiness assessments/reviews, operations, maintenance, security, shutdown and turnover activities for each of the project systems and facilities.

Operations activities which could affect K Basins SNF acceptance by OCRWM include those which affect the physical condition of the MCO payload, operational tests to validate performance of the CVD process, maintenance and control of selected processes, and development and maintenance of fuel and MCO records required to satisfy OCRWM data needs.

As such, the QARD is applicable to the following SSCs during the operational phase:

- K Basins fuel;
- FRS equipment that ensures safety bases are satisfied for fuel particulate loading;
- FRS weighing system;
- Equipment that ensures safety bases requirements are satisfied for removal of water during cold vacuum drying;
- Systems for monitoring hydrogen generation and MCO pressure and temperature during storage at the CSB;

The following activities associated with acceptance, operations, and maintenance of these SSCs require application of the QARD:

- Activities to load fuel, particulate, and other material into each MCO, where necessary to:
 - Ensure safety bases limits related to particulate inventory, fuel surface area, and criticality are satisfied;
 - Maintain nuclear material accountability of MCO contents;
 - Satisfy OCRWM data needs, as identified in formal direction from RL;

This includes the controls to ensure that foreign materials are not introduced into MCOs.

- Corrective actions to physical damage to the MCOs or other non-conformances to SSCs requiring application of the QARD.
- Control of changes to MCO payload after loading, which affect MCO integrity or particulate generation of fuel within MCO, including:
 - Materials (inert gas, etc.) introduced into MCO after loading and associated water or oxidant content;
 - Amount of water and/or particulate removed from MCO;
 - Loaded MCO queuing time at the K Basins and transfer time to CVD.
- Activities within operational tests/process validation tests used to establish adequacy of fuel cleaning and fuel inspection, where necessary to ensure safety bases requirements for fuel surface area and amount of particulate are satisfied.
- Activities within operational tests/process validation tests used to establish adequacy of CVD process, where necessary to ensure safety bases requirements for water removal and particulate generation are satisfied.
- Activities to assure adequacy of FRS and CVD processes during operations (i.e., applicable process measurements, and calibration of equipment), where necessary to ensure safety bases requirements for maximum surface area, particulate removal, and fuel drying are satisfied.

- Post-conditioning monitoring of MCOs to assess hydrogen generation and/or pressurization.
- Maintenance of SSCs (calibration, etc.), where necessary to ensure adequacy of SSCs to satisfy safety bases requirements for particulate loading and generation, drying, hydrogen generation, MCO pressurization, and hydride removal.

Additionally, data developed or managed by Operations that is needed by OCRWM, as identified in formal direction from RL, requires application of the QARD. The data will include record of MCO pressure and temperature during storage, records of MCO Nonconformance Reports (NCRs), etc.

4.5 FACILITY PROJECTS

4.5.1 Facility Upgrades

The Facility Upgrades work scope includes activities to repair, replace and modify essential K Basins infrastructure to facilitate successful execution of the SNF Project mission objectives, maintain a cold test facility for fuel and sludge removal development activities, and prepare the South Transfer Areas in each basin for the Cask Transportation System. The Facility Upgrade activities are improving the K Basins facilities to ensure their adequacy for continued safe operations and personnel protection during routine operations and activities to remove SNF and sludge from the K Basins. Essential facility systems recovery actions are being completed for electrical, potable water, fire protection, and maintenance systems. Supplemental facilities are being provided for maintenance and basin loadout personnel. Personnel exposure is being reduced during current and planned operations, maintenance and construction activities in keeping with as-low-as-reasonably-achievable (ALARA) practices.

K Basins Modifications activities do not meet any of the assessment checklist criteria (Section 2.1), and, therefore, application of the QARD requirements is unnecessary.

4.5.2 Fuel Retrieval System Acquisition

The FRS work scope includes acquisition and preparation of the FRS for operations in the K Basins. The FRS will retrieve SNF from existing storage, remove the SNF from existing canisters, remove fuel corrosion particulate from the SNF to the extent necessary to satisfy dry storage and transport requirements, and place the SNF into baskets for transfer into MCOs. Major activities include detailed design, fuel retrieval system testing, system procurement, and installation.

In addition to the physical removal of fuel from the K Basins pools, operation of the FRS system will directly affect the amount of fuel and particulate within an MCO and the potential for criticality, MCO pressurization, temperature excursion, and hydrogen generation. As such, the following SSCs within the FRS require application of the QARD:

- Equipment that ensures safety bases requirements are satisfied for fuel particulate loading;
- The fuel weighing system.

The QARD will be applied to the following activities associated with these FRS SSCs during the acquisition phase:

- FRS process validation testing, where necessary to ensure safety bases requirements will be satisfied for fuel particulate loading within an MCO.
- Acquisition and acceptance of systems for control and monitoring of process conditions, where necessary to satisfy safety bases requirements for limiting fuel particulate loading within an MCO.
- Fuel weighing system acquisition and acceptance, where necessary to ensure nuclear material accountability requirements are satisfied.

FRS equipment and test records necessary to support OCRWM data needs, as defined in formal direction from RL must be provided in accordance with QARD requirements.

4.5.3 Other Facility Projects

Other Facility Project work scope includes acquisition of an Integrated Water Treatment (IWT) system to improve water cleanup at the KE and KW Basins, and sludge and debris removal system acquisitions. The activities also include design, permitting, procurement, and installation of the systems.

Acquisition of systems for removal and disposition of sludge and debris from the K Basins and water treatment do not meet any of the assessment checklist criteria (Section 2.1) and, therefore, application of the QARD requirements is unnecessary.

4.6 SNF STORAGE

4.6.1 MCO Acquisition

The MCO workscope includes all activities to acquire the MCOs, which will provide confinement/containment of the K Basins SNF during onsite transport, cold vacuum drying, and interim storage. Currently, off-site shipment and final disposition of the K Basins SNF within the MCOs are assumed.

The MCO activity includes design, testing, and procurement of 400 MCOs. A Topical Safety Report is being developed to support the safety basis for MCO related operations. MCO acquisition has progressed to the fabrication procurement phase.

The MCO (including components and baskets) will be accepted by OCRWM. Based on direction from RL, the OCRWM QARD will not be applied to procurement and fabrication of the MCOs. As such, there are no SSCs that require application of the QARD for the MCO project. Data acquired by the MCO project that is needed by OCRWM, will apply OCRWM QARD requirements as identified in formal direction from RL.

4.6.2 Cask/Transport System Acquisition

The Cask/Transport work scope includes acquisition of the system to enable fuel loading into MCOs and onsite shipment of MCOs from the 100 Area to the CSB. The activity includes: modifications at the K Basins for cask handling; procurement of five casks and transport vehicles, and MCO loading equipment; and issuance of a Safety Analysis Report for Packaging for onsite shipment of the casks.

Transportation is identified by DOE as one of the activities requiring application of the QARD. Acquisition of the cask/transportation system (WHC 1995f), however, does not meet any of the assessment criteria because it supports only on-site shipment. Additionally, acquisition of the MCO Loading

System will not affect the fuel condition, MCO integrity or MCO acceptance by OCRWM and are, therefore, not subject to application of the QARD.

The Cask/Transport system acquisition does not include activities that provide information necessary for OCRWM acceptance of the MCO and its payload, and therefore does not require application of the QARD.

4.7 CSB ACQUISITION

The CSB work scope includes acquisition of the CSB substructure, the deck, the superstructure, the MCO Handling Machine (MHM), and other CSB supporting equipment/systems. The CSB will be used for staging and storage of the K Basins SNF and T Plant SNF prior to OCRWM acceptance of the canistered SNF. Acquisition includes the definition of functions and requirements, design, procurement, construction, safety documentation, environmental compliance, and permitting.

CSB SSCs that require application of the QARD include those that: ensure MCO integrity is maintained; and monitor hydrogen generation during interim storage.

The activities associated with the CSB acquisition that require application of the QARD are:

- Equipment acquisition, acceptance, and testing (specification, calibration, etc.), where necessary to ensure MCO integrity is maintained; and monitor MCO pressure and temperature during interim storage.
- Analysis of the maximum MCO temperature during storage at the CSB, and verification that the conditions identified in the analysis are satisfied.

CSB equipment and test records necessary to support OCRWM data needs, as defined in formal direction from RL, must be provided in accordance with QARD requirements.

4.8 COLD VACUUM DRYING

The CVD work scope includes acquisition of the CVD facility and cold vacuum drying stations for removal of free water from the MCOs for onsite transport and storage at the CSB. Design has been completed for the CVD Facility and process systems.

The adequacy of the drying operation within the CVD system will directly affect the amount of particulate within an MCO and the future amount of hydrogen/oxygen generation and internal pressure within an MCO. Each of these will affect potential releases within the proposed repository surface and sub-surface facilities. As such, CVD equipment that ensure adequacy of water removal at the CVDF and that site bases requirements are satisfied for limiting particulate generation require application of the QARD requirements.

Additionally, measures to ensure non approved materials (i.e., RCRA regulated, etc.) are not introduced into the MCO during CVD processing require application of the QARD requirements. CVD equipment and test records which are also necessary to support OCRWM data needs, as these data needs are identified formally by RL, will require application of the OCRWM QARD requirements.

The detailed CVD SSCs and activities requiring application of the QARD requirements, and the rationale for their selection are identified in Appendix B of this document. The high level CVD SSCs and activities requiring

application of the QARD requirements are summarized in Table 3-1.

5.0 SITE-WIDE SNF ASSESSMENT

5.1 SITE-WIDE SNF INVENTORIES

Site-Wide SNF inventories are described in Table 5-1. This SNF is currently stored at various locations at the Hanford Site (see Figure 5-1). This SNF will be placed in safe interim storage in the 200 Area until final disposition. Application of the QARD requirements to these fuels must address process and storage plans for each fuel type.

Actions to attain safe interim storage of Site-Wide SNF inventories include near-term consolidation of most 300 and 400 Areas SNF to the 400 Area Interim Storage Area (ISA). These actions support deactivation missions and vulnerability corrective actions at the Fast Flux Test Facility (FFTF) and numerous buildings in the 300 Area.

Table 5-1 Site-Wide Spent Nuclear Fuel Description

Fuel Inventory	Current Storage Location	Quantity (MTHM)	Comments	Future Storage Location
FFTF SNF	FFTF, 400 Area ISA	11.0	<p>FFTF SNF loading into Interim Storage Casks (ISCs) initiated prior to establishment of preliminary requirements for repository acceptance. SNF is washed to remove sodium, dried, placed in Core Component Containers within inert environment, and then loaded into ISCs and stored temporarily at the 400 Area Interim Storage Area (ISA).</p> <p>Self-protecting FFTF SNF will be transferred from the 400 Area ISA to the 200 Area ISA proceeded by the Site-Wide SNF Project prior to FFTF deactivation. The sodium-bonded FFTF SNF will be transloaded from ISCs into T-3 casks at the CSB using equipment provided by the Site-Wide SNF Project for shipment to INEEL for treatment. The non-sodium bonded self-protecting FFTF SNF which comprises the majority of the FFTF SNF in storage will remain in storage in ISCs at the 200 Area ISA until preparation for final deactivation. Non self-protecting FFTF SNF will instead be shipped to the Plutonium Finishing Plant in ISCs for interim storage.</p>	200 Area ISA, PFP
PWR Core 2 SNF	T Plant (221-T)	15.8	PWR Core 2 SNF is currently in underwater storage at T Plant. SNF will be loaded into canisters for dry interim storage at the CSB that satisfy repository requirements and are compatible with transport, handling, and storage systems for the K Basins SNF MCOS.	CSB
LWR SNF	324 Bldg	2.3	The LWR SNF will be canistered and transferred into dry storage. Previous baseline of on-site transfer and storage in NAC-1 casks is being re-evaluated. The SNF will be stored in canisters within NAC-1 casks or the CSB. The canisters will also satisfy repository requirements.	200 Area ISA or CSB
NRF TRIGA SNF	400 Area ISA	0.02	Prior to modified DOE SNF EIS Record of Decision, NRF TRIGA SNF was removed from reactor pool storage, dried, and canistered to enable facility deactivation and transfer to INEEL without repackaging. Due to lead shielding, SNF removal from existing canisters is required to satisfy repository requirements.	200 Area ISA
LAMPRE SNF	PFP	0.008	LAMPRE SNF is stored within welded pipes that were not fabricated and inspected to 10CFR71 or 10CFR72 criteria. A repackaging evaluation will be completed to determine timing and scope of any repackaging activity.	PFP
OSU TRIGA SNF	Low-level Burial Grounds	0.02	OSU TRIGA SNF will be retrieved from LLBG concurrent with waste retrieval activities. The SNF will be repackaged into repository compliant canisters.	200 Area ISA or CSB

Figure 5-1 Hanford Site Fuel Storage Locations

After construction of the CSB, a 200 Area ISA will be constructed adjacent to the CSB. The SNF at the 400 Area ISA and most 200 West Area SNF will be transferred to the 200 Area ISA, or to the CSB to minimize storage costs, and to enable deactivation of other facilities. The CSB will be used to transload this SNF for transfer off-site during final disposition of Hanford SNF. SNF requiring enhanced safeguards and security will be stored at the Plutonium Finishing Plant (FPF). Additional discussion on process plans for these fuels are discussed in the *Defense Nuclear Facilities Safety Board Recommendation 94-1 Hanford Site Integrated Stabilization Management Plan* (FDH 1997).

The assessment checklist was used to address each fuel type. The activities that would influence the acceptance of the SNF by OCRWM include SNF packaging into containers that may be transferred to the repository and data package development. Data package development would address the requirements of Section 2.1, and may occur at any of the process steps listed above.

5.1.1 LLBG SNF

Thirteen drums of Oregon State University (OSU) TRIGA7 SNF are buried under four feet of soil in Trench 7 of the 218-W-4C Burial Facility of the 200 Area LLBG in TRIGA7 Standard Fuel Element Storage Drums. A total of 90 TRIGA7 elements are stored in the drums.

The Solid Waste Disposal Project plans to exhume this SNF simultaneously with retrieval of solid waste at the LLBG. The drums will then be overpacked and transferred to the CSB by SWD for repackaging by the SNF Project successor into an approved canister for storage within the CSB or at the 200 Area ISA. The following activities associated with the OSU TRIGA SNF within the SNF Project scope require application of the QARD:

- Maintain OCRWM data records.

The following activities associated with the OSU TRIGA SNF that are outside of the scope of the SNF Project should apply the QARD:

- Canister criticality analyses, drop analysis, thermal hydraulic analysis, material compatibility analysis, and analyses that are required to support later off-site shipment;
- Dimensional verification of canister after receipt;
- Canister loading, including loading procedures, documentation of fissile loading, etc.
- Other data needed by OCRWM, as identified in formal direction from RL.

5.1.2 T Plant SNF

The Shippingport FWR Core 2 assemblies at T Plant will be retrieved by the Solid Waste Disposal Project, dried, and placed into T Plant canisters, which are similar to the K Basins SNF MCOs and will satisfy requirements for interim storage and repository acceptance. The loaded T Plant Canisters will be transferred by the SNF Project to the CSB vault for interim storage. The SNF Project will acquire the canisters and drying system and will utilize the K Basins SNF MCO Casks (TN-WHC) for the onsite shipment.

Upon arrival at the CSB, the MCO Casks will be inspected and placed within the MCO service pit via use of the CSB receiving area gantry crane. The T Plant Canister will be transferred to a storage tube location using the MCO Handling Machine.

The SNF Project will develop the fuel preparation specification and complete analyses for on-site shipment and storage at the CSB, including thermal, criticality, and shielding analyses. The Solid Waste Disposal Project will complete any requisite characterization of sludge, sludge, drying specification.

The PWR Core 2 SNF and the T Plant Canister will be accepted by OCRWM, and therefore, each constitutes an SSC. Additionally, performance of the fuel drying and welding systems will affect OCRWM acceptance and require application of the QARD. The following activities associated with these T Plant SNF SSCs within the SNF Project scope require application of the QARD:

- Fuel drying specification, drying system acquisition (including acceptance), verification to specification, and drying system testing;
- Canister criticality analyses, drop analysis, thermal hydraulic analysis, material compatibility analysis, and analyses that are required to support later off-site shipment;
- Record of canister damage or other non-conformances and corrective actions after receipt by SNF Project;
- Maintain OCRWM data records.

The following activities associated with the PWR Core 2 SNF that are outside of the scope of the SNF Project should apply the QARD:

- Canister loading, including loading procedures, documentation of fissile loading, etc.;
- Fuel drying, including drying procedures and drying records;
- Record of canister damage or other non-conformances and corrective actions at T Plant;
- Develop OCRWM data records for the fuel inventory, as identified in formal direction from RL.

5.1.3 PNL 324/325/327 Buildings SNF

Two BWR assemblies and five PWR assemblies and miscellaneous pins and pieces stored primarily in the 324 Radiochemical Engineering (RE) Cells will be encapsulated and transferred to dry storage systems by B&W Hanford Co. LWR SNF pins and pieces will also be canistered and transferred to dry storage systems. The fuel canisters will satisfy requirements for repository acceptance of the SNF. Current plans to transfer the SNF to the 400 Area ISA for storage are being reevaluated and direct shipment to the 200 Area for storage at the 200 Area ISA or CSB is likely.

The 324 Building LWR SNF and canisters must be accepted by OCRWM, and therefore require application of the QARD. The following activities associated with the 324 Building LWR SNF within the SNF Project scope require application of the QARD:

- Record of canister damage or other non-conformances and corrective actions after acceptance by SNF Project;
- Record of canister inspections and leak tests for storage system, after acceptance by SNF Project;

- Maintain OCRWM data records.

The following activities associated with the 324 Building LWR SNF that are outside of the scope of the SNF Project should apply the QARD:

- Acquire and test fuel drying and inerting systems;
- Wash, dry, and package the SNF;
- Record of canister damage or other non-conformances and corrective actions prior to acceptance by SNF Project;
- Prepare thermal, shielding, criticality, fuel pin rupture, and drop analyses for storage and transport;
- Develop OCRWM data records for the fuel inventory, as identified in formal direction from RL.

5.1.4 308 Building Annex SNF

The 308 Building Annex SNF workscope includes activities to manage NRF TRIGA SNF at the 400 Area and to relocate the SNF to the 200 Area. The SNF Project has responsibility for funding and/or performing actions for management of the NRF TRIGA SNF, except development of OCRWM data records which is the responsibility of the Transition Programs Division of RL.

TRIGA7 SNF previously stored at the 308 Building annex was loaded into six NRF TRIGA7 Casks and transferred to the 400 Area ISA for storage in December 1995. TRIGA7 Fuel Follower Control Rods were shipped at the same time and are being stored in two DOT 6M containers. The NRF TRIGA Casks and DOT 6M containers are stored in a Rad-Vault at the 400 Area ISA.

The NRF TRIGA7 casks, DOT 6M containers and Rad-Vault will be transferred to the 200 Area ISA by the Site-Wide SNF Project, concurrent with the FFTF SNF transfers. The SNF Project funds management of the NRF TRIGA SNF by the FFTF Transition Project at the 400 Area ISA and storage of equipment at FMEF. Interim storage of NRF TRIGA7 SNF at the 200 Area ISA will use the same configuration as currently used for NRF TRIGA7 SNF storage at the 400 Area ISA.

The NRF TRIGA7 Casks will be placed into their impact limiters for transfer to the 200 Area ISA and placed on a transporter for transfer to the 200 Area ISA. Upon arrival at the 200 Area ISA, the NRF TRIGA7 Casks will be inspected and impact limiters removed. Upon completion of inspection the casks will be placed via crane into the Rad-Vault. The NRF TRIGA7 SNF will be periodically inspected.

The NRF TRIGA SNF and the NRF TRIGA cask fuel basket must be accepted by OCRWM, and therefore require application of the QARD. The following activities associated with the NRF TRIGA SNF SSCs within the SNF Project scope require application of the QARD:

- Record of leak tests after acceptance by SNF Project;
- Maintain OCRWM data records.

The following activities associated with the NRF TRIGA SNF that are outside of the scope of the SNF Project should apply the QARD:

- Develop OCRWM data records for the fuel inventory, as identified in

formal direction from RL.

5.1.5 FFTF SNF

The FFTF SNF work scope includes SNF Project activities to manage the SNF, acquisition of the 200 Area ISA, and acquisition of sodium-bonded FFTF SNF transloading capability at the CSB. The FFTF Stabilization Project has responsibility to develop OCRWM data records, place the SNF into Interim Storage Casks (ISCs) at the 400 Area ISA or PFP, and maintain operations for the 400 Area ISA until the SNF Project accepts custody of the SNF.

The SNF currently at FFTF will be washed in the FFTF Interim Examination and Maintenance (IEM) Cell to remove sodium, dried and loaded into Core Component Containers (CCCs). Each CCC will be inserted into an ISC, which will function as confinement. After each ISC is closed, the ISC will be inerted and moved to the adjacent 400 Area ISA.

The ISCs at the 400 Area ISA will subsequently be transferred by the SNF Project to the 200 Area ISA for storage until transfer offsite. The ISCs will be moved to the 200 Area ISA from the 400 Area via truck. Upon arrival at the 200 Area ISA, the ISC will be inspected and placed on the concrete storage pad. The ISCs will require periodic surveillance during storage.

Sodium bonded FFTF SNF will be shipped to INEEL for consolidation with similar SNF. The sodium bonded FFTF SNF will be initially stored in ISC's and later transloaded into T-3 Casks at the CSB, using equipment transferred from FFTF by the SNF Project.

Two or three ISCs containing non-self protecting FFTF SNF will be placed inside the protected area at PFP to satisfy safeguards requirements. The ISCs will be shipped directly to PFP after loading and will not be stored at the 400 Area ISA.

To implement final disposition, the fuel within the CCCs will be repackaged. The repackaging activity will be conducted by the SNF Project successor organization.

The FFTF SNF must be accepted by OCRWM, and therefore require application of the QARD. The following activities associated with the FFTF SSCs SNF within the SNF Project scope require application of the QARD:

- Record of inspections/leak tests after acceptance by the SNF Project;
- Record of fuel damage or other non-conformances and corrective actions after acceptance by the SNF Project;
- Maintain OCRWM data records.

Because the FFTF SNF ISC procurement, procedure development, equipment acquisition, and loading activities are substantially complete, the QARD should be applied to development and management of records associated with the SSCs. As such, the activities associated with the FFTF SNF that are outside of the scope of the SNF Project that should apply the QARD are limited to development and management of OCRWM data records, as identified in formal direction from RL, including information packages associated with the FFTF Detailed Refueling Plan.

5.1.6 PFP SNF

Three dissimilar fuel types are or will be stored at PFP: LAMPRE SNF, FFTF SNF, and University of Washington High-Enriched Uranium SNF. Because of physical differences, the storage systems for each of these SNF types will vary.

The LAMPRE SNF is packaged in three EBR-II casks, which have primarily been used as onsite transportation casks. The three casks are stored inside a concrete vault to provide an additional security barrier and supplement the casks' lead shielding. A review of the cask for continued dry storage will be completed by the SNF Project. The LAMPRE SNF will be repackaged by the SNF Project successor organization prior to transport off-site for final disposition.

A small amount of highly enriched uranium fuel from the University of Washington is stored in a 55-gallon drum inside the 2736-ZB Building, also located in the protected area. The planning basis for this material is to repackage the material at the same time as the LAMPRE SNF. The University of Washington material will not continue to be classified as SNF. Therefore, the planning basis will be modified after formal reclassification is completed and the material dispositioned per requirements for highly enriched uranium.

The ISCs containing FFTF SNF designated for storage at PFP will be transported to an outdoor location inside PFP's protected area for storage on a precast concrete pad. The FFTF SNF will be managed by the PFP Stabilization Project.

Development and maintenance of OCRWM data records for the PFP SNF is the only activity within the SNF Project scope that requires application of the QARD. The PFP SNF, the LAMPRE canisters, and potentially the CCCs will require acceptance by OCRWM, and therefore should be SSCs requiring application of the QARD. The following activities associated with the PFP SNF SSCs that are outside of the scope of the SNF Project should apply the QARD:

- Material transfer and canister inspection records;
- Records of canister damage or other non-conformances and associated corrective actions;
- Canister criticality analyses, drop analysis, thermal hydraulic analysis, material compatibility analysis, and analyses that are required to support later off-site shipment;
- Canister loading, including loading procedures, documentation of fissile loading, etc.

5.2 NATIONAL PROGRAM

5.2.1 General Activities

The Site-Wide SNF Project workscope includes interface with the National SNF Program and the Nuclear Materials Stabilization Task Group. Major activities include: participation in National SNF Project strategy meetings, EM Integration workshops, and Technology Integration Technical Working Group activities; providing site input to development and maintenance of the National SNF Program Master Logic Schedule; development of site input to the DNFSB Recommendation 94-1 Implementation Plan and Site Integrated Stabilization Management Plan; and providing periodic status of site progress on DNFSB Recommendation 94-1 commitments.

General National Program activities do not meet any of the assessment

checklist criteria (Section 2.1) and, therefore, application of the QARD requirements is unnecessary.

5.2.2 Final Disposition

The Site-Wide SNF Project will develop a disposition plan for Hanford Site SNF that will identify the compliance strategy for each SNF inventory. The Site-Wide SNF Project will have lead responsibility for review of guidance on final disposition requirements from the NSNF Program and providing input to the NSNF Program on acceptability of draft guidance.

Additionally, the Site-Wide SNF Project will complete the following activities: ensure data records are completed and maintained for final disposition of site-wide SNF, consistent with approved MOUs; support scoping performance assessment and criticality analyses activities being conducted by National SNF Program for final disposition of Hanford Site SNF with funding provided by the National SNF Program; support definition of a standard canister for repository acceptance of DOE SNF; plan for fuel preparation capability to support final disposition. The acquisition of facilities to transfer fuel for final disposition will be delayed until finalization of program requirements and will be completed by the SNF Project successor organization.

The following activities associated with final disposition planning within the scope of the SNF Project require application of the QARD:

- Acceptance/maintenance of OCRWM data records.

There are no SSCs applicable to this work scope.

6.0 REFERENCES

- 10 CFR 60, *Disposal of High Level Radioactive Wastes In Geologic Repositories*
- 10 CFR 71, *Packaging and Transportation of Radioactive Material.*
- 10 CFR 72, *Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste.*
- 10 CFR 830.120, *Quality Assurance Requirements.*
- DOE, 1995, *Preliminary Requirements for the Disposition of DOE Spent Nuclear Fuel in a Deep Geologic Repository*, DI:A00000000-00811-1708-00006, Revision 00, U.S. Department of Energy, Washington, D.C.
- DOE, 1997a, *Quality Assurance Requirements and Description*, DOE/RW/0333P, Revision 6, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, Washington, D.C.
- DOE, 1997b, *Guidelines for Meeting Repository Requirements for Disposal of U.S. Department of Energy Spent Nuclear Fuel (Draft)*, DOE/SNF/REP-009, U.S. Department of Energy, Washington, D.C.
- DOE, 1998, Contract No. DE-AC06-96RL13200- *Modification of Spent Nuclear Fuel (SNF) Project Standards/Requirements Identification Documents (S/RIDS) Relative to Office of Civilian Radioactive Waste Management (OCRWM) RW-0333-P, Quality Assurance (QA) Requirements Description (QARD)*, Letter to R. D. Hanson, 99-SFD-024, November 16, 1998, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- Ecology, EPA, and DOE, 1994, *Hanford Federal Facility Agreement and Consent Order*, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.
- FDH 1997, *DNFSB Recommendation 94-1 Hanford Site Integrated Stabilization Management Plan*, HNF-EP-0853, Revision 5, Fluor Daniel Hanford, Inc., Richland, Washington.
- FDH 1998, *Characterization Program Management Plan for Hanford K Basin Spent Nuclear Fuel*, HNF-SD-SNF-PLN-010, Rev. 1, Fluor Daniel Hanford, Inc., Richland, Washington.
- Idaho, 1995, *Public Service Company of Colorado v. Batt*, Consent Order - No. 91-0035-S-EJL, District Court of Idaho, October 17, 1995, Boise, Idaho.
- Sellers, E. D., 1995, *Office of Civilian Radioactive Waste Management (OCRWM), Quality Assurance Requirements and Description (QARD) [RW-0333P]* (letter to Dr. A. L. Trego, Westinghouse Hanford Company, July 12, 9503493), U.S. Department of Energy, Richland Operations Office, Richland, Washington.

**APPENDIX A:
CHECKLIST OF DRAFT REPOSITORY
GUIDELINES FOR DOE-OWNED SNF**

The following tables from the *Guidelines for Meeting Repository Requirements for Disposal of U.S. Department of Energy Spent Nuclear Fuel (Draft)* (DOE, 1997b) DOE/SNF/REP-009 identify the draft DOE SNF acceptance criteria, requirements, and compliance methods used to assess applicability of the QARD to SNF Project items and activities.

Criteria	Requirements/Limits	Compliance Method
Description		
Source (10CFR 961) CRD 3.3.1.2	Provide information on production of SNF and the facility in where it was irradiated	Provide requested data on form provided in Guidance Document
Drawings CRD 3.3.1.1.F ICPP FAC	Provide drawings of SNF and shipping geometry sufficient to describe package and contents.	Provide information as described in Guidance Document
Dimensions CRD 3.3.1.1.F ICPP FAC	Provide dimensions of SNF and shipping containers sufficient to describe package and contents.	1. Provide dimensions as requested per Guidance Document or 2. Indicate on Drawings required dimensions.
Weights and Materials CRD 3.3.1.1.F (10CFR60.21.c.1.ii.F .5)	Provide weights of SNF and packaging sufficient to describe total weight and weight distribution of package. List materials contained within the SNF and SNF package. Identify materials making up at least <TED> wt %, or <TED> kg (which ever is greater), of total package. No RCRA materials should be present.	Provide requested data on indicated form in Guidance Document. Data can be from actual weighing or calculations. Provide list of materials on indicated form in Guidance Document. Reference to data satisfying QPP-0333P shall be provided or, where qualified data is not available, a statement as to range of data provided.
Physical Condition CRD 3.3.1.2 ICPP FAC	Provide a description of the physical state of the SNF, i.e., intact, breached clad, broken, corrosion - light, severe-etc.	Provide the requested description on form in Guidance Document.
Identification Tags 10CFR70.51(e)(1)(i) CRD 3.3.1.2 10CFR60, 135(b)(4) CRD 3.3.1.1.A	Provide a unique identification number or tag on each SNF container	Provide a record in the Data Package which documents the type, format, and location of the identification tag on the SNF canister.

Physical and Chemical Characteristics

Criteria	Requirements/Limits	Compliance Method
Isotopes (10CFR60.113.a.ii.B)	Isotopic inventory of SNF is required (total species and accuracy required is TBD)	Output from validated ORIGEN run giving isotope name and quantity, or, assay results providing isotope quantity, or calculated maximum
Reactivity (10CFR0.135.a.2) CRD 3.2.1.1.H CRD 3.7.1.2.K.1	SNF shall not react with the containment structure or any other material contained within the package	Provide documentation that SNF will not react with the containment material or any other SNF within the immediate containment
Pyrophoricity (10CFR60.135.b.1) CRD 3.7.1.2.K.1	Materials that can self-ignite under repository conditions (TBD) and cause loss of function (TBD) to the repository may not be deposited.	Provide evidence that SNF is either a) non pyrophoric by nature or b) has been treated to be not pyrophoric or c) use methodology in Appendix D of Guidance Document.
Combustible or Explosive (10CFR60.135.b.1) (10CFR60.135.c.3) CRD 3.7.1.2.K.1 CRD 3.7.1.2.K.5	Materials are forbidden that can explode or undergo rapid oxidation under repository conditions (TBD) and cause loss of function (TBD) to the repository.	Provide evidence that SNF is either a) non combustible by nature or b) will not burn in known repository conditions.
Compatibility (10CFR0.135.a.2)	It is required that the deposited SNF be compatible with the planned environment of the repository (TBD)	Provide data or calculations to indicate that SNF will be compatible with repository environment.
Corrosion Resistance (10CFR.60.113.a.ii.A) (10CFR0.135.a.2)	The corrosion resistance of the inner containment/canister will influence time before diffusion of isotopes into environment (The limits on this parameter are TBD)	Provide data to show corrosion resistance, or, show that material is more resistance than commercial fuel.
Gas Generation (10CFR0.135.a.2) CRD 3.2.1.1.H	Gas generation is not allowed in the repository to the point where function of the repository is degraded. (The level of this function is TBD)	Provide data or calculations to indicate that SNF will not degrade repository function through gas generation.
Particulate (10CFR60.135.c.2) CRD 3.7.1.2.K.4 (10CFR60.135.c.1) CRD 3.2.2.7	Particulate fuels of a size <(TBD) must be consolidated. SNF shall be in a solid form, i.e., no liquids or gases will be accepted into the repository.	Indicate process by which particulate fuel has been stabilized. Provide documentation that SNF is not a liquid or gas.
Leachability (10CFR.60.113.a.ii.A) (10CFR.60.113.a.ii.B)	Each isotope of amount >(TBD) shall be calculated for its leachability and transport capability under repository migration rates (TBD).	Isotopes shall be calculated with the ORIGEN code and the isotopic transport rate.

Criteria	Requirements/Limits	Compliance Method
RCRA Materials CRD 3.2.1.E Memo: Dreyfus to O'Leary, 6/22/95	No RCRA materials are to be deposited in the repository	Provide documentation that no RCRA material is contained in the SNF canisters or fuel elements

Performance Characteristics

Operating History CRD 3.3.1.2 ICPP FAC	The operating history of the SNF is required in order to calculate burnup and isotopic inventory	Provide validated operating history. Backup method is to supply validated total burnup of SNF
Free Liquids (10CFR60.135.b.2) CRD 3.7.1.2.K.2	Free liquids are not allowed in a container in an amount (TBD) that can cause loss of function (TBD) to the repository	Subject SNF to a standard drying procedure or show by test or record that SNF contains no free liquid.
Radiation Level 10CFR60.21.c.1.ii.F. 5) CRD 3.3.1.2 10CFR73.6.b) CRD 3.3.1.2	SNF canister shall exhibit a gamma-ray dose rate less than 10E5 rem per hour and a neutron dose rate less than 10 rem/hr at a distance of 1 meter. Forms with a total external dose rate less than 100 rems per hour at 3 feet must be addressed on case by case basis.	Provide results of radiation survey per qualified measurement procedure.
Heat Generation Rate (10CFR60.135.a.2) CRD 3.2.1.1.H	Total container shall have a thermal load of < 14.2 kW. Individual canisters shall be proportionally loaded with SNF and placed within a MPC (or TBD) such that total thermal load is < 14.2 kW.	Provide documentation from measurements or calculations that total container thermal loading is less than 14.2 kW. Small canisters must be proportioned to volume of MPC or DPC.
Criticality Evaluation (10CFR60.131.b.7) CRD 3.2.2.5	Canisters must be loaded such that k_{eff} is less than 0.95 for all conditions other than two independent occurrences.	Provide analyses to show that criticality requirements are met under (TBD) repository conditions.

Criteria	Requirements/Limits	Compliance Method
Container Size CRD 3.3.1.1.F CRD 3.7.1.2.K CRD 3.2.1.1.H DOE Order 4700.1 Ch V Pt C.2.a	The canistered DOE SNF shall be sized to optimize system standardization. Unique standard dimensions and weights for bare DOE SNF assemblies and canistered DOE SNF have not been determined	Use canisters which fit within the (as yet to be determined) size ranges of the repository requirements.
Construction Drawings	Provide documentation of the canisters and their design parameters	Provide documentation of container/canister as part of data package. If a standard canister is being used, reference to standard is sufficient.
Internals 10 CFR 60.135(a) and (b) CRD 3.2.1.1.H	The internals of a DOE SNF canister must be considered in the evaluation of any potential reaction with the SNF and of any potential criticality of the contents of the package. The internals shall be described, in both form and material against this requirement.	Include documentation of the canister internals, both of potential material reactivity and criticality effects, in the data package.
Sealing of Canister 10 CFR 60.135(b)(3) 10 CFR 60.135(c)(1) 10 CFR 60.135(a)(2) CRD 3.2.1.1.H	The canister shall be capable of being sealed and shall have an inert cover gas leak rate of less than 10^{-4} atm/sec at the time of canister closure (if considered the outermost closure). After closure of the canister, canistered DOE SNF shall not contain or generate free gases X of greater than 22 psi.	Document sealing process per standard recommended procedure if using standardized canister. If unique canister, submit process by which canister is sealed, along with RW-0333P verification documentation.
Handling NUREG 0612 ANSI N14.6 DOE Order 6430.1A 1300-6.1&6.3 CRD 3.3.7.11	Handling equipment design shall be provided suitable for use in loading or unloading bar DOE SNF or canistered DOE SNF from a transportation cask or waste package.	Include design and operating procedures for handling requirements/equipment as part of data package, addressing specific requirements and regulations governing design.
Identification 10 CFR 60.135(b)(4) CRD 3.3.1.1.A	Canister shall be designed to permit use of an NRC tamper-safe seal	Include identification process in data package and the method used to read canister identification.

APPENDIX B: COLD VACUUM DRYING FACILITY

B. 1 INTRODUCTION

The Cold Vacuum Drying (CVD) process is one step in the removal of SNF from the K Basins to storage in the 200 Area on the Hanford Site. The CVD process constitutes fuel "conditioning" and will potentially be the final conditioning process prior to final disposition of the SNF from the K Basins. This appendix defines the detailed CVD SSCs and activities requiring application of the QARD requirements and the rationale for their selection.

The SSCs and activities identified in this appendix will be documented and maintained within Q-Lists per procedures defined in AP-11-012, "Development and Maintenance of OCRWM QARD Q-Lists". Additionally, CVDF Design Requirement Document, HNF-SD-SNF-DRD-002, will reflect the requirements identified in this appendix.

B. 2 CVD PROCESS REVIEW

As identified in Table 3-1 of this document, the high level CVD Facility (CVDF) SSCs and activities requiring application of the QARD requirements include the following, due to there ability to affect repository acceptance as identified in guidance established in DOE/SNF/REP-009:

- Equipment that ensures adequacy of water removal from an MCO at the CVDF, and that site safety bases requirements are satisfied for limiting particulate generation.
- Process validation tests/operational tests, where necessary to demonstrate adequacy of process conditions for removal of water from MCO and for limiting particulate generation.
- Equipment acquisition, and acceptance (specification, calibration, etc.), where necessary to ensure adequacy of water removal from the MCO and that site safety bases requirements are satisfied for limiting particulate generation.
- CVD process design specifications, design, design analyses, and design verification, to the specifications, where necessary to assure adequacy of water removal from the MCO and that site safety bases limits are satisfied for particulate generation.
- Measures to ensure non-approved materials are not introduced into MCO.
- Data developed by CVD that are also needed by OCRWM as identified in formal direction from RL.

The CVDF process flow diagram (H-1-81116) and other project documentation (i.e., final product specification, etc.) were reviewed based on the high level SSCs and activities identified in Table 3-1 and additional guidance provided in Section 2.0 of this document to determine which detailed SSCs and activities within the CVDF Project require application of the QARD requirements.

B.2.1 MCO Free Water Removal

A test will be completed at the CVDF to determine if free water has been sufficiently removed from the MCO. The test will measure the MCO internal pressure at a specified temperature. This information and the analysis (HNF-SD-SNF-TM-001) that documents the correlation of temperature and pressure to water content in the MCO will be used to determine if the fuel in the MCO has met the "no free liquid" criteria. The pressure and the temperature instrumentation will be procured and/or certified with QARD requirements. The analysis and procedures (to be developed for this acceptance test will be prepared and issued per QARD requirements.

B.2.2 Gas Generation

A second test will correlate pressure and time with an analysis to determine if the MCO with fuel is ready to be shipped to the CSB. The pressure and temperature instrumentation will be procured and/or certified to QARD requirements. The analysis (HNF-SD-SNF-TM-001) and procedures (to be developed) will be reviewed and approved in compliance with QARD requirements.

B.2.3 Particulate Generation

The SNF in the MCO will be received at the CVDF immersed in water and some particulate (i.e., corrosion products) will be present in the MCO upon receipt. During the process of removing the water, the SNF will be heated up and this will result in additional production of corrosion products.

Bounding analysis documentation (HNF-SD-W441-CN-001 and HNF-SD-SNF-TM-001) shows that the generated particulate will not exceed the final corrosion product generation as identified in the safety basis (HNF-SD-SNF-SAR-002). These analyses will be reviewed and approved with the appropriate oversight to meet the QARD requirements. Analyses, tests, inspections, etc. that establish the amount of particulate in the MCO at receipt at the CVDF will be performed commensurate with the QARD requirements by other SNF subprojects (i.e., characterization, FRS, etc.) and will be addressed within their respective appendixes to this document.

B.2.4 Control of Non-Approved Materials

Helium gas will be used to purge the MCO after the water is removed. The MCO will be filled with helium prior to transfer to the CSB. Helium is the only material introduced into the MCO while at the CVDF. The helium gas, contained within tube trailers, will be procured from a qualified vendor and verified with acceptance documentation and receipt inspection, prior to acceptance at the CVDF. Approved procedures will be used to change out the helium tube trailers as required during the operational life of the CVDF. Prior to startup of the facility, the lines will be purged with helium and sample taken at the MCO connection. These activities will be documented and follow QARD requirements, to show that during the operation at the CVDF non-approved material will not be introduced into the MCO.

B.3 EQUIPMENT REQUIRING APPLICATION OF QARD REQUIREMENTS

Instrumentation that will be procured, using the QARD requirements or a dedication to QARD requirements are as follows:

- two total pressure indicators (PT-1*08 and PT-1*10 as identified on H-1-82161) for each process skid;
- two temperature indicators (TIT-3*05 and TIT-3*12 as identified on H-1-82163) for each process skid;

The method for QARD application of the instrument loops is defined in Section B.5

B.4 ACTIVITIES REQUIRING APPLICATION OF QARD REQUIREMENTS

The following documentation will apply the QARD requirements:

- Analysis (HNF-SD-SNF-TM-001) and characterization test results () showing the correlation of pressure and temperature to water quantity in the MCO.
- Analysis (HNF-SD-W441-CN-001 and HNF-SD-SNF-TM-001) to show corrosion generation will not exceed safety basis limits.
- Design specification and design necessary to ensure adequacy of water removal and that particulate generation will not exceed site safety basis requirements.
- Validation plan for CVDF water removal strategy, test procedures, and test results.

- Operating procedures for CVDF drying.
- Operating procedures for helium hookup, receipt inspection records on helium purity, and helium purity sample data.
- Operating data records from PT-1*08 and PT-1*10, and TIT-3*05 and TIT-3*12.
- Calibration records for PI-1*08 and PI-1*10, and TIT-3*05 and TIT-3*12.

Data collected and controlled during the CVD drying process to show compliance with the QARD requirements will be summarized and inserted into each MCO data package (traveller) prior to shipping the respective MCO to the CSB, consistent with QARD requirements.

B.5 STRATEGY FOR QARD IMPLEMENTATION OF INSTRUMENT LOOPS

The CVD project has identified four instrument loops providing OCRWM data. The loops include instruments that measure, display and record Multi-Canister Overpack (MCO) vacuum pressure and Tempered Water (TW) temperature data. Figure B shows one of the two redundant pressure loops and one of the two TW temperature loops.

For the procurement of the field pressure instruments and the SCIC electronics, these items are designated Safety Significant due to their role in hydrogen control during the drying process. The Resistance Temperature Detectors (RTDs) and the electronics of the Monitoring and Control System (MCS) are designated general service, as a failure of these devices will not impact safety.

The strategy for the procurement of the non-safety, general service items is to "certify" the loop through extensive testing and calibration prior to use. The procurement will remain general service and off-the-shelf items will be procured, however, documentation indicating the field certification of the reading/printout shall be performed routinely.

B.6 REFERENCES

HNF-SD-SNF-DRD-002, 1997, *Cold Vacuum Drying Facility Design Requirements*, Rev. 1, Fluor-Daniel Hanford Incorporated, Richland, Washington.

HNF-SD-SNF-SAR-002, 1996, *Safety Analysis Report for the Cold Vacuum Drying Facility Phase I, Supporting Civil/Structural Construction* Rev. 1B, Fluor-Daniel Hanford Incorporated, Richland, Washington.

HNF-SD-SNF-TM-001, 1997, *Flowsheet Description for the Cold Vacuum Drying Facility Supporting the Spent Nuclear Fuel Project*, Rev. 0, Fluor-Daniel Hanford Incorporated, Richland, Washington.

HNF-SD-W441-CN-001, 1997, *Radionuclide Inventory of Bulk MCO Water at Cold Vacuum Drying Facility*, Rev. 0, Fluor-Daniel Hanford Incorporated, Richland, Washington.

H-1-81166, *SNF Project K Basin SNF Vacuum Drying Level 1 PFD*, Rev. 1.

H-182161, *Cold Vacuum Drying Facility Process Equipment Skid, P&ID MCO/Cask Interface*, Rev. 0.

H-1-82163, *Cold Vacuum Drying Facility Process Equipment Skid, P&ID MCO/Tempered Water System*, Rev. 0

FIGURE B
MCO PRESSURE TYPICAL INSTRUMENT LOOP

TEMPERED WATER TEMPERATURE TYPICAL INSTRUMENT LOOP

APPENDIX C: CHARACTERIZATION

The Characterization Program Management Plan (HNF 1998) provides documentation requirements for test and analyses results associated with fuel characterization. The SNF characterization reports that require application of the QARD are listed in Tables 1 and 2.

Table 1. Duke Engineering & Services Hanford, Inc. Reports to Be Qualified.

Report Number	Report Topic
I. Reports Completed	
WHC-SD-SNF-TI-012, Rev. 0	K East Basin Underwater Visual Fuel Survey
HNF-SD-SNF-TI-045, Rev. 0	Visual Examinations of K East Fuel Elements
HNF-SD-SNF-TI-046, Rev. 0	Visual Examinations of K West Fuel Elements
II. Reports in Preparation	
HNF-3589	Analysis of K West Fuel Internal Sludge and Surface Coating
HNF-3534	K Basin Spent Nuclear Fuel Characterization

Table 2. Pacific Northwest National Laboratory
Characterization Reports to be Qualified.

Report Number	Report Topic
I. REPORTS QUALIFIED	
PNNL-11438	Metallographic Examination of Damaged N Reactor Spent Nuclear Fuel Element SFEC5,4378
PNNL-11786	Dry Air Oxidation Kinetics of K Basin Spent Nuclear Fuel
PNNL-11806	Examinations of Surface Coatings Removed from K East Basin Fuel Elements
PNNL-11817	Drying Results of K Basin Fuel Element 1990 (Run 1)
PNNL-11818	Drying Results of K Basin Fuel Element 3128W (Run 2)
PNNL-11814	Spent Fuel Drying System Test Results (First Dry Run)
PNNL-11838	Spent Fuel Drying System Test Results (Second Dry Run)
PNNL-11844	Oxidation Rate of K Basin Spent Nuclear Fuel in Moist Air
PNNL-11820	Drying Results of K Basin Fuel Element 0309M (Run 3)
PNNL-11821	Drying Results of K Basin Fuel Element 5744U (Run 4)
PNNL-11896	Drying Results of K Basin Fuel Element 1164M (Run 6)
II. REPORTS COMPLETED UNDERGOING REVIEW	
PNNL-11816	Analysis of Ignition Testing on K West Basin Fuel
III. REPORTS IN PREPARATION	
PNNL-11841	Drying Results of K Basin Fuel Element 6603M (Run 5)
PNNL-11897	Drying Results of K Basin Fuel Element 2660M (Run 7)
PNNL-11969	Drying Results K Basin Fuel Element 6513U (Run 8)
TBD	Drying K West Internal Sludge and Surface Coatings

**APPENDIX D:
PROCESS ENGINEERING**

Process Engineering Documents requiring application of the OCRWM QARD are as follows:

Document Number	Document Title
HNF-SD-SNF-CN-017	Fuel Surface Area
HNF-SD-SNF-TI-020	SNF Project Recommended Reaction Rate Constants for Corrosion of N-Reactor Fuel
HNF-SD-W441-CN-001	SNF Inventory in Bulk MCO Water at the Cold Vacuum Drying Facility
HNF-SD-SNF-CN-006	Evaluation of Radiolytic Gas Generation from Water Dissociation in a Multi-Canister Overpack
HNF-1523	K Basins Particulate Water Content, Behavior, and Impact