S

ENGINEERING CHANGE NOTICE

1. ECN 655705

Proj. ECN

2. ECN Category (mark one)		3. Originator's Name, Organization, MSIN, and Telephone no.	4. USQ Required?	5. Date
Supplemental	[ ]	Bijan Gorpani, Mechanism Engineering, E6-15, 376-9259	~~[X]~~ Yes [X] No DRP 11-8-99	October 20,1999
Direct Revision	[X]			
Change ECN	[ ]	6. Project Title/No./Work Order No.	7. Bldg./Sys./Fac. No.	8. Approval Designator
Temporary	[ ]	Debris Removal Subproject	100 K / K Basin	E, S, Q, D
Standby	[ ]			
Supersedure	[ ]	9. Document Numbers Changed by this ECN (includes sheet no. and rev.)	10. Related ECN No(s).	11. Related PO No.
Cancel/Void	[ ]	WHC-SD-SNF-FRD-009, Rev. 0 (all sheets)	N/A	N/A

12a. Modification Work	12b. Work Package No.	12c. Modification Work Complete	12d. Restored to Original Condition (Temp. or Standby ECN only)
[ ] Yes (fill out Blk. 12b) [X] No (NA Blks. 12b, 12c, 12d)	N/A	N/A Design Authority/Cog. Engineer Signature & Date	N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change 13b. Design Baseline Document? [X] Yes [ ] No

This revision of the Functions and Requirements Document updates the approved Functions and Requirements for Debris Removal Subproject WHC-SD-SNF-FRD-009, Rev. 0. It has been revised in its entirety to reflect the current scope of work for Debris Removal as canisters and lids under the K Basin Projects work breakdown structure (WBS). In this revision the canisters and lids will be consider debris and a new set of Functions and Requirements have been developed to remove the canisters and lids from the basin.

USQ NOT REQUIRED PE NS-4-001 APPENDIX D EXCEPTION 2

DRP 11-8-99

14a. Justification (mark one)

Criteria Change	[X]	Design Improvement	[ ]	Environmental	[ ]	Facility Deactivation	[ ]
As-Found	[ ]	Facilitate Const.	[ ]	Const. Error/Omission	[ ]	Design Error/Omission	[ ]

14b. Justification Details

Due to the new WBS breakdown, Debris Removal Subproject has defined a new mission and scope of work for the debris. In order to reflect these changes new Functions and Requirements have been developed to remove the canisters and lids from the basin. (Also see 13a.)

15. Distribution (include name, MSIN, and no. of copies)

~~See attached distribution sheet.~~

D. Precechal x3-85
J. Muller x3-85
K. Basin file x3-85
C. Farwick x3-85

RELEASE STAMP

DATE: DEC 29 1999
STA: 4
HANFORD RELEASE
ID: 2

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): 655705

16. Design Verification Required	17. Cost Impact				18. Schedule Impact (days
	ENGINEERING		CONSTRUCTION		
[ ] Yes	Additional	[ ] $ N/A	Additional	[ ] $ N/A	Improvement [ ] N/A
[X] No	Savings	[ ] $ N/A	Savings	[ ] $ N/A	Delay [ ] N/A

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	[ ]	Spare 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 Procedures	[ ]	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	[ ]	N/A	[X]
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
N/A		

21. Approvals

Title	Signature	Date	Title	Signature	Date
Design Authority	D.R. Precechtel D. R. Precechtel	11/8/99	Design Agent		
Cog. Eng.	B. Gorpani B. Gorpani	11/8/99	PE		
Cog. Mgr.	F.J. Muller F.J. Muller	11/8/99	QA		
QA	J.I. Diehl John I. Diehl	11/8/99	Safety		
Safety	S.H. Peck S.H. Peck	11/9/99	Design		
Environ.	J.E. Turnbaugh J.E. Turnbaugh	11/8/99	Environ.		
Plant engineer	M.J. Langevin M.J. Langevin	11/8/99	Other		
ALARA	C.A. Bullock C.A. Bullock	11/8/99			
Operations	D.E. Bullock D.E. Bullock	11/9/99			

DEPARTMENT OF ENERGY

Signature or a Control Number that Tracks the Approval Signature. Dale H. Splett: 00-SFO-031

S

Functions and Requirements for Debris Removal System – Project A.2

D. R. Precechtel
Fluor Daniel Hanford, Inc., Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN:	ECN 655705	UC:	2000
Org Code:	2G400	Charge Code:	105516 / AJ60
B&R Code:	EW7002010	Total Pages:	~~31~~ 32 12.29.99.

Key Words: Functions and Requirements for Debris Removal, 100K, canisters, racks and technical baseline.

Abstract: This revision of the Functions and Requirements Document updates the approved Functions and Requirements for Debris Removal Subproject WHC-SD-SNF-FRD-009, Rev. 0. It has been revised in its entirety to reflect the current scope of work for Debris Removal as canisters and lids under the K Basin Projects work breakdown structure (WBS). In this revision the canisters and lids will be consider debris and a new set of Functions and Requirements have been developed to remove the canisters and lids from the basin.

TRADEMARK DISCLAIMER. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

Printed in the United States of America. To obtain copies of this document, contact: Document Control Services, P.O. Box 950, Mailstop H6-08, Richland WA 99352, Phone (509) 372-2420; Fax (509) 376-4989.

12/29/99

Release Approval Date

DATE: HANFORD RELEASE
STA: 4 ID: 3
DEC 29 1999
Release Stamp

Approved for Public Release

RECORD OF REVISION	(1) Document Number HNF-SD-SNF-FRD-009, Rev. 1	Page 1

(2) Title

Functions and Requirements for Debris Removal System – Project A.2

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change – Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr.	Date
Rev. 0	(7) Initial Release – EDT 616132	RM Yanochko	JC Womack	8/05/96
Rev. 1 RS	Complete revision PER 655705	B Gorpani 11-10-99	FJ Muller 11-9-99	11/08/99

HNF-SD-SNF-FRD-009
REVISION 1

SPENT NUCLEAR FUEL PROJECT

FUNCTIONS AND REQUIREMENTS FOR DEBRIS REMOVAL SYSTEM (Canisters and Lids Only)

NOVEMBER 1999

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 BACKGROUND 1
1.2 PURPOSE 1
1.3 TECHNICAL BASELINE AND APPROACH 1
2.0 OVERVIEW 3
2.1 MISSION STATEMENT 3
2.2 SCOPE 3
2.3 TECHNICAL BASELINE DEVELOPMENT 3
2.3.1 Technical Baseline Products 3
2.3.1.1 Debris Removal 3
2.3.2 Document Hierarchy 4
3.0 FUNCTIONS 6
3.1 FUNCTION HIERARCHY 6
3.2 FUNCTION DEFINITIONS 9
4.0 REQUIREMENTS 14
4.1 MISSION REQUIREMENTS 14
4.2 AUTHORIZATION BASIS 14
4.3 REQUIREMENT SOURCES 15
5.0 ARCHITECTURE 16
6.0 INTERFACES 19
7.0 ISSUES 21
8.0 ENABLING ASSUMPTIONS 22
9.0 STUDIES 23
10.0 GLOSSARY 24
10.1 ACRONYMS 24
10.2 DEFINITION 24
11.0 REFERENCES 26

FIGURES

Figure 2-1. Debris Removal Subproject Document Tree 5
Figure 3-1. Debris (Canister) Removal System Top-Level Function Hierarchy 7
Figure 3-2. Remove Debris (Canister), tsd. 2.1.1.1.2.7.4, Function Hierarchy 8
Figure 5-1. Debris (Canister) Removal System Architecture Hierarchy 17

TABLES

Table 3-1. Debris (Canister) Removal System Function Definition 9
Table 4-1. Debris (Canister) Removal System Requirements Summary 15
Table 5-1. Debris (Canister) Removal System Architecture 18
Table 6-1. DRS (CRS) Interface Description K West 19
Table 6-2. DRS (CRS) Interface Description K East 20
Table 7-1. Debris (Canister) Removal System Issues 21
Table 8-1. DRS (CRS) Enabling Assumptions 22
Table 9-1. Debris (Canister) Removal System Studies 23

1.0 INTRODUCTION

This document describes the functional requirement baseline for the Debris Removal System (DRS). This functional requirement baseline information consists of top-level functions, requirements, architect, interface, issues, and enabling assumptions.

During SNF removal, the Debris Removal Subproject (DRS) has been tasked to only remove the canisters in both K-East (KE) and K-West (KW) Basins and the canister lids in the KW Basin. In this document, the empty canisters in the K Basins and the canisters lids in the KW Basin are considered debris, and all other debris (rack, poles, equipment, etc.) will be dealt with as part of the Transition Project (see section 10.2 for a definition of debris). In this document, debris and canister/lids will be used interchangeably. The DRS will be the Canister Removal System (CRS). This will aid in coordinating this document with the higher technical baseline documents.

1.1 Background

Technical baseline information is derived from HNF-SP-1104, *Spent Fuels Multi-Year Work Plan* (MYWP), (FDH 1998a), The document describes the mission and programmatic functions and requirements (F&R) of the Spent Nuclear Fuel (SNF) project.

This F&R document further defines the overall SNF project technical baseline by developing the lower tier F&R for the CRS.

1.2 Purpose

The CRS function and requirement document identifies the functions, requirements, architecture, interfaces, issues, and assumptions applicable to the CRS. This document also:

- Defines the mission of the CRS.
- Defines the functions that the CRS needs to accomplish its mission, and document the requirements basis.
- Provides the basis for the development of the performance requirements baseline

The intent of this higher level F&R document is to support CRS activities so that additional function and requirement documents will not be required.

1.3 Technical Baseline and Approach

This F&R documentation has been developed to obtain concurrence of its technical baseline from the U. S. Department of Energy, Richland Operations Office (RL). The Debris Removal Subproject will develop a technical baseline in a manner that enables the maintenance of traceability to the Hanford Site mission, functions, and requirements. This F&R has been generated to comply with the requirements in the following documents:

1. HNF-3552, *Spent Nuclear Fuel Project Execution Plan,* Section 7.0, Engineering/Design., (FDH 1998b).

2. WHC-SD-SNF-SEMP-001, *System Engineering Management Plan,* Section 3.1, Integrated SNF Project Engineering Process, and Section 3.6.2, Functions and Requirements Documentation (WHC 1996a).

2.0 OVERVIEW

Section 2.0 provides an overview of the CRS.

2.1 Mission Statement

The mission of the CRS is to perform the canister removal and disposition activities in the K Basins to support SNF removal. The CRS provides the structure, system, and components for operations to perform the "remove debris" function (see Section 3.1).

2.2 Scope

The scope of the DRS includes the definition and acquisition of the CRS and necessary support to implement. The acquisition of the CRS includes design, fabrication, test, construction, qualification documentation, and training.

2.3 Technical Baseline Development

The initial functions and requirements analysis has been conducted to provide a hierarchy of F&R that support the development of traceable and defensible top-down system architecture. This architecture has been used to develop the work breakdown structure, providing integration with the cost and schedule baselines. The end goal is to generate appropriate performance specifications that contain the requirements for CRS activities.

2.3.1 Technical Baseline Products

A review of all existing technical baseline documents related to canister cleaning system was performed to help determine 1) required revision for existing technical documents, and 2) what documents are required to be developed. A document tree (shown in Figure 2-1) graphically displays the CRS technical baseline documents. Following is a review of existing and future technical baseline documents:

2.3.1.1 Debris Removal

1. WHC-SD-SNF-FRD-009, *Functions and Requirements for Debris Removal Subproject*, Rev. 0 (Yanachko, 1997) – This document identifies the functions, requirements, architecture, interfaces, decisions, and alternatives applicable to the DRS. This is the top-level technical baseline document covering all cooling-pool debris removal activities.

   Document Review – This document is being updated to delete those debris activities related to the Transition Project. This revised document will be updated to include all F&Rs for canister and lid removal from the basins.

2. WHC-SD-SNF-FRD-018, *Functions and Requirements for Debris Removal from 105-KE Basin South Loadout Pit*, Rev 0 (Crystal, 1995) – This document provides the functions and requirements associated with cleanup of the 105 KE Basin south loadout pit in support of fuel retrieval.

   Document Review - This is a sub-tier document to WHC-SD-SNF-FRD-009.that will be part of the SNF removal technical baseline. The document will remain in the technical baseline supporting SNF removal from the Basins.

3. HNF-SD-SNF-FRD-021, *Functions and Requirements for the Dummy Elevator Pit Debris Removal Project at the 105 KE Basin*, Rev. 1 (Huisingh, 1997). The dummy elevator pit debris removal system moves sludge from the dummy elevator pit to the weasel pit; removes and disposes of debris in the dummy elevator pit, debris at the entry to the weasel pit, debris presently located in the 105 KE Fuel Storage Basin, fuel storage hangers, and sufficient amounts of other debris to allow the removal of sludge and fuel from the Basins. This document provides F&R and operating criteria.

   Document Review – This is a sub-tier document to WHC-SD-SNF-FRD-009 that will be part of the SNF removal technical baseline. This document will remain in the technical baseline supporting SNF removal from the Basins.

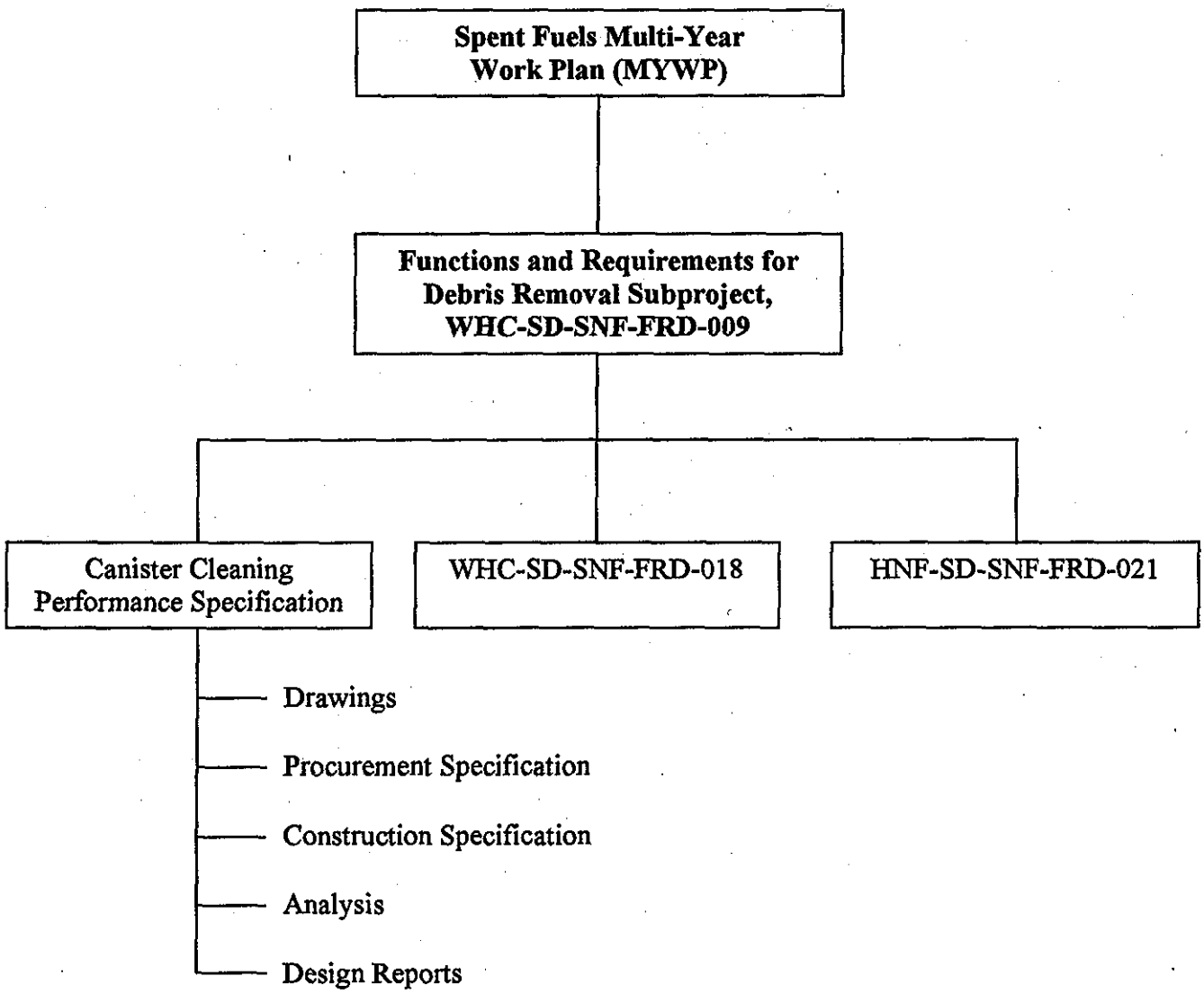
4. Debris-Related SNF Removal Documentation – Any new debris removal documentation associated with SNF removal activities will be developed from the DRS F&R database. New debris-related Debris Removal Subproject documentation would be provided in a specification format.

   Document Analysis - New technical documentation will, as a minimum, be specifications, such as for the canister cleaning system. New specification(s) may be identified as the technical baseline develops.

2.3.2 Document Hierarchy

Debris Removal Subproject products and documentation are shown in Figure 2-1. The figure displays the results of the document analysis and identifies other DRS products and associated documents. The product tree displays the deliverable systems and documents required for compliance with the CRS scope in support of fuel removal (i.e., canisters and lids). This product tree is an expansion of the SNF Project Product Tree, Figure 8-2, contained in WHC-SD-SNF-SD-005, *Spent Nuclear Fuel Project Technical Baseline, Fiscal Year 1996*, (WHC 1996b). This product tree will be updated as the Debris Removal Subproject baseline develops.

Figure 2-1. Debris Removal Subproject Document Tree



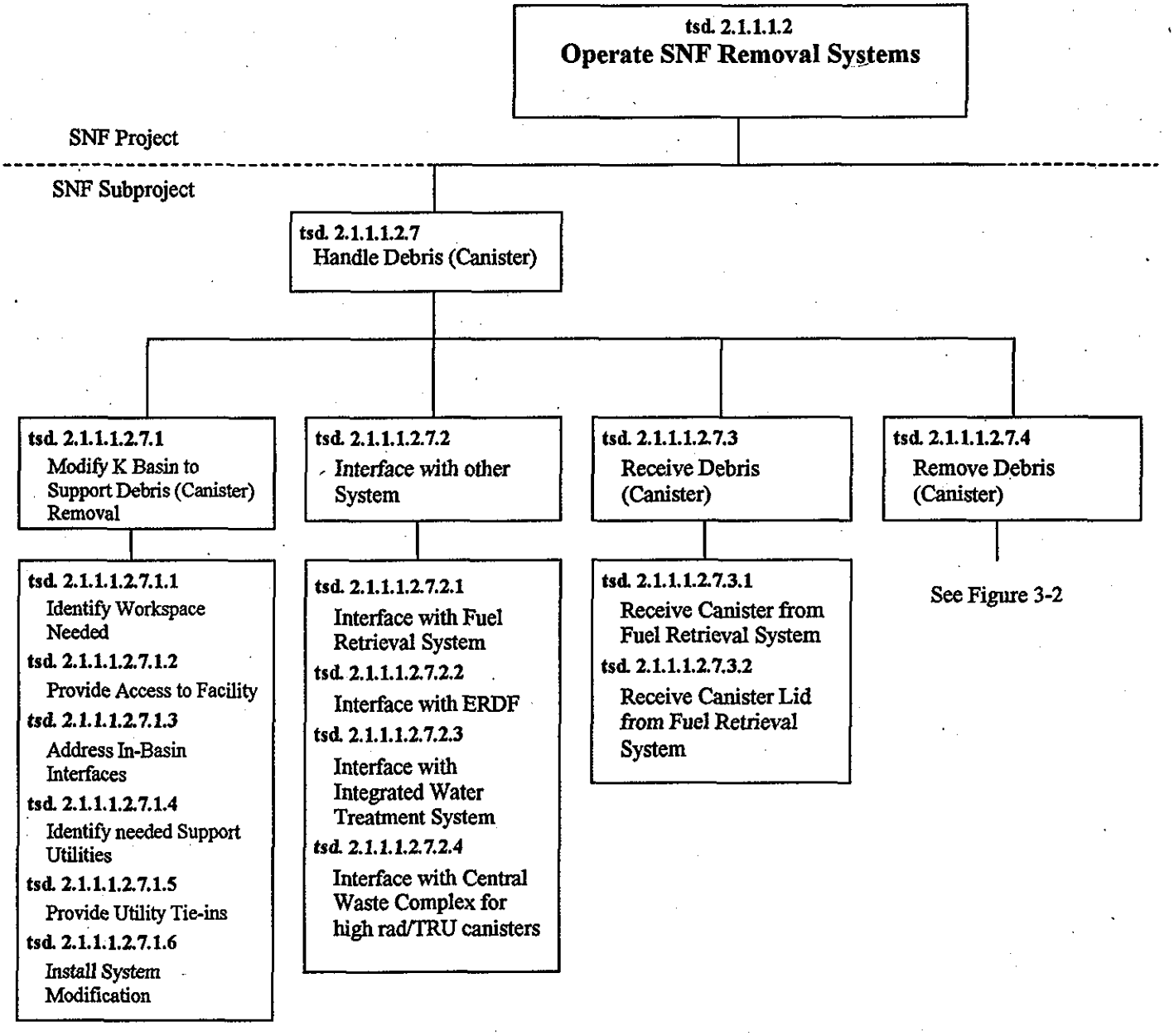
3.0 FUNCTIONS

Section 3.0 provides the CRS functional analysis results. The functional analysis was performed to meet the intent of SEP-3.0, *System Function Definition,* (WHC 1995a).

3.1 Function Hierarchy

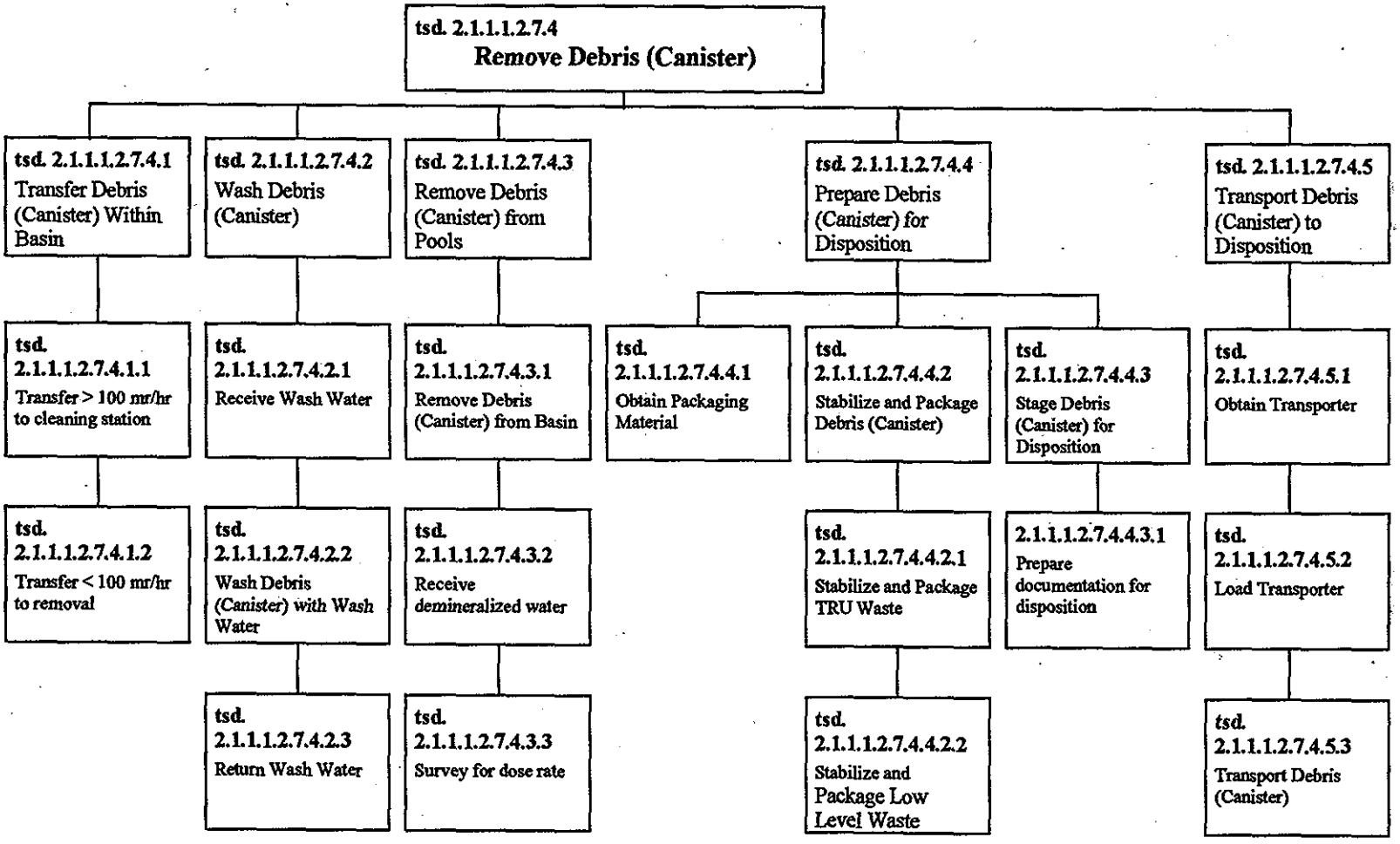
HNF-SP-1104, *Spent Fuels Multi-Year Work Plan* (MYWP), (FDH 1998a), contains the top-level functional breakdown for the SNF Project treatment, storage, and disposal (tsd) function. The Debris Removal Subproject executes function tsd. 2.1.1.1.2 Operate SNF Removal Systems, which acquires the system necessary to execute function tsd. 2.1.1.1.2.7 Handle Debris (Canister). This function decomposition (hierarchy) is depicted in Figure 3-1, and 3-2.

Figure 3-1. Debris (Canister) Removal System Top-Level Function Hierarchy



Note: During Fuel Retrieval, the Canisters in both Basins and Canister's Lids in K West Basin are considered Debris for the Debris Removal Subproject.

Figure 3-2. Remove Debris (Canister), tsd. 2.1.1.1.2.7.4, Function Hierarchy



Note: During Fuel Retrieval, the Canisters in both Basins and Canister's Lids in K West Basin are considered Debris for the Debris Removal Subproject.

3.2 Function Definitions

The system function definitions are provided in Table 3-1. This table is the dictionary for subproject system functions, presenting the number, title, and definition.

Table 3-1. Debris (Canister) Removal System Function Definition

Function Number	Function Title and Definition
tsd. 2.1.1.1.2	Operate SNF Removal Systems Perform the Remove, Repackage, and Dry K Basins SNF functions. Includes operation of the Fuel Removal and supporting Systems including: MultiCanister Overpacks, Cold Vacuum Drying, Cask Transportation, Dose Reduction, Debris Removal and IWTS. This function includes all activities necessary to support removal of the K Basins SNF and repackaging into Multi-Canister Overpacks (MCOs) for downstream fuel handling and storage, including fuel retrieval, MCO, cask/transportation, facility upgrades, Integrated Water Treatment System (IWTS), and Cold Vacuum Drying. The SNF retrieval process, located within each Basin pool, removes fuel elements from existing canisters cleans them, and loads them into separate baskets prior to placement in the MCO. The MCO will provide primary confinement for fuel elements during transport, conditioning, and storage. The cask/transportation system will be utilized to load tier baskets into MCOs and transfer the loaded MCO/cask to the CVD facility and to the CSB. This function includes activities necessary for drying the fuel to remove free water from MCOs containing K Basins SNF to enable safe transport to and staging in the CSB. This function includes activities necessary to treat water contained in the basins to maintain water quality and safe conditions within the K Basins. This function includes transferring the full or empty package (MCO, cask) between the K Basins facility, CVD and the CSB. Also included are all steps required to declare facility and system readiness. Includes trained and qualified staff to perform required tasks for processing and storage of SNF.
tsd.2.1.1.1.2.7	Handle Debris (Canister) Perform all debris-related activities required to meet end point criteria. Perform activities associated with fuel retrieval.
tsd. 2.1.1.1.2.7.1	Modify K Basin to Support Debris (Canister) Removal Modify the K Basin facilities and systems to enable installation and operation of the DRS (CRS).
tsd. 2.1.1.1.2.7.1.1	Identify Workspace Needs Identify space in the basin required for the placement of DRS (CRS).

Function Number	Function Title and Definition
tsd. 2.1.1.1.2.7.1.2	Provide Access to Facility Minimize impact to operations and maintenance personnel who routinely work in the facility. This includes changeout facilities, offices, restroom facilities, and lunchrooms.
tsd. 2.1.1.1.2.7.1.3	Address In-Basin Interference Clear any objects in the pools, which may obstruct debris (canister) removal systems and equipment installation and operation.
tsd. 2.1.1.1.2.7.1.4	Identify Needed Support Utilities Determine utilities needed to support debris removal activities while also supporting other basin operations and maintenance work. Includes water, air, and power.
tsd. 2.1.1.1.2.7.1.5	Provide Utility Tie-Ins Provide tie-ins for utilities needed by debris removal systems.
tsd. 2.1.1.1.2.7.1.6	Install System Modifications Perform modifications to the K Basin system to accommodate debris (canister) removal systems.
tsd. 2.1.1.1.2.7.2	Interface with Other Systems Provide interfaces with other systems.
tsd. 2.1.1.1.2.7.2.1	Fuel Retrieval System Interface Provide debris (canister) removal system specific interface with FRS.
tsd. 2.1.1.1.2.7.2.2	ERDF Interface Provide debris (canister) removal system specific interface with ERDF.
tsd. 2.1.1.1.2.7.2.3	Integrated Water Treatment System Interface Provide debris (canister) removal system specific interface with IWTS.
tsd. 2.1.1.1.2.7.2.4	Central Waste Complex Interface Interface with Central Waste Complex for high rad/TRU canisters.
tsd. 2.1.1.1.2.7.3	Receive Debris (Canister) Receive debris (canister) from SNF retrieval operations.
tsd. 2.1.1.1.2.7.3.1	Receive Canisters form Fuel Retrieval System Receive canister obtained during the separation of fuel from storage containers.
tsd. 2.1.1.1.2.7.3.2	Receive Canister Lids from Fuel Retrieval System Receive canister lid obtained during the opening of fuel canisters in the KW Basin.

Function Number	Function Title and Definition
tsd. 2.1.1.1.2.7.4	Remove Debris (Canister) Provide for the cleaning removal, packaging, and dispositioning of debris from K Basins. Include necessary identification, preparation, staging, monitoring, controls, removal operations, waste container acquisition, packaging material acquisition, loading, container transporter acquisition, and transportation activities. Provide for all activities to enable final disposition of retrieved debris. Arrange for and obtain the necessary load transporters, loading, and transportation of debris as waste.
tsd. 2.1.1.1.2.7.4.1	Transfer Debris (Canister) Within Basin Transfer debris (canister) to process stations within the cooling pools as required.
tsd. 2.1.1.1.2.7.4.1.1	Transfer Canisters Dose rate > 100 mr/hr to cleaning station.
tsd. 2.1.1.1.2.7.4.1.2	Transfer Canisters Dose rate < 100 mr/hr to removal.
tsd. 2.1.1.1.2.7.4.2	Wash Debris (Canister) Wash debris (canister) to meet as-low-as-reasonably-achievable (ALARA) goals and waste packaging criteria.
tsd. 2.1.1.1.2.7.4.2.1	Receive Wash Water Receive wash water from the integrated water treatment system.
tsd. 2.1.1.1.2.7.4.2.2	Wash Debris (Canister) with Wash Water Wash debris (canister) to remove sludge and other constituents, which would make the debris (canister) unacceptable for disposal as solid waste.
tsd. 2.1.1.1.2.7.4.2.3	Return Wash Water Return used wash water back to the integrated water treatment system as required.
tsd. 2.1.1.1.2.7.4.3	Remove Debris (Canister) from Pools Remove debris (canister) from the K Basin cooling pools for packaging.
tsd. 2.1.1.1.2.7.4.3.1	Remove Debris (Canister) from Basin Lift debris (canister) out of the basin water. Place debris (canister) in a staging area for packaging.
tsd. 2.1.1.1.2.7.4.3.2	Receive Demineralized Water Wash debris with demineralized water from existing decontamination hose bibs.

Function Number	Function Title and Definition
tsd. 2.1.1.1.2.7.4.3.3	Survey for Dose Rate Perform radiological surveys, assays, etc., to enable debris (canister) to be brought out of pool. If surveys < 100 mr/hr remove debris (canister), if surveys > 100 mr/hr return for cleaning, and if surveys > 140 mr/hr treat as TRU Waste.
tsd. 2.1.1.1.2.7.4.4	Prepare Debris (Canister) for Disposition Package retrieved debris (canister) to enable handling and transportation to final disposal. Obtain the necessary packaging materials, waste containers, reusable debris (canister) containers, debris (canister) preparation, and container loading. Identify packaging material needs, acquire packaging materials, verify packaging material inventory, deliver packaging, and stage packaging materials.
tsd. 2.1.1.1.2.7.4.4.1	Obtain Packaging Material Arrange, obtain, store, stage, etc., containers and packaging materials in support of debris (canister) packaging and disposition activities.
tsd. 2.1.1.1.2.7.4.4.2	Stabilize and Package Debris (Canisters) Perform activities necessary to ensure the debris (canister) is acceptable as solid waste.
tsd. 2.1.1.1.2.7.4.4.2.1	Stabilize and Package TRU Waste Stabilize TRU waste as required for acceptability as solid waste. Packaging TRU waste in the provided containers. This assumes that TRU toxic waste can be deposed of as TRU waste since the standards for disposal of TRU waste are more rigorous than those for the disposal of toxic waste.
tsd. 2.1.1.1.2.7.4.4.2.2	Stabilize and Package Low-Level Waste Stabilize low-level waste as required for acceptability as solid waste. Package low-level waste in the provided containers.
tsd. 2.1.1.1.2.7.4.4.3	Stage Debris (Canister) for Disposition Stage filled debris (canister) containers in preparation of loading and transportation. Handle, move, and position containers and make notifications.
tsd. 2.1.1.1.2.7.4.4.3.1	Prepare Documentation for disposition Prepare all required documentation for disposition.
tsd. 2.1.1.1.2.7.4.5	Transport Debris (Canister) to Disposition Provide for all activities enabling final disposition of retrieved debris (canister).
tsd. 2.1.1.1.2.7.4.5.1	Obtain Transporter Arrange for and obtain the necessary transporters.

Function Number	Function Title and Definition
tsd. 2.1.1.1.2.7.4.5.2	Load Transporter Arrange for and obtain the necessary loading of debris (canister).
tsd. 2.1.1.1.2.7.4.5.3	Transport Debris (Canister) Prepare the necessary transfer documentation and supporting data, make the necessary notifications. Ship the waste containers to the disposal and/or storage site.

4.0 REQUIREMENTS

This section identifies the CRS requirements. The baseline management system (BMS) database contains the requirement definition. Requirements are derived from various source materials including federal and state regulations and standards; DOE orders, directives, and implementing procedures; formal agreements; customer, contract, and organizational policies and procedures; external project interface requirements; system requirements; design requirements; etc. The source of requirements for the CRS is in HNF-SP-1104, *Spent Fuels Multi-Year Work Plan* (MYWP), (FDH 1998a).

4.1 Mission Requirements

Top-level mission requirements are used as the primary or "driver" requirement Debris Removal Subproject requirement analyses. This section lists top-level mission requirements and sources for the Debris Removal Subproject. Mission requirements include requirements derived from the Hanford Strategic Plan (HSP) interim and final end points as well as:

1. Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan, DOE/EIS-0222D.

2. Hanford Site Environmental Management Specification, DOE/RL-97-55, section 3.4 Requirement References, and section 4.2.3 SNF Mission Area.

3. Contract No. DE-AC06-96RL13200, Modification M071.

4. Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement), Revision 5, DOE/RL-89-10.

4.2 Authorization Basis

The Debris Removal Subproject will manage all activities in accordance with approved Authorization Basis documents and approved standards/requirements identification documents (S/RID).

- K Basin Safety Analysis Report, WHC-SD-SNF-WM-062, and any approved amendments thereto.

- K Basins Technical Safety Requirements, WHC-SD-SNF-TSR-001, and any approved amendments.

4.3 Requirement Sources

The S/RIDs and the following list of other requirement source documents define the requirements document set to be applied to the CRS functions.

Table 4-1. Debris (Canister) Removal System Requirements Summary

Requirement Source	Requirement Source Documents
1.0	DNFSB 94-1, Defense Nuclear Facilities Safety Board Recommendation 94-1 Implementation Plan (Requirement 14.0 only).
2.0	DOE Letter 95-AMW-003, Approval of Spent Nuclear Fuel (SNF) Path Forward Recommendation, February 14, 1995 (Requirement 84.0 only).
3.0	DOE Letter 95-SFD-167, Implementation of the K Basins Spent Nuclear Fuel Project Regulatory Policy, September 12, 1995 (Requirement 8.0 only).
4.0	DOE/RL-93-102, Fiscal Year 1995 Hanford Mission Plan, Volume 1 Site Guidance, September 1994 (Requirement 82.0 only).
5.0	SNF-RD-PM-001 Rev 0, Spent Nuclear Fuel Program Requirements Document, Revision 0 (Requirement 103.0 only)
6.0	DOE Order 6430.1A – General Design Criteria
7.0	10 CFR 835 – Occupational Radiation Protection
8.0	DOE/EH0256T(940431) – U.S. Department of Energy Radiological Control Manual
9.0	BHI-00139 – Environmental Restoration Disposal Facility Waste Acceptance Criteria

5.0 ARCHITECTURE

The system architecture defines the physical configuration and sub-elements selected to complete the functions to be performed. This section describes the general characteristics of the CRS and its components.

The CRS architecture was chosen based on the need for a system to perform the functions described in Section 3.0 to meet the requirements described in Section 4.0. The architecture hierarchy of the CRS is shown in Figure 5-1. The architecture descriptions for the Debris Removal Subproject are contained in Table 5-1. Unless indicated, equipment will be both in the KE Basin and the KW Basin. In Figure 5-1 and Table 5-1, the "D-C" designation identifies a component of the CRS.

Figure 5-1. Debris (Canister) Removal System Architecture Hierarchy

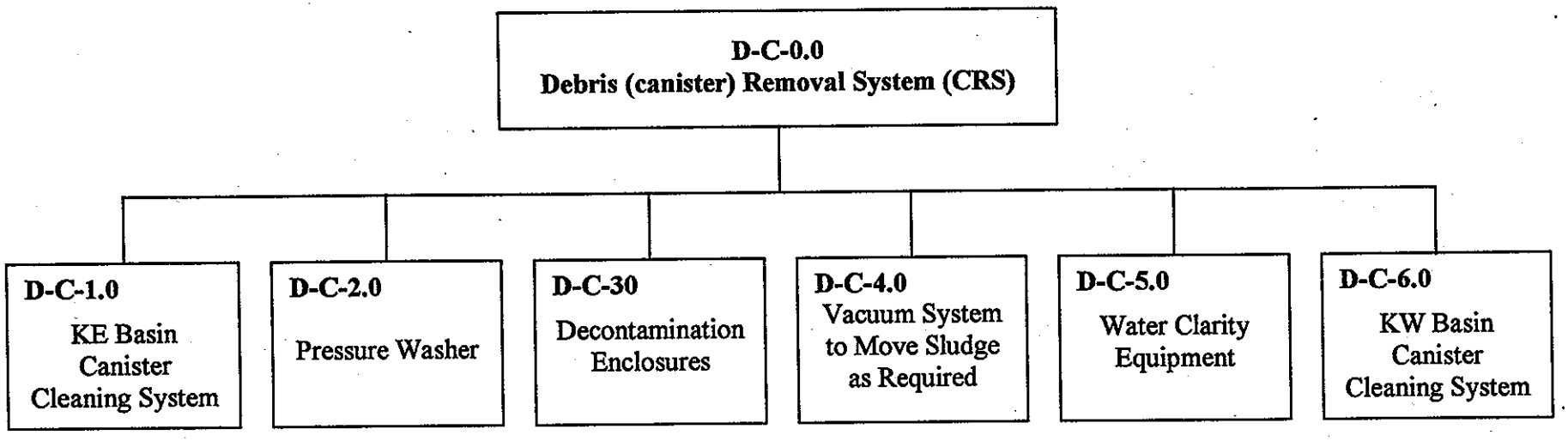


Table 5-1. Debris (Canister) Removal System Architecture

Architecture Number	Architecture Title and Description	Status
D-C-0.0	Debris (Canister) Handling System. This system performs all debris (canister)-related activities required to meet end-point criteria. It performs activities associated with supporting fuel removal, and removal of canisters from both Basins and canister lids from KW Basin.	In progress
D-C-1.0	KE Basin Canister Cleaning System. This system has been installed in the KE Basin and uses basin water for cleaning to avoid water inventory increases in the basin. Debris (canister) was washed with the high-pressure water jet wash prior to removal from the Basin water. This water jet washing has been conducted below the surface of the basin water to minimize exposure of personnel.	This system has been set up in KE Basin and a number of canisters have been cleaned and disposed of. This system will be modified before it is used for the next campaign of cleaning.
D-C-2.0	Pressure Washer. A portable under water spraying system for removal of loose sludge and contamination from debris (canister).	This system has been set up in KE Basin: Baseline for KW Basin
D-C-3.0	Decontamination Enclosures. Decontamination enclosures with exhaust air filtered with dedicated high-efficiency particulate air (HEPA) filters will be erected at the work sites. These facilities will be primarily used to control airborne contamination.	This system has been set up in KE Basin. Baseline for KW Basin.
D-C-4.0	Vacuum System to Move Sludge as Required. Sludge removal systems to move sludge will be utilized to facilitate debris (canister) removal where this proves to be the most practical solution. This equipment consists of the Wilden pumping system and the Tri-Nuclear pumping system. Both systems will be used depending on the need at the basin.	This system has been set up in KE Basin. Baseline for KW Basin.
D-C-5.0	Water Clarity Equipment. For some situations, the Tri-Nuclear pump will be utilized to assist the basin systems in maintaining water clarity.	This system has been set up in KE Basin.
D-C-6.0	KW Basin Canister Cleaning System A combination of mechanical and pressure washing systems for canister cleaning in the K West Basin.	On going. This system will be designed, fabricated, and installed in KW Basin.

6.0 INTERFACES

External subproject interfaces are documented on interface agreement coversheet/interface scope sheets. The SNF project interface control database lists all the SNF Project external and internal (subproject to subproject) interfaces, including those involving the Debris Removal Subproject. The SNF project Level 0 and Level 1 process flow diagram (PFD) (WHC 1995b) graphically portray the process-related Debris Removal Subproject interfaces. The CRS interface description is shown in Table 6-1, and 6-2.

Table 6-1. DRS (CRS) Interface Description – K West

KW Interface Control			
Interface Control Number	**Interface Description**	**From Drawing Number**	**To Drawing Number**
IC-022	Fuel Canister From Fuel Retrieval System	H-1-81164, sh-1	H-1-81163,* sh-1
IC-038	Transport to Solid Waste Burial	H-1-81162, sh-1	N/A
IC-039	Transport to Solid TRU Storage	H-1-81162, sh-1	N/A
IC-040	Solid Waste Path out of KW Basins in Support of Debris (Canister) Removal Sub-Project Activities	H-1-81163, sh-1	H-1-81162,* sh-1
IC-042	Clear, Deionized Wash Water from KW Water Treatment to Debris (Canister) Removals High Pressure Cleaning Pumps	H-1-81161, sh-1	H-1-81163*, sh-1
IC-051	Contamination Control Water KW Debris (Canister) Removals Canister Cleaning Enclosure to KW Water Treatment System	H-1-81163,* sh-1	H-1-81161, sh-1
IC-080	Canister Lid From Fuel Retrieval System	H-1-81164, sh-1	H-1-81163,* sh-1
IC-099	KW Basin TRU Solid Waste to K Basin Solid Waste Handling	H-1-81163,* sh-1	H-1-81162,* sh-1
IC-146	Ion Exchange Modules From KW Water Treatment System	H-1-81161, sh-1	H-1-81162,* sh-1
IC-177	Loadout Enclosure Water Treatment System	H-1-81155, sh-1	H-1-81163,* sh-1

Note: The "*" indicates where the IC number will appear on the PFD drawing.

Table 6-2. DRS (CRS) Interface Description – K East

KE Interface Control			
Interface Control Number	**Interface Description**	**From Drawing Number**	**To Drawing Number**
IC-015	Fuel Canister From Fuel Retrieval	H-1-81159, sh-1	H-1-81158,* sh-1
IC-023	KE Basin Debris Low-Level Solid Waste to KE Basin Solid Waste Handling	H-1-81158,* sh-1	N/A
IC-024	To KE Basin Water Treatment System	H-1-81158,* sh-1	H-1-81155, sh-1
IC-036	Transport to Solid Waste Burial	H-1-81156,* sh-1	N/A
IC-037	Transport to Solid TRU Storage	H-1-81156,* sh-1	N/A
IC-041	Clear, Deionized Wash Water from KE Water Treatment to Debris (Canister) Removals High Pressure Cleaning Pumps	H-1-81155, sh-1	H-1-81158,* sh-1
IC-097	KE Basin Debris (Canister) TRU Solid Waste, to KE Solid Waste Handling, Packaged as Solid Waste	H-1-81158,* sh-1	H-1-81156, sh-1
IC-098	KE Basin Debris (Canister) Mixed TRU Solid Waste, to KE Solid Waste Handling, Packaged as Solid Waste	H-1-81158,* sh-1	H-1-81156, sh-1
IC-176	Loadout Enclosure Supply from KE Water Treatment System	H-1-81158,* sh-1	H-1-81155, sh-1
IC-182	KE Debris (Canister) Mixed LLW to K Basin Solid Waste handling	H-1-81158,* sh-1	N/A
IC-183	KE Debris (canister) Mixed Toxic Solid Waste to K Basin Solid Waste Handling	H-1-81158,* sh-1	H-1-81156, sh-1
IC-209	Clear, Deionized Water from KE Water Treatment System to Debris (Canister) Removal Aqua Blaster Cleaning Pump	H-1-81155, sh-1	H-1-81158*, sh-1

Note: The "*" indicates where the IC number will appear on the PFD drawing.

7.0 ISSUES

Issues that have potential to impact technical, cost, and schedule baselines are identified below. These issues need resolution in order to achieve project success. Enabling assumptions may be needed depending on the status of the open issue and project status. Issues will be linked to appropriate project functions to identify ownership and enable project impact quantification.

Table 7-1. Debris (Canister) Removal System Issues

Issue Identification	Issue Description	Enabling Assumption	Assigned Function
I-1	Canisters not meeting low level dose requirements or non-TRU designations will require different removal and/or final disposition.	EA-3	tsd. 2.1.1.1.2.7.4.4 Prepare Debris (Canister) for Disposition
I-2	All off-normal canisters need to be cleaned by a manual canister cleaning system.	EA-6	None

8.0 ENABLING ASSUMPTIONS

This section identifies assumption made to enable project progress. These assumptions will need validation. Enabling assumptions are linked to project issues and trade studies, as appropriate. Trade studies may be used to support assumption validation. DRS (CRS) enabling assumptions are identified in Table 8-1.

Table 8-1. DRS (CRS) Enabling Assumptions

Assumption Identification	Enabling Assumption Description	Issue	Assigned Function
EA-1	The fuel retrieval system (FRS) will deliver the canisters or place them at a staging area	None	tsd. 2.1.1.1.2.7.3.1 Receive Canister from FRS
EA-2	The FRS will deliver the canister lids or place them at a staging area.	None	tsd. 2.1.1.1.2.7.3.2 Receive Canister Lids
EA-3	The canisters and canister lids are considered to be TRU or non-TRU.	I-1	tsd. 2.1.1.1.2.7.4.4 Prepare Debris (Canister) for Disposition
EA-4	The pressure under 10,000 psi will be sufficient for washing canisters based on previous work.	None	tsd. 2.1.1.1.2.7.4.2 Wash Debris
EA-5	A space for the connex. Boxes will be provided in the Basin.	None	tsd. 2.1.1.1.2.7.4.4 Prepare Debris for Disposition.
EA-6	Manual handling canister-cleaning system will be provided for the off-normal canister.	I-2	None

9.0 STUDIES

This section provides the supporting studies that are used to validate the assumption or will be used as technical bases for the requirements.

The enabling assumptions listed in section 8.0 will be addressed/validated during the design and fabrication work that will be prepared through the end of FY2000. CRS Studies are identified in Table 9-1.

Table 9-1. Debris (Canister) Removal System Studies

Studies Number	Studies Title
WHC-SD-SNF-DTR-001	*Development Test Report for the High-Pressure Water Jet System Nozzles*, 1995, DE&S Hanford, Inc., Richland Washington
WHC-SD-GN-ER-10006 Rev. 0	*K Basins Floor Loads and Calculations*, and associated ECN 604268, Westinghouse Hanford Company, Richland, Washington
WHC-SD-SNF-ATR-010	*Acceptance Test Report for the High-Pressure Water Jet System Canister Cleaning Fixture*, 1995, DE&S Hanford, Inc. Richland
WHC-SD-SNF-ES-013	*Debris Removal Engineering Process Evaluation – Engineering Study*, 1995, DE&S Hanford, Inc. Richland
WHC-SD-SNF-TI-019, Rev. 0	*Characterization of Empty Fuel Storage Canisters in the 105KE Basin,* Scientific Ecology Group. 1996

10.0 GLOSSARY

10.1 Acronyms

ALARA	As low as reasonably achievable
BMS	Baseline Management System
CRS	Canister Removal System
DOE	U. S. Department of Energy
DRS	Debris Removal System
F&R	Functions and Requirements
FDH	Fluor Daniel Hanford, Incorporated
FRS	Fuel Retrieval System
HSP	Hanford Strategic Plan
KE	K East
KW	K West
MYWP	Multi-Year Work Plan
PCB	Polychlorinated biphenyl
PFD	Process Flow Diagram
RL	U. S. Department of Energy, Richland Operations
S/RID	Standards/requirements identification document
SNF	Spent Nuclear Fuel
TSD	Treatment, storage, disposal
TRU	Transuranic
WHC	Westinghouse Hanford Company

10.2 Definition

Canister – Metal (aluminum or stainless steel) container used to store reactor fuel rods/elements. Canisters containing fuel are configured in a double-barrel shape.

Conditioning – Processing SNF by physical, chemical or mechanical means to prepare the SNF to meet predetermined requirements for safe and compliant storage or disposal. Does not include packaging.

Contamination – Radioactive and/or other hazardous material in any place where it is not desired, particularly where its presence may be harmful.

Debris – Any object in the Basin greater than .635 cm (.25 inches) in any physical dimension that is not physically attached to the Basin or any permanent structure within the Basin and is not used for any current or planned operations or maintenance activity. SNF is excluded from this definition. In this document, the empty canisters in both K Basins and the canisters lid in KW Basin are considered to be debris. All other debris (rack, poles, equipment, etc.) will be dealt during the Transition Project.

Function – Specific actions, activities, or processes that achieve or support the achievement of the mission. That which must be achieved by the collective effects of all constituent parts. It is synonymous with "purpose."

Interface – System boundary across which material, data, and/or energy passes.

Path Forward – Integrated activities to achieve a defined strategy for final disposition of SNF.

Requirement – A requirement is a description of a mandatory condition under which a function must be performed. Requirements define how well a function must perform. Requirements set limits on functions and also limits on the outputs from functions. Requirements are documented in technical specifications, statutes, regulations, Secretary of Energy Notices, DOE orders, RL Directives, or other official direction from the DOE customer.

Sludge – Any object located in the Basin less than .635 cm (.25 inches) in all physical dimensions, not physically attached to the Basin or any permanent structure within the Basin and is not used for any current or planned operations or maintenance activity.

Spent Nuclear Fuel – Nuclear fuel that has been withdrawn from a nuclear reactor following irradiation and the constituent elements that have not been separated by reprocessing.

Systems Engineering – T he systematic approach used to transform technical goals and objectives into an optimized, operational, physical system that achieves its mission. It is the iterative technical and management process applied throughout a system life cycle that produces and maintains a well-defined and documented system technical baseline.

Technical Baseline – The documented functions, requirements, and configuration from which the program will acquire an operational system. The technical baseline is maintained under configuration control and is the basis for technical performance measurement.

11.0 REFERENCES

Crystal, J. B. (1995), *Functions and Requirements for Debris Removal from 105 KE Basin South Loadout Pit*, WHC-SD-SNF-FRD-018, Revision 0, Westinghouse Hanford Company, Richland, Washington.

DOE/RL-89-10, *Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement)*, Revision 5.

DOE/RL (1999), *Hanford Site Environmental Management Specification*, DOE/RL-97-55.

FDH (1998a), HNF-SP-1104, *Spent Fuels Multi-Year Work Plan.*

FDH (1998b), HNF-3552, *Spent Nuclear Fuel Project Execution Plan.*

DOE/EIS-0222D, *Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan.*

DOE/RL-97-55, *Hanford Site Environmental Management Specification.*

Huisingh, J. S. (1997), *Functions and Requirements for the Dummy Elevator Pit Debris Removal Project at the 105KE Basin*, HNF-SD-SNF-FRD-021, Revision 1, Westinghouse Hanford Company, Richland, Washington.

Spent Nuclear Fuel Project, Administrative Procedure EN-6-021, *Interface Control Process*, Revision 0, July 1, 1999.

Tomaszewski, T. A. (1996), *Packaging Design Criteria for the K East Basin Sludge Transportation System*, WHC-SD-TP-PDC-035, Revision 0, Westinghouse Hanford Company, Richland, Washington

WHC (1995a), *SNF Project Level 0 Process Flow Diagram*, Drawing H-2-825868, Westinghouse Hanford Company, Richland, Washington.

WHC (1995b), *Hanford Site Systems Engineering Manual*, SEP-3.0, System Function Definition, Revision 0, Westinghouse Hanford Company, Richland, Washington.

WHC (1995c), *Hanford Site Systems Engineering Manual*, SEP-4.0, Requirements Identification & Allocation, Revision 0, Westinghouse Hanford Company, Richland, Washington

WHC (1995d), *Integrated Process Strategy for K Basins Spent Nuclear Fuel*, WHC-SD-SNF-SP-005, Westinghouse Hanford Company, Richland, Washington.

WHC (1995e), *Hanford Site Systems Engineering Manual*, WHC-IP-1117, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC (1995f), *Spent Nuclear Fuel Project Management Plan*, WHC-SD-SNF-PMP-011, Westinghouse Hanford Company, Richland, Washington.

WHC (1995g). *Spent Nuclear Fuel Project Technical Baseline Description Fiscal Year 1996*. WHC-SD-SNF-SD-005, Westinghouse Hanford Company, Richland. Washington.

WHC (1995h), *K Basin Standard and Requirements Identification Document*, WHC-SD-SNF-RD-001, Westinghouse Hanford Company, Richland, Washington.

WHC (1995i), *Hanford Site Systems Engineering Manual*, WHC-IP-0117, Westinghouse Hanford Company, Richland, Washington.

WHC (1995j), *Debris Removal Engineering Process Evaluation*, (Engineering Study), WHC-SD-SNF-ES-013, Westinghouse Hanford Company, Richland, Washington.

WHC (1996a), *Spent Nuclear Fuel Project, Systems Engineering Management Plan*, WHCSD-SNF-SE-MP-001, Revision 1, Westinghouse Hanford Company, Richland, Washington.

WHC (1996b), *Spent Nuclear Fuel Project Technical Baseline Fiscal Year 1996*, WHC-SD-SNF-SD-005, Revision 1, Westinghouse Hanford Company, Richland, Washington