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SEP 25 2000

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT 630622

2. To: (Receiving Organization)	3. From: (Originating Organization)	4. Related EDT No.:
SNF Project	SNF Project	~~NA~~ See box 8.
5. Proj./Prog./Dept./Div.:	**6. Design Authority/Design Agent/Cog. Engr.:**	**7. Purchase Order No.:**
Spent Nuclear Fuel Project	L. J. Olguin	NA
8. Originator Remarks:		**9. Equip./Component No.:**
For release.		NA
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15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	SNF-7081		0	Spent Nuclear Fuel Project Design Verification and Validation Process	NA	1	1	1

16. KEY

Approval Designator (F)	Reason for Transmittal (G)	Disposition (H) & (I)
E, S, Q, D OR N/A (See WHC-CM-3-5, Sec. 12.7)	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION
(See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
1	1	Design Authority L. J. Olguin	L. J. Olguin	9-22-00	x4-01
		Design Agent N/A			
1	1	Cog. Eng. T.B. Bergman	T.B. Bergman	9/22/00	X3-78
1	1	Cog. Mgr. L. J. Olguin	L. J. Olguin	9-22-00	x4-01
		QA N/A			
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(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN

18.	19.	20.	21. DOE APPROVAL (if required)
T.B. Bergman 9/22/00 Signature of EDT Originator / Date	N/A Authorized Representative for Receiving Organization / Date	L. J. Olguin 9-22-00 Design Authority/ Cognizant Manager / Date	Ctrl No. N/A ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	SNF Engineering	Date September 22, 2000
Project Title/Work Order		EDT No. 630622
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Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
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Central Files	A3-88	X			

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Rev. 0

Spent Nuclear Fuel Project Design Verification and Validation Process

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract D-AC06-96RL13200

P.O. Box 1000
Fluor Hanford
Richland, Washington

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Spent Nuclear Fuel Project Design Verification and Validation Process

Project No: SNF

Division: SNF

L. J. Olguin
Fluor Hanford, Inc.

Date Published
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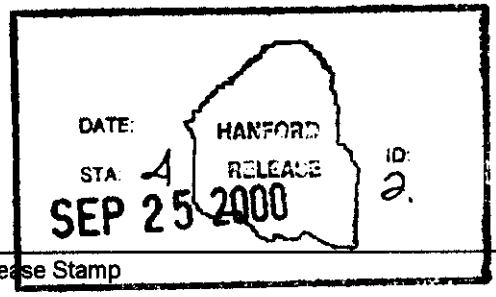
P.O. Box 1000
Richland, Washington

Fluor Hanford



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SNF-7081
REVISION 0

SPENT NUCLEAR FUEL PROJECT DESIGN VERIFICATION AND VALIDATION PROCESS

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Charge Code: 105351/B000
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Key Words: Spent Nuclear Fuel (SNF), Design Verification, Design Validation, Verification and Validation (V&V), Canister Storage Building (CSB), K Basin, Cold Vacuum drying (CVD), MCO Cask, Multi-Canister Overpack (MCO).

Abstract:
Design verification and validation activities implemented by the Spent Nuclear Fuel (SNF) Project included Design Verification Reports (DVRs) for each subproject, validation assessments for testing, and verification of the safety function of systems and components identified in the Safety Equipment List to ensure that the design outputs were compliant with the SNF Technical Requirements. Although some activities are still in progress, the results of the DVR and associated validation assessments indicate that Project requirements for design verification are being effectively implemented.

ACRONYMS

CSB	Canister Storage Building
CTFM	Cask and Transportation Facility Modifications
CTS	Cask and Transportation System
CVD	Cold Vacuum Drying
CVDF	Cold Vacuum Drying Facility
DA	Design Authority
DOE	U.S. Department of Energy
DEG	Deficiency Evaluation Group
DVR	Design Verification Report
DNFSB	Defense Nuclear Facilities Safety Board
ES&H	Environmental, Safety, and Health
FRS	Fuel Retrieval System
IWTS	Integrated Water Treatment System
MCO	Multi-Canister Overpack
SAR	Safety Analysis Report
SARP	Safety Analysis Report for Packaging
SEL	Safety Equipment List
SNF	Spent Nuclear Fuel
SSC	Systems, Structures, and Components

1.0 SUMMMARY

This document provides a description of design verification and validation activities implemented by the Spent Nuclear Fuel (SNF) Project. During the execution of early design verification, a management assessment (Bergman, 1999) and external assessments on configuration management (Augustenburg, 1999) and testing (Loscoe, 2000) were conducted and identified potential uncertainties in the verification process. This led the SNF Chief Engineer to implement corrective actions to improve process and design products. This included Design Verification Reports (DVRs) for each subproject, validation assessments for testing, and verification of the safety function of systems and components identified in the Safety Equipment List to ensure that the design outputs were compliant with the SNF Technical Requirements.

Although some activities are still in progress, the results of the DVR and associated validation assessments indicate that Project requirements for design verification are being effectively implemented. These results have been documented in subproject-specific technical documents (Table 2). Identified punch-list items are being dispositioned by the Project. As these remaining items are closed, the technical reports (Table 2) will be revised and reissued to document the results of this work.

2.0 BACKGROUND

In August 1993, the U.S. Department of Energy (DOE) performed a comprehensive baseline assessment of the environmental, safety, and health (ES&H) vulnerabilities associated with the storage of spent nuclear fuel. Environmental concerns voiced by the Hanford Advisory Board, regional tribal nations, the Defense Nuclear Facilities Safety Board (DNFSB), and others indicated the risks associated with the spent nuclear fuel stored in pools of water at the K Basins, located in the 100 Area along the shore of the Columbia River, were the top priority for resolution by the SNF Project. The highly corroded fuel stored in the K Basins continues to degrade as long as it remains wet. Since wet storage is more costly to maintain than dry storage, placing the K Basin fuel in dry storage is the desired outcome of this Project.

The SNF Project scope includes engineering design, procurement, construction management, operation, and maintenance. These activities are structured and managed to safely consolidate all Hanford spent nuclear fuel in the 200 Area in safe, cost effective, environmentally sound interim storage pending national decisions on ultimate disposition and transition to decommissioning and decontamination. The SNF Project was organized during the design and construction phase into subprojects. Table 1 provides a short description of the management strategy used to execute subproject requirements.

Each subproject was structured to address the unique characteristics of the applicable scope and procurement strategy. Due to the manner in which the subprojects were initially formulated, a risk-based execution strategy was adopted to conduct design, procurement, construction, and test activities concurrently. Although this added to the complexity of the management task, it was

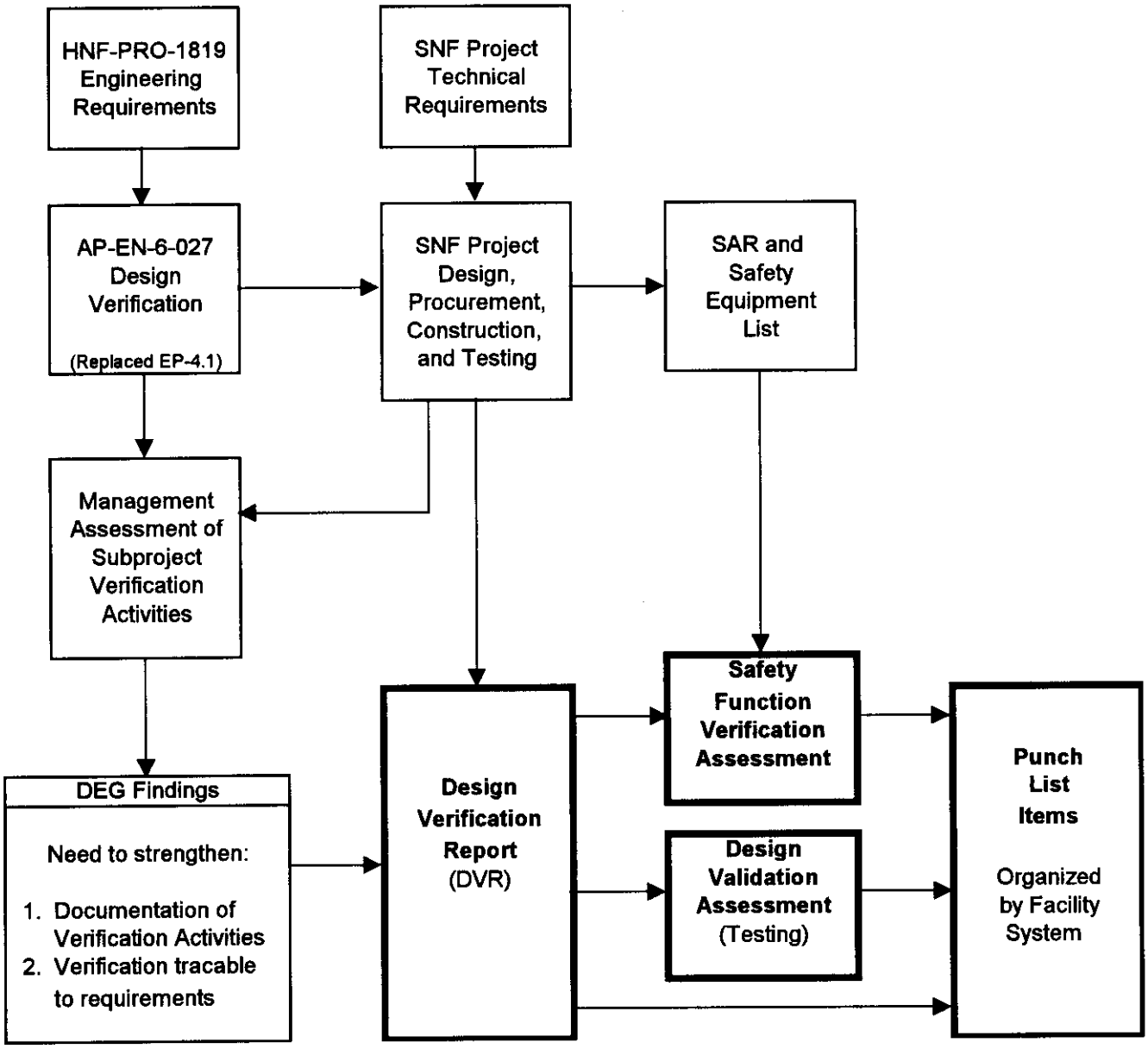
necessary given the pressing need to remove the fuel from the 100K storage basins. Consequently, the verification activities for the project were conducted accordingly. This introduced some risk into the traditional design verification process and resulted in the need for special controls to be imposed by the SNF Chief Engineer.

Table 1 - Management Strategies for SNF Subprojects

Subproject	Project Activities	Management Strategy
Storage (MCO, CTS)	Design and procure transport cask, cask transporter, MCO Loading System, MCO, and MCO baskets.	Self-procurement of major equipment and systems. Integration of MCO topical report and SARP with technical issue resolution activities and facility safety analysis activities.
Cold Vacuum Drying (CVD)	Design and construct a green-field facility and associated process systems.	Contracting of design and construction activities through subcontracts. Self-procurement of major equipment systems.
K Basins (FRS, IWTS, CTFM)	Conduct plant modification and restoration activities necessary to support installation and operation of new systems. Design, development, fabrication, and installation of fuel handling, cleaning, and removal systems necessary to remove fuel, sludge, and debris from K West Basins.	Both self-management and sub-contracting of design and construction planning. These activities require close integration with on-going plant operations and maintenance. Development of special processes and procedures for construction activity controls. Self-procurement and contracted procurement of major equipment systems.
Canister Storage Building (CSB)	Design and construct new facility adapted for use by SNF project from original conceptual design by the Hanford Waste Vitrification Plant. Design and fabricate MCO handling system and sampling and welding equipment.	Construction management through sub-contracts.

In May 1998, the SNF Chief Engineer chartered a management assessment of design verification activities conducted by the Subprojects. These were to be measured against the Project engineering procedures for Design Verification, which included applicable requirements from HNF-PRO-1819, *PHMC Engineering Requirements*. The relationship between these requirements documents is illustrated in Figure 1 along with a description of the SNF Project verification and validation process.

Figure 1 - SNF Design Verification and Validation



3.0 DESIGN VERIFICATION AND VALIDATION PROCESS

The Design Verification Management Assessment identified the need for improved traceability from design outputs to design requirements. It also indicated that the planning and documentation on the subprojects design verification needed to be strengthened.

3.1 Design Verification Report

The resulting Deficiency Evaluation Group (DEG) process identified corrective actions for all SNF subprojects. These included the preparation of Design Verification Reports (DVRs) to document traceability for subproject designs and applicable design requirements. These were developed as compliance matrices providing a comprehensive list of design requirements. They also provided a designation of the verification method(s) used to verify the requirements and applicable reference documents used to validate the verification action(s). Approved design verification methods are defined in SNF Project Procedures (SNF 1999) and typically consist of informal reviews, alternate calculations, qualification (and other) testing, informal reviews, and formal reviews.

3.2 Validation Assessments

The SNF Chief Engineer determined that validation of some of the completed verification activities (reviewed by the DVR work) should be carried out. This was based on two perspectives. First, an RL assessment of SNF testing activities (Loscoe, 2000) indicated a need for stronger control by engineering in test activities. In addition, the parallel/concurrent-path execution strategy used by all of the subprojects introduced some risk into the verification process. This was of particular concern for circumstances where an evolution of the SAR resulted in a design change to safety class or safety significant equipment. Therefore, a graded approach was employed to validate elements of subproject design verification. This provided an additional level of assurance for structures, systems, and components (SSCs) verified through testing and for those designated as safety class or safety significant. These two additional validation assessments described below were carried out for all subprojects:

- **Safety Function Verification Assessment** Design verification actions for all systems and components identified on the Safety Equipment List (SEL) were 100% validated using design media, supporting analysis, testing results, commercial grade dedication analysis, and safety analysis reports.

- **Design Validation Assessment** Where testing was designated as the verification method in the DVR, validation of all safety class and safety significant items was required. In addition, a sampling basis was used to validate verification tests for general service items.

3.3 Punch-list Items

An integrated punch-list was developed to track open issues. Entries from this process were derived from open items (in some cases actions that are planned but not yet completed) from the DVRs, the Safety Function Verification Assessments, and the Design Validation Assessments. These are organized by facility system and dispositioned by the SNF facility management.

A summary of applicable DVR and validation assessment documentation is provided in Table 2. Where open items exist, the documents will be updated as specific verification and validation activities are completed.

Table 2 - Summary of Verification and Validation Documentation

Sub-project	Verification Report	Design Validation Report	Safety Function Verification Assessment
CSB	SNF-6442, *Design Verification Report SNF Project Canister Storage Building Subproject W-379*	SNF-7028, *CSB Facility Design Validation Assessment – Project W-379*	SNF-7030, *CSB Safety Function Verification Report*
CVDF	SNF-6340 (Draft), *CVD Design Verification Report*	SNF-7041 (draft) CVD *Design Validation Assessment – Project W-441*	SNF-7042 (draft) CVD *Safety Function Verification Assessment – Project W-441*
MCO	SNF-5465 Rev 0A, *SNF MCO Design Verification Summary*	SNF-7040 Rev 0, *MCO Design Validation Report*	
CTS	SNF-6891 Rev 0, *Design Verification Report for Cask Transport System (CTS) – Project W-443*	SNF-6918 Rev 0, *Design Validation Report for Cask Transport System (CTS) – Project W-443*	
CTFM	SNF-6738 Rev 0, *Design Verification Report for the 105 K West Cask Transportation Facility Modifications (CTFM) – Project A.5/A.6*	SNF-6863 Rev 0, *Design Validation Report for the 105 K West Cask Transportation Facility Modifications (CTFM) — Project A.5/A.6*	
FRS	SNF-5683 Rev 0, *FRS Design Verification Report*	*HNF-6535 Rev 0, Evaluation of Requirements Supporting the Phased Startup Initiative Regarding the Fuel Retrieval System and Integrated Water Treatment System*	
IWTS	SNF-6036 Rev 1, *K West Basin IWTS Design Verification Report, Project A-9*		

4.0 REFERENCES

Augustenburg, J.M., RL to Hanson, R.D., FH, *Contract No, DE-AC06-96RL13200 – Configuration Management Deficiencies on the Spent Nuclear Fuel (SNF) Project,* 99-AMW-015/FDH-9953258A, dated May 10, 1999.

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Design Verification Process, AP-EN-6-027-01, issued September 30, 1999.

Loscoe, P.G., RL to Hanson, R.D., FH, *Contract No. DE-AC06-96RL13200 – Test Control Program Deficiencies On The Spent Nuclear Fuels (SNF) Project*, letter #0001331 A/00-SFO-086, dated March 8, 2000.

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