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Project Title/Work Order System Verification and Validation Plan for SY-101 Hydrogen Mitigation Test Project Data Acquisition and Control System (DACS-1)		EDT No. 600142 ECN No. N/A

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Page 1 of 1

1. EDT

600142

2. To: (Receiving Organization) Distribution		3. From: (Originating Organization) TWRs Safety Programs Engineering Support		4. Related EDT No.: N/A	
5. Proj./Prog./Dept./Div.: DACS/WM		6. Cog. Engr.: R. W. Truitt		7. Purchase Order No.: N/A	
8. Originator Remarks: Submitted for approval and release.				9. Equip./Component No.: N/A	
				10. System/Bldg./Facility: DACS	
11. Receiver Remarks:				12. Major Assm. Dwg. No.: N/A	
				13. Permit/Permit Application No.: N/A	
				14. Required Response Date: N/A	

15. DATA TRANSMITTED					(F)	(G)	(H)	(I)
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	Impact Level	Reason for Trans- mittal	Origi- nator Dispo- sition	Receiv- er Dispo- sition
1	WHC-SD-WM-CSWD-067	--	0	System Verification and Validation Plan for SY-101 Hydrogen Mitigation Test Project Data Acquisition and Control System (DACS-1)	SQ	1,2	1	

16. KEY					
Impact Level (F)		Reason for Transmittal (G)		Disposition (H) & (I)	
1, 2, 3, or 4 (see MRP 5.43)		1. Approval	4. Review	1. Approved	4. Reviewed no/comment
		2. Release	5. Post-Review	2. Approved w/comment	5. Reviewed w/comment
		3. Information	6. Dist. (Receipt Acknow. Required)	3. Disapproved w/comment	6. Receipt acknowledged

(G)	(H)	17. SIGNATURE/DISTRIBUTION (See Impact Level for required signatures)								(G)	(H)
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1	1	Cog.Eng.	R. W. Truitt	9-13-94	L6-37	A. M. Ermi	AM Ermi	9-13-94	L6-39	1	1
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18. Signature of EDT Originator R. W. Truitt 9-13-94		19. Authorized Representative Date for Receiving Organization		20. Cognizant/Project Engineer's Manager R. E. Bauer 9/13/94		21. DOE APPROVAL (if required) Ltr. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments	
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RELEASE AUTHORIZATION

Document Number: WHC-SD-WM-CSWD-067, Revision 0

Document Title: System Verification and Validation Plan for SY-101
Hydrogen Mitigation Test Project Data Acquisition
and Control System (DACS-1)

Release Date: 10/12/94

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SUPPORTING DOCUMENT

1. Total Pages **13**

2. Title

System Verification and Validation Plan for SY-101 Hydrogen Mitigation Test Project Data Acquisition and Control System (DACS-1)

3. Number

WHC-SD-WM-CSWD-067

4. Rev No.

0

5. Key Words

241-SY-101
Hydrogen Mitigation
DACS
Verification
Validation

6. Author

Name: R. W. Truitt

Signature

Organization/Charge Code 8D210/N2B91

7. Abstract

This document outlines the system verification and validation plan for the SY-101 DACS, covering the operation and maintenance phase of the project life cycle.

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9. Impact Level **SQ**

10. RELEASE STAMP

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**SYSTEM VERIFICATION AND VALIDATION PLAN FOR
SY-101 HYDROGEN MITIGATION TEST PROJECT
DATA ACQUISITION AND CONTROL SYSTEM (DACS-1)**

September 1994

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**SYSTEM VERIFICATION AND VALIDATION PLAN FOR
SY-101 HYDROGEN MITIGATION TEST PROJECT
DATA ACQUISITION AND CONTROL SYSTEM (DACS-1)**

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this system verification and validation plan (SVVP) is to document the verification and validation to be performed on the SY-101 data acquisition and control system (DACS-1).

1.2 SCOPE

The DACS-1 is in the operation and maintenance phase of its product life cycle. Therefore, the only verification and validation (V&V) activity covered by this SVVP is for the "operation and maintenance phase" of the project life cycle.

1.3 OVERVIEW

In early 1992, LANL was tasked with providing data acquisition and control capability for support of hydrogen mitigation testing at Tank 241-SY-101. The DACS trailer and associated equipment were provided per a DACS functional specification prepared by LANL in May 1992. The trailer was delivered in October 1992. Westinghouse Hanford Company provided all tank farm located equipment, as well as utility connections to the trailer.

The DACS was designed to provide data monitoring, display, and storage for Tank 241-SY-101. It also provides alarm and control of all the hydrogen mitigation testing systems, as well as ancillary systems and equipment (HVAC, UPS, etc.) required to achieve safe and reliable operation of the testing systems in the tank.

To date, EG&G and LANL have provided engineering and technician support for safe and reliable operation of the DACS trailer and associated equipment. Westinghouse Hanford Company is now tasked with assuming ownership and maintenance of the DACS system from LANL and EG&G. This transition activity planning is documented in WHC-SD-WM-WP-264, "Work Plan for Transition of SY-101 Hydrogen Mitigation Test Project Data Acquisition and Control System" (Reference 4). Many of the activities, deliverables, and milestones addressed in that document constitute verification and validation of the project, requirements, and design.

DACS is in the operation and maintenance phase of its life cycle. Therefore, the only verification and validation activity addressed by this plan is the "operation and maintenance phase" of the project life cycle. Appendix A, "Verification and Validation Checklist," summarizes the V&V activities.

1.4 SYSTEM VERIFICATION AND VALIDATION ANALYSIS

System configuration management for DACS is documented in WHC-SD-WM-CSCM-023, "System Configuration Management Plan for SY-101 Hydrogen Mitigation Test Project Data Acquisition and Control System" (Reference 5). This document addresses how configuration management shall be done for the DACS project and includes the establishment of a change control board (CCB) to review and approve all changes to the DACS. As part of its review, the CCB decides the level of testing and verification required for any change.

1.5 ABBREVIATIONS AND DEFINITIONS

CCB	Change Control Board
DACS	Data Acquisition and Control System
LANL	Los Alamos National Laboratory
SCMP	System Configuration Management Plan
SCR	System Change Request
WHC	Westinghouse Hanford Company

- Acceptance Test Procedure (ATP)--A test or procedure performed on projects, systems, purchased items, etc., that provides instructions for checking and testing a process, system, or operation including interfaces, its components, or interrelationships with other systems which will demonstrate their fulfillment of engineering, contract, work order, or other requirements.
- Change Control Board (CCB)--The group established for the purpose of evaluating and approving or disapproving plans, change requests, and unresolved issues for impact on cost, schedule, deliverables, risk, and resources.
- Cognizant Manager--The WHC manager responsible for identifying and assigning work to system developers, for periodically assessing accomplishments of assigned work, and for ensuring system developer responsibilities are transferred in an orderly manner.
- Configuration Management--A discipline applying technical and administrative direction and surveillance to: identify and document the functional and physical characteristics of a configuration item, control changes to those characteristics, record and report change processing

and implementation status, and verify compliance with specified requirements (IEEE Std 610.12-1990).

- Engineering Practices (EPs)--Documented management methods which establish the manner and the order for the performance of common configuration management practices relating to engineering tasks (WHC-CM-6-1).
- Operation and Maintenance Phase--The period of time in the project life cycle during which a product is employed in its operational environment, monitored for satisfactory performance, and modified as necessary to correct problems or to respond to changing requirements (IEEE Std 610.12-1990).
- Project Cognizant Engineer--responsible engineer within the performing development organization that assumes cognizant engineer responsibility for development of the system as defined by WHC-CM-6-1, "Standard Engineering Practices."
- Retirement Phase--The period of time in the software life cycle during which support for a software product is terminated (IEEE Std 610.12-1990).
- Review--A process or meeting during which a work product or set of work products is presented to project personnel, managers, users, customers, or other interested parties for comment or approval. Types include code review, design review, formal qualification review, requirements review, test readiness review (IEEE Std 610.12-1990).
- Software---Computer programs, procedures, and possibly associated documentation and data pertaining to the operation of a computer system. This includes user-provided instructions and data that implement preprogrammed algorithms in control systems, computer codes and data that will reside in firmware, and (where specified by the cognizant manager) user-provided instructions and data used by commercial software such as spreadsheet and database packages (IEEE Std 610.12-1990 Modified per WHC-6-1).
- Software Life Cycle--The period of time that begins when a software product is conceived and ends when the software is no longer available for use. The software life cycle typically includes a concept phase, requirements phase, design phase, implementation phase, test phase, installation and checkout phase, operation and maintenance phase, and (sometimes) retirement phase. These phases may overlap or be performed iteratively (IEEE Std 610.12-1990).
- Software Project--The set of all project functions, activities, and tasks (both technical and managerial) required to satisfy the terms and conditions of the project agreement. A software project may be self-contained or may be part of a larger project. A software project

may span only a portion of the software product life cycle (IEEE Std 1058.1-1987).

- Software Project Management--The process of planning, organizing, staffing, monitoring, controlling, and leading a software project (IEEE Std 1058.1-1987).
- System Cognizant Engineer--Responsible engineer that assumes cognizant engineer responsibility for the system as defined by "Standard Engineering Practices," EP-5.2, for the facility and user (WHC-CM-6-1).
- System Configuration Management Plan--A plan for identifying and defining the configuration items in a system, controlling the release and change of these items throughout the system life cycle, recording and reporting the status of configuration items and change requests, and verifying the completeness and correctness of the items. Also known as system configuration management plan.
- System Life Cycle--The period of time that begins when a system is conceived and ends when a system is no longer available for use (see also software life cycle) (IEEE Std 610.12-1990).
- System Verification and Validation Plan (SVVP)--A plan for the conduct of software verification and validation (IEEE Std 1012-1986 Modified).
- System Verification and Validation Report (SVVR)--Documentation of V&V results and appropriate software quality assurance results (IEEE Std 1012-1986 Modified).
- Verification and Validation (V&V)--The process of determining whether the requirements for a system or component are complete and correct, the products of each development phase fulfill the requirements or conditions imposed by the previous phase, and the final system or component complies with specified requirements (IEEE Std 610.12-1990).
- Validation--The process of evaluating a system or component during or at the end of the development process to determine whether it satisfies specified requirements (IEEE Std 610.12-1990).
- Verification--The process of evaluating a system or component to determine whether the products of a given development phase satisfy the conditions imposed at the start of that phase (IEEE Std 610.12-1990).

2.0 VERIFICATION AND VALIDATION OVERVIEW

2.1 ORGANIZATION

Organizational responsibilities are documented in WHC-SD-WM-WP-264. Changes are controlled and verified as delineated in WHC-SD-WM-CSCM-023.

2.2 MASTER SCHEDULE

The schedule for transitioning responsibility of DACS from LANL/EG&G is included in WHC-SD-WM-WP-264. The overall hydrogen mitigation schedule is addressed in WHC-SD-WM-MA-014, "Mitigation Test Management Plan" (Reference 6). Additionally, LANL has been chartered to provide major upgrade work for DACS. They are developing a separate work plan and schedule to address these.

2.3 RESOURCES SUMMARY

Staffing of the DACS project is detailed in WHC-SD-WM-WP-264. Change control board membership is detailed in WHC-SD-WM-CSCM-023.

2.4 RESPONSIBILITIES

Organizational responsibilities for the project are detailed in WHC-SD-WM-WP-264. Change control board membership is detailed in WHC-SD-WM-CSCM-023.

2.5 INDEPENDENCE

WHC-SD-WM-WP-264 details the quality affecting documentation and the reviews/approvals required.

2.6 TOOLS, TECHNIQUES, AND METHODOLOGIES

Configuration control is detailed in WHC-SD-WM-CSCM-023.

3.0 LIFE CYCLE VERIFICATION AND VALIDATION

This plan only addresses the operation and maintenance phase of DACS, as the system is already operational.

3.1 MANAGEMENT OF VERIFICATION AND VALIDATION

If V&V requirements change during the operation and maintenance phase of DACS, the affected sections of WHC-SD-WM-WP-264 and WHC-SD-WM-CSCM-023 shall be updated along with any changes required to this plan.

3.2 OPERATION AND MAINTENANCE PHASE VERIFICATION AND VALIDATION

The primary method of validation and verification for the operation and maintenance phase shall be the system change request (SCR) and CCB review and approval, along with the performance of acceptance test procedures (ATPs) as deemed necessary by the CCB. When necessary, an ATP shall be written and performed to test changes to DACS. The CCB has the authority to determine if a change requires an ATP. ATPs shall be written by Program Plant Engineering with input from the developers and other affected personnel. It will be critically reviewed by users and an independent test person(s).

Once an approved ATP has been provided, the test will be performed. Record of the performance will be provided by an acceptance test report (ATR). The acceptance test performers, plus management, shall review and approve the ATR.

ATR approval shall constitute verification and validation of the change, customer acceptance of the change(s), and final closeout of the SCR(s). Both the ATP and the ATR shall be issued as supporting documents and shall be included in the project file.

Testing of changes that do not require a formal ATP shall be documented as part of the change request record.

4.0 SYSTEM VERIFICATION AND VALIDATION REPORTING

4.1 REQUIRED REPORTS

The results of implementing this plan will be documented via an ATR whenever an ATP is performed. SCR implementation will be documented per WHC-SD-WM-CSCM-023.

4.2 OPTIONAL REPORTS

No optional reports are specified by this SVVP.

5.0 VERIFICATION AND VALIDATION ADMINISTRATION

5.1 ANOMALY REPORTING AND RESOLUTION

The method of reporting and resolving anomalies, including the criteria for reporting an anomaly, the anomaly report distribution list, and the authority and time lines for resolving anomalies, are documented in WHC-SD-WM-CSCM-023.

5.2 TASK ITERATION POLICY

Two V&V tasks are performed: ATP performance and SCR resolution. These tasks shall be performed when the CCB determines their need.

5.3 DEVIATION POLICY

No deviation from this plan is anticipated. However should such a need arise, the need shall be reviewed and approved by the cognizant manager and cognizant engineer. All impacted documents (including this plan) shall then be modified per EP 2.2, "Engineering Document Change Control" (Reference 3).

5.4 CONTROL PROCEDURES

The control procedures applied to this V&V effort are the release of all ATPs and ATRs as supporting documents per EP 1.12, "Supporting Documents." (See WHC-SD-WM-CSCM-023 for the control procedures for SCR processing.)

5.5 STANDARDS, PRACTICES, AND CONVENTIONS

WHC-CM-3-10 governs the performance of V&V tasks.

6.0 REFERENCES

1. WHC-CM-3-8, "Software Practices"
SP-8.1, "Identification, Release and Change Control"
2. WHC-CM-4-2, "Quality Assurance Manual"
QR 19.0, "Software Quality Assurance Requirements"

3. WHC-CM-6-1, "Standard Engineering Practices"
 - EP 1.6, "Engineering Data Transmittal"
 - EP 1.7, "Engineering Document Approval and Release Requirements"
 - EP 1.12, "Supporting Documents"
 - EP 2.1, "Software Configuration Management"
 - EP 2.2, "Engineering Document Change Control"
 - EP 5.2, "Cognizant Engineer Responsibilities"
4. WHC-SD-WM-WP-264, "Work Plan for Transition of SY-101 Hydrogen Mitigation Test Project Data Acquisition and Control System"
5. WHC-SD-WM-CSCM-023, "System Configuration Management Plan for SY-101 Hydrogen Mitigation Test Project Data Acquisition and Control System"
6. WHC-SD-WM-MA-014, "Mitigation Test Management Plan"

APPENDIX A

VERIFICATION AND VALIDATION CHECKLIST

VERIFICATION AND VALIDATION CHECKLIST

PLANNED ACTIVITY	YES	NO	N/A	COMMENTS
1. MANAGEMENT OF VERIFICATION AND VALIDATION				
System V&V plan preparation.	X			This document.
System V&V plan review, approval, and release.	X			
System V&V analysis performance.			X	
Requirements for independence established.	X			SCMP.
2. CONCEPT PHASE			X	
3. REQUIREMENTS PHASE			X	
4. DESIGN PHASE			X	
5. IMPLEMENTATION PHASE			X	
6. TEST PHASE			X	
7. INSTALLATION AND CHECKOUT PHASE			X	
8. OPERATION AND MAINTENANCE PHASE				
System V&V plan revision.	X			This document, as required.
Anomaly evaluation.	X			SCMP.
Proposed change assessment.	X			SCMP.
Phase task iteration.		X		