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Title/Desc:

SYSTEM VERIFICATION & VALIDATION PLAN FOR SY101
HYDROGEN MITIGATION TEST PROJECT DATA ACQUISITION
& CONTROL SYSTEM

ENGINEERING CHANGE NOTICE

Page 1 of 41. ECN **No 625229**Proj.
ECN2. ECN Category
(mark one)

Supplemental ☐
 Direct Revision ☒
 Change ECN ☐
 Temporary ☐
 Standby ☐
 Supersedure ☐
 Cancel/Void ☐

3. Originator's Name, Organization, MSIN,
and Telephone No.

A. M. Ermi, Characterization
 Monitoring Systems,
 L6-37, 376-5099 **75420**

3a. USQ Required?

[X] Yes [] No

4. Date

June 30, 1995

5. Project Title/No./Work Order No. **N2B2E**

Tank 241-SY-101 Hydrogen
 Mitigation Test Project

6. Bldg./Sys./Fac. No.

Tank 241-SY-101

7. Approval Designator

SQ

8. Document Numbers Changed by this ECN
(includes sheet no. and rev.)

WHC-SD-WM-CSWD-067, Rev. 0
 (all sheets)

9. Related ECN No(s).

N/A

10. Related PD No.

N/A

11a. Modification Work

[] Yes (fill out Blk.
 11b)
 [X] No (NA Blks. 11b,
 11c, 11d)

11b. Work Package
No.

N/A

11c. Modification Work Complete

N/A

11d. Restored to Original Condi-
tion (Temp. or Standby ECN only)

N/A

Cog. Engineer Signature & Date

Cog. Engineer Signature & Date

12. Description of Change

Incorporated elements of the Quality Assurance Manual (CM-4-2), "Software Quality Assurance Requirements" (Section QR-19) into the System Verification and Validation Plan for SY-101 Hydrogen Mitigation Test Project Data Acquisition and Control System (DACS-1).

13a. Justification (mark one)

Criteria Change ☐ Design Improvement ☐ Environmental ☐ Facility Deactivation ☐
 As-Found ☒ Facilitate Const ☐ Const. Error/Omission ☐ Design Error/Omission ☐

13b. Justification Details

The changes were made in response to WHC Inspection/Surveillance Report Number ISR-95-0077-200, Condition 3: Control Systems - "The System Verification and Validation Plan, WHC-SD-WM-CSWD-067, does not meet the intent of WHC-CM-4-2, Quality Assurance Manual, QR-19, Paragraph 4.2.3, Software validation planning."

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

See distribution sheet

RELEASE STAMP

OFFICIAL RELEASE
 BY WHC

DATE **SEP 27 1995**

Sta. 21

[illegible]

UNREVIEWED SAFETY QUESTION SAFETY REVIEW FORM

(Per WHC-IP-0842, 15.9)

ECN 625229

Page 3 of 4

REFERENCE DOCUMENT(S):

ECN No. 625229

PCA No.

Work Pkg No.

Other (Specify) WHC-SD-WM-CSWD-067 REV. 0

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

REFERENCES:

1. Leach, C.E. and S.M. Stahl, 1994 "Hanford Site Tank Farm Facility Interim Safety Basis," WHC-SD-WM-ISB-001, Westinghouse Hanford Company, Richland, Washington.
2. Van Vleet, R.J., 1994, "Safety Basis for Activities in Double-Shell Flammable Gas Watch List Tanks," WHC-SD-WM-SARR-002, Westinghouse Hanford Company, Richland Wa
3. Sullivan, L.H., 1995, "A Safety Assessment for Proposed Pump Mixing Operations to Mitigate Eposodic Gas Releases in Tank 241-SY-101: Hanford Site, Richland Washington," LUAR-92-3196, Los Alamos National Laboratory, Los Alamos New Mexico

BACKGROUND:

This System Verification and Validation Plan describes verification and validation to be performed on the data acquisition and control computer system (DACS-1) used in hydrogen mitigation of tank 241-SY-101 during the operation and maintenance phase. The referenced document has been revised to incorporate elements of the Quality Assurance Manual as specified in an Inspection/Surveillance Report. This USQ screening discusses consequences of those changes.

- A. Does the PROPOSED CHANGE represent a change to the facility as described in the AUTHORIZATION BASIS documentation?

☐ N/A ☒ No ☐ Yes/Maybe

Basis: The referenced item makes no changes to the facility as described in the authorization basis. The verification and validation Plan is being updated to meet the intent of the Quality Assurance Manual and does not drive any changes to the 241-SY-101 tank farm facility.

- B. Does the PROPOSED CHANGE represent a change to procedures as described in the AUTHORIZATION BASIS?

☐ N/A ☒ No ☐ Yes/Maybe

Basis: No new procedures or procedure revisions, as described in the authorization basis will be required as a result of this change.

UNREVIEWED SAFETY QUESTION SAFETY REVIEW FORM
(Continued)

ECN 625229
Page 4 of 4

C. Does the test or experiment represent a test or experiment not described in the AUTHORIZATION BASIS documentation?

☐ N/A ☒ No ☐ Yes/Maybe

Basis: The 241-SY-101 Mitigation program is an ongoing Safety program that IS described in the authorization basis.

D. Does the change, test or experiment impact:

- Implemented OSRs or IOSRs? ☐ N/A ☒ No ☐ Yes/Maybe
- Approved IOSR Compliance Implementation Plans? ☐ N/A ☒ No ☐ Yes/Maybe

Basis: No OSRs, IOSRs, or IOSR compliance implementation plans will be affected as a result of this change.

Based on the above, a Safety Evaluation ☐ DOES ☒ DOES NOT
need to be performed for this change

USQE No. 1 Eric K. Straalsund

Print Name

Signature

Date

USQE No. 2 Greg J. Gauck

Print Name

Signature

Date

RELEASE AUTHORIZATION

Document Number: WHC-SD-WM-CSWD-067, Rev. 1

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

Release Date: 10/5/95

**This document was reviewed following the
procedures described in WHC-CM-3-4 and is:**

APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

C. WILLINGHAM

10/5/95

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SUPPORTING DOCUMENT

1. Total Pages 14

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. 1
5. Key Words 241-SY-101 Hydrogen Mitigation DACS Verification and Validation	6. Author Name: A. M. Ermi <i>A. M. Ermi</i> Signature Organization/Charge Code 75420/N2B2E	
7. Abstract This document outlines the system verification and validation plan for the SY-101 Data Acquisition and Control System (DACS), covering the operation and maintenance phase of the project life cycle.		
8. RELEASE STAMP OFFICIAL RELEASE BY WHO DATE SEP 27 1995 <i>Sta. 21</i>		

[illegible]

WHC-SD-WM-CSWD-067
Rev. 1

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

June 1995

prepared by:

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

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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 (V&V) to be performed on the SY-101 Data Acquisition and Control System (DACS).

1.2 SCOPE

The V&V activity covered by this SVVP is for the operation and maintenance phase of the DACS-1 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 241SY101. 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 241SY101. 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.

LANL provided engineering and technician support for safe and reliable operation of the DACS trailer and associated equipment through September 1994. Since then, Westinghouse Hanford Company assumed ownership and maintenance of the DACS system from LANL. This transition was documented in WHC-SD-WM-WP-264, "Work Plan for Transition of SY-101 Hydrogen Mitigation Test Project Data Acquisition and Control System" (Transition Work Plan, Reference 1). Many of the activities, deliverables, and milestones addressed in that document constitute V&V of the project, requirements, and design. The V&V activities are summarized in Appendix A, "Verification and Validation Checklist."

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" (SCMP, Reference 2). 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

- 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 Change Notice - Used to document, approve, and control changes to engineering documents and drawings (form A-7900-013), WHC-CM-6-1, "Standard Engineering Practices" (EPs, Reference 3).
- 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, EPs, Reference 3.
- 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 in the EPs, Reference 3.
- 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 the EPs, Reference 3).
- 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 in the EPs, Reference 3).

- System Configuration Management Plan (SCMP) - 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 AND RESPONSIBILITIES

Organizational responsibilities and staffing of the DACS project are documented in the Transition Work Plan, Reference 1. Changes are controlled and verified as delineated in the SCMP, Reference 2.

2.2 INDEPENDENCE

The quality affecting documentation and the reviews/approvals required are detailed in the Transition Work Plan, Reference 1.

2.3 TOOLS, TECHNIQUES, AND METHODOLOGIES

Configuration control is described in the SCMP, Reference 2.

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, any affected sections of the Transition Work Plan (Reference 1), the SCMP (Reference 2) and this V&V plan shall be updated.

3.2 OPERATION AND MAINTENANCE PHASE VERIFICATION AND VALIDATION

The method of V&V is based on practices found in WHC-CM-4-2, "Quality Assurance Manual" (Reference 4). During the operation and maintenance phase, V&V is controlled through a system change request (SCR) process utilizing a change control board (CCB). The CCB charter and SCR process is governed by the SCMP, Reference 2. Section 6 and appendices A and B of the SCMP outline the change control process in detail.

Once an originator submits and justifies a change request to the CCB through an SCR (blocks 6 and 7 of the SCR form, HMTP-SCR-1 [6-19-94]), the CCB determines:

- (1) The affected hardware, software and documents (block 8) - These include:
 - (a) procedures,
 - (b) drawings,
 - (c) DACS software,
 - (d) WHC-SD-WM-EL-001, "241-SY-101 Hydrogen Mitigation Test Data Acquisition and Control System (DACS-1) Input/Output Channel List" (Reference 5),
 - (e) WHC-SD-WM-SDD-045, "System Design Description for SY-101 Hydrogen Mitigation Test Project Data Acquisition and Control System (DACS-1)" (the [hardware] SDD, Reference 6), and

- (f) WHC-SD-WM-CSDD-008, "Computer System Design Description for SY-101 Hydrogen Mitigation Test Project Data Acquisition and Control System (DACS-1)" (the CSDD, Reference 7).

The DACS control software (Modicon "Modsoft" for the programmable logic controllers, and Iconics "Genesis" for the interactive workstations) are graphical interface type programs, and do not lend themselves to conventional program listings. However, included in the CSDD are appendices containing lists and tables which define the parameters for the DACS control software. For example, the "Data Dictionary" generated for the Genesis software defines the current system configuration, and any changes to the software affecting configuration can be traced and verified using this listing.

Prior to SCR closeout, all affected documents/drawings must be revised via ECNs.

- (2) The disposition of the change request (block 10) - Approve, Reject, Defer, Approve/Modify or Cancel.
- (3) The priority (block 11) - Emergency, Urgent or Routine
- (4) The schedule for implementing the change (block 12)
- (5) Whether an ATP shall be required (also block 12). Not all changes to the DACS system require ATPs, particularly trivial or minor changes that do not change system configuration (such as modifying screen text or screen layouts).

When the CCB determines that an ATP is required, the methods and procedures used to perform testing of the changes to DACS shall be specified in the ATP. The ATP shall be written by Plant Engineering with input from the developers and other affected personnel. To minimize the risk associated with the prescribed testing, appropriate incremental testing during the development of the ATP shall be performed in the 306E/DACS Development Laboratory. The 306E/DACS Development Laboratory consists of instrumentation and computer stations simulating the 241SY101 DACS, and is used for software development, training, troubleshooting, and for performing tests on system components and software prior to installation at the 241SY101 DACS.

Once the ATP has been written, it shall be reviewed by plant operations personnel, the cognizant engineer, the cognizant manager and an independent test person. The approved ATP describing the system acceptance criteria shall be provided prior to any testing on DACS at 241SY101.

In some cases, as directed by the CCB and specified in the ATP, part or all of the ATP shall be performed in the 306E/DACS Development Laboratory. Under these circumstances, it is not necessary to perform the ATP or the specified sections of the ATP at the 241SY101 DACS.

The SCR solution comments section (block 15) documents the steps used to implement the change. Engineering change notices (ECNs) are used to change any controlled engineering documents resulting from the SCR. The ECNs shall be implemented according to the EPs, Reference 3, for the development, review, approval, release, and incorporation of changes. The ECN numbers shall be documented in the solution comments section.

After a required ATP has been performed, the record of the performance, including any test exceptions (suspension of testing due to unplanned discrepancies) shall be provided by an acceptance test report (ATR). The acceptance test performers, cognizant engineer and cognizant manager shall review and approve the ATR. ATR approval shall constitute V&V of the change, customer acceptance of the change, and final closeout of the SCR. Both the ATP and the ATR shall be issued as supporting documents and shall be included in the project file.

When the CCB determines that an ATP is not required to test the change, the CCB shall specify the method of testing the change and the system acceptance criteria. Once again, to minimize the risk associated with the prescribed testing, the 306E/DACS Development Laboratory is used to perform offline testing of the software changes associated with the SCR. This involves independent verifications by a minimum of two software developers to check software changes. To verify that the software changes result in the expected performance, observations are made of the systems in operation by appropriate DACS personnel at both the 306E/DACS Development Laboratory and at 241SY101 DACS Trailer. This method of testing changes and all pertinent information pertaining to the test results shall be described in the solution comments section. In this case, final closeout of the SCR shall constitute V&V of the change and customer acceptance of the change.

All SCRs affecting a specific revision of DACS software shall be summarized using a Software Revision Record (SRR, form HMTP-SRR-1 [4-20-94], from the SCMP, Reference 2). The SRR provides an orderly and traceable record of 241SY101 DACS control software changes. It provides a brief description of the reason for the change, and cross-references all SCRs included in this revision of software. Details for use of the SRR are in the SCMP, Reference 2.

Once the SCR has been closed out, including revisions to all affected documents/drawings, the SCR shall be incorporated, via ECN, into the final deliverable, a "Closed Out Tank 241-SY-101 DACS System Change Request" document (References 8-11). All SRRs are also incorporated, via ECN, into References 8-11.

4.0 SYSTEM VERIFICATION AND VALIDATION REPORTING

4.1 REQUIRED REPORTS

Implementation of an SCR will be documented per the SCMP, Reference 2. When an ATP is performed, the results will be documented via an ATR.

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 solution comments section of the SCR is the method of reporting the resolution of anomalies. If an ATP is required, a record of the performance, including any test exceptions (suspension of testing due to unplanned discrepancies), will be provided by an ATR.

5.2 TASK ITERATION POLICY

Active SCRs are periodically reviewed by the CCB. During scheduled meetings, these SCRs are statused regarding their disposition in accordance with the SCMP, Reference 2.

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 the EPs, 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 the EPs, Reference 3. (See the SCMP, Reference 2, for the control procedures for SCR processing.)

5.5 STANDARDS, PRACTICES, AND CONVENTIONS

The performance of V&V tasks are governed by WHC-CM-3-10, "Software Practices" (Reference 12).

6.0 REFERENCES

1. WHC-SD-WM-WP-264, "Work Plan for Transition of SY-101 Hydrogen Mitigation Test Project Data Acquisition and Control System"
2. WHC-SD-WM-CSCM-023, "System Configuration Management Plan for SY-101 Hydrogen Mitigation Test Project Data Acquisition and Control System"
3. WHC-CM-6-1, "Standard Engineering Practices"
4. WHC-CM-4-2, "Quality Assurance Manual"
5. WHC-SD-WM-EL-001, "241-SY-101 Hydrogen Mitigation Test Data Acquisition and Control System (DACS-1) Input/Output Channel List"
6. WHC-SD-WM-SDD-045, "System Design Description for SY-101 Hydrogen Mitigation Test Project Data Acquisition and Control System (DACS-1)"
7. WHC-SD-WM-CSDD-008, "Computer System Design Description for SY-101 Hydrogen Mitigation Test Project Data Acquisition and Control System (DACS-1)"
8. WHC-SD-WM-CMD-001, "Closed Out Tank 241-SY-101 DACS System Change Request #1-100"
9. WHC-SD-WM-CMD-002, "Closed Out Tank 241-SY-101 DACS System Change Request #101-200"
10. WHC-SD-WM-CMD-003, "Closed Out Tank 241-SY-101 DACS System Change Request #201-300"
11. WHC-SD-WM-CMD-004, "Closed Out Tank 241-SY-101 DACS System Change Request #301-400"
12. WHC-CM-3-10, "Software Practices"

APPENDIX A

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		