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System Maintenance Verification and Validation Plan for the TWRS Controlled Baseline Database System

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Abstract: TWRS Controlled Baseline Database, formally known as the Performance Measurement Control System, is used to track and monitor TWRS project management baseline information. This document contains the verification and validation approach for system documentation changes within the database system.

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**SYSTEM MAINTENANCE
VERIFICATION AND VALIDATION PLAN
FOR THE
TWRS CONTROLLED BASELINE DATABASE SYSTEM**

*Prepared for
Lockheed Martin Hanford Company*

TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	PURPOSE AND SCOPE.....	1
1.2	OVERVIEW	2
1.3	DEFINITIONS AND ACRONYMS	2
1.3.1	Definitions	2
1.3.2	Acronyms	3
2	VERIFICATION AND VALIDATION OVERVIEW	3
2.1	ORGANIZATIONAL RESPONSIBILITIES.....	3
2.2	INDEPENDENT REVIEWERS.....	3
3	MAINTENANCE VERIFICATION AND VALIDATION	4
3.1	VERIFICATION AND VALIDATION APPROACH.....	4
3.2	VERIFICATION AND VALIDATION MATRIX.....	5
3.2.1	Verification and Validation Matrix Description.....	5
3.2.2	Verification and Validation Matrix Process.....	5
4	SYSTEM VERIFICATION AND VALIDATION REPORTING.....	6
5	VERIFICATION AND VALIDATION ADMINISTRATION.....	7
6	REFERENCES.....	8
	APPENDIX A: TCBD V&V MATRIX.....	9

1 INTRODUCTION

This System Maintenance Verification and Validation Plan (VVP) identifies a verification and validation (V&V) approach for the Tank Waste Remediation System (TWRS) Controlled Baseline Database (TCBD).

The TCBD was developed as the electronic data repository for cost, schedule, and technical administrative baseline information for the TWRS Program. The current baseline software version of the TCBD was released with informal, undocumented V&V, but was accepted by the customer as complete. Since the TCBD is in a maintenance state, the current strategy is to identify all changes via the *Software Configuration Management Plan for the TWRS Controlled Baseline Database System* (SCMP) (LMHC 1998a). Approved changes must have V&V tasks performed on all appropriate documentation per this VVP.

The V&V activities identified in this plan are to be performed in parallel with the maintenance testing; refer to the *System Maintenance Test Plan for the TWRS Controlled Baseline Database System* (MTP) (LMHC 1998b). V&V and testing must be completed before release of changes into the TCBD production environment.

For more information on the relationship between the SCMP (LMHC 1998a), MTP (LMHC 1998b), and this VVP, refer to Appendix C of the SCMP (LMHC 1998a).

1.1 PURPOSE AND SCOPE

The purpose of this TCBD VVP is to provide an effective process to verify and validate changes made to the TCBD system and documentation prior to release of these modified items into the production environment and documentation system, respectively. The audience for this document is the Design Authority, Lead Engineer, Software Developer and Maintainer, and Software Engineer (per Table 1 of the SCMP [LMHC 1998a]).

This VVP provides an overall planning and documentation approach for documentation and system testing reviews. It is intended as a plan that, during maintenance, system developers can use for TCBD system life-cycle documentation to capture the V&V process and its results.

This V&V process is initiated when dealing with formal software changes approved by the Change Control Board (CCB) via the SCMP (LMHC 1998a). Typically, V&V occurs for a group of several Software Charge Requests/Problem Reports(s) (SCR/PRs) (see Appendix A of the SCMP [LMHC 1998a]). The SCR/PR(s) document requested TCBD changes.

V&V activities, per this plan, will ensure that affected TCBD system life-cycle documentation, such as a software requirements specification, are kept up-to-date and reflect the current state of the system. These V&V activities also will allow appropriate reviewers to ensure that testing of SCR/PR changes, via test procedures and test results, are adequate and valid.

Once the affected life-cycle documentation is reviewed and approved, the system software and revised documentation can be released as the new TCBD baseline. This is documented via the "TCBD Release Cover Sheet and Revision Record," provided in Appendix B of the SCMP (LMHC 1998a).

1.2 OVERVIEW

The TCBD project, formally known as the Performance Measurement Control System, was initiated to facilitate specific data integration processes surrounding the project scheduling system environment. The *Performance Measurement Control System Project Management Plan* (LMHC 1997) provides a brief project history and acquisition planning information.

During its initial development, the TCBD was released and accepted by the customer with no formal documentation to capture the V&V activities. Since that time, several versions of the TCBD have been released, all with undocumented V&V. As the TCBD system was recently placed under software configuration management, this VVP allows V&V activities to be documented *within* this configuration process.

1.3 DEFINITIONS AND ACRONYMS

1.3.1 Definitions

Production: A module that has been released for system use following acceptance by the customer.

Software Change Request and Problem Report (SCR/PR): A form that identifies a proposed change to, or a suspected problem with the TCBD system. A SCR/PR may identify a new function, modify an existing function, or report suspected problems of the software or system hardware, at varying levels of priority.

Software Configuration Management: A set of management disciplines within the context of the software engineering process that applies technical and administrative direction and surveillance. It identifies and documents the functional and physical characteristics of a product, controls changes to those characteristics, and records and reports the change processing and implementation.

Validation: Process of analyzing information to determine whether it conforms to certain predefined parameters of completeness and consistency.

Verification and Validation Plan (VVP): A plan that defines a process to perform V&V activities for a system during the software development life cycle.

Verification: To ascertain that either an activity has been performed or a test result is correct.

1.3.2 Acronyms

BMO	Business Management Organization
CCB	Change Control Board
ECN	Engineering Change Notice
LMHC	Lockheed Martin Hanford Company
LMSI	Lockheed Martin Services, Inc.
MTP	Maintenance Test Plan
RCR	Review Comment Record
SCMP	Software Configuration Management Plan
SCR/PR	Software Change Request and Problem Report
TCBD	TWRS Controlled Baseline Database
TI	SCR/PR Test Information Form
TWRS	Tank Waste Remediation System
V&V	Verification and Validation
VVP	Verification and Validation Plan

2 VERIFICATION AND VALIDATION OVERVIEW

2.1 ORGANIZATIONAL RESPONSIBILITIES

LMHC, TWRS Business Management Organization (BMO) is designated as system owner, operator, and maintenance authority of the TCBD. The Master Planning Group that is within the BMO is assigned the responsibility to continue development and maintenance of the TCBD. This group maintains information that includes identification of requirements and changes to those requirements in a TCBD project file. They are responsible for the issuance, maintenance, communication and implementation of this SVVP. This group has the responsibility for resolving issues resulting from V&V tasks and the authority for approving V&V products.

LMHC, TWRS TCBD Users are designated as providing project direction for implementation and testing of the TCBD during development. The Master Planning Group will coordinate appropriate V&V tasks when applicable (i.e., documentation reviews).

Lockheed Martin Services, Inc. (LMSI) is designated the TCBD developer, maintainer, and custodian until acceptance and process testing of the system has been completed via the TWRS BMO. The V&V tasks relating to testing will be coordinated via the Master Planning Group.

The interfaces between the group and organization are through normal line management chains of command.

2.2 INDEPENDENT REVIEWERS

The TCBD documentation for potential V&V is listed in Section 2 of the V&V Matrix in

Appendix A. During reviews, the independent reviewers are to be defined specifically by the TCBD Design Authority, but at a minimum shall include the following:

- BMO representative for business related reviews (i.e., user manual)
- LMSI representative for technical related reviews (i.e., test results)
- BMO Master Planning Group for all review types (preferably someone independent from the implementation).

3 MAINTENANCE VERIFICATION AND VALIDATION

3.1 VERIFICATION AND VALIDATION APPROACH

The V&V approach involves the use of the TCBD V&V Matrix provided in Appendix A. The TCBD V&V Matrix is completed whenever SCR/PR(s) are being processed for production release.

As discussed, the TCBD system (hardware and software) modifications and enhancements will be documented via SCR/PR form(s) per the SCMP (LMHC 1998a). In Table 1 of the SCMP (LMHC 1998a), the different individual roles and responsibilities are identified. The TCBD Change Control Board (CCB) evaluates all SCR/PR(s) before implementation. In addition, all SCR/PR forms approved and implemented are released into the production environment only after appropriate testing and V&V activities.

The V&V activities are based on the level of the change (i.e., having a minor or major impact as determined by the Lead Engineer). For more information on the testing approach used for TCBD maintenance, refer to the MTP (LMHC 1998b).

Typically, V&V occurs for groupings of multiple SCR/PR forms. When the CCB approves SCR/PRs, there may be an effect on life-cycle documentation (i.e., document changes). For example, if a new requirement resulted from an SCR/PR, then the TCBD Software Requirements Specification would need to be:

1. Updated in the appropriate sections
2. Reviewed by appropriate personnel with comments noted
3. Released via the Engineering Change Notice (ECN) process.

Also, the SCR/PR(s) will all have a specific level of testing performed to ensure that changes have been implemented correctly. The Design Authority determines the testing criteria for use by the Software Developer and Maintainer in generating test strategies. The V&V occurs for both the testing approach prior to actual testing and for any test results generated. Refer to Appendix A, "Test Information Form (TI)" in the MTP (LMHC 1998b), and to Appendix C of the SCMP (LMHC 1998a).

3.2 VERIFICATION AND VALIDATION MATRIX

The V&V approach uses the TCBD V&V Matrix found in Appendix A. The matrix helps to evaluate, design the appropriate level of system documentation and testing review necessary, and to document its completion. This applies to both major and minor changes, and individual and/or grouped SCR/PR form(s). However, major changes may require completely new and substantially different development efforts and may therefore require new system documentation, including an expanded VVP targeted toward development.

3.2.1 Verification and Validation Matrix Description

The TCBD V&V Matrix (Appendix A) is designed to allow the user to enter complete information about V&V activities that will occur for a given production release and includes the following sections:

- SCR/PR Information (Section 1.0)
- Documentation Reviews (Section 2.0)

These sections meet the intent of outline guidance within HNF-PRO-491, *Software Practices - System Verification and Validation Test Plan* for the operation and maintenance phase described in Section 3.8 of HNF-PRO-491. If required, refer to this procedure for more information. Complete the TCBD V&V Matrix form in pen and perform the following:

Section 1.0: List the individual SCR/PR form(s) covered by this release via the appropriate notation (e.g., SCR #52, 53, 55-76). This reference and the type of changes must match those documented on the SCR/PR TI form(s) generated per the MTP (LMHC 1998b) for a given release.

Section 2.0, second column: Identify all document number(s) to be reviewed as part of the V&V process. This reference number correlates to the TCBD life-cycle documentation listed in rows in the first column of this section.

Section 2.0, third column: Check mark as appropriate on the action that will be taken on the referenced document(s).

Section 2.0, fourth column: This column is reserved for the revision of a modified document released per an ECN (e.g., Revision 1), the date when the V&V was completed, and/or for a new Engineering Data Transmittal number (e.g., for testing results).

3.2.2 Verification and Validation Matrix Process

The V&V Matrix process begins when the TCBD V&V Matrix (Appendix A) is completed with the appropriate SCR/PR(s) of interest. Only system documentation that is affected or may have an effect by the change(s) is reviewed. These TCBD documents and reference numbers with revisions are listed in the first and second columns, respectively.

Secondly, the V&V action to be taken is indicated by a checkmark in the third column. If "No Change Required or N/A" is checked, then columns two and four may be left blank. If "Change Per SCR/PR..." is checked, then the following occurs:

1. Changes are implemented as required, per SCR/PR(s), to the document. It is suggested that changes be incorporated using redline (for additions) and strikeout (for deletions) to assist in the review process.
2. Document reviewers are selected with regard to the need for independence or special skills and/or knowledge. This is the responsibility of the Design Authority, but the minimum documentation reviews are performed as defined in Section 2.2.
3. A V&V review package is assembled and contains the following:
 - a) The distribution letter listing all reviewers
 - b) A cover sheet indicating area of reviewer responsibility, a list of any supporting documents, how changes are indicated in the document (e.g., redline and strikeout), format for returning comments (e.g., Review Comment Record [RCR] form via cc:Mail), due date for comments, and MSIN or cc:Mailbox to return comments
 - c) The actual revised document for review
 - d) Any other supporting information.
4. Once the comments are returned, they are resolved typically via the RCR process. The results are then stored temporarily in the TCBD project file (V&V file) for later release.
5. The updated documents are released via ECN, or in the case of testing results, via reference to the *TCBD System Release and Change Record* (LMHC 1998c). The document numbers (including revisions) are listed in the fourth column of Section 2.

4 SYSTEM VERIFICATION AND VALIDATION REPORTING

Once the V&V activity is complete, the TCBD V&V Matrix (Appendix A) is completed, approved by the Design Authority, and becomes the front sheet for the complete V&V package. This V&V package consists of groupings of all distribution letters and resolved RCRs for each affected TCBD system documentation or test documentation.

The V&V package is grouped, for a production release, with the associated SCR/PR(s) and TI forms, and released via ECN to the *TCBD System Release and Change Record* (LMHC 1998c). This is per the "Release Cover Sheet and Revision Record" (see Appendix B of the SCMP [LMHC 1998a]). It is distributed as required to reviewers and all appropriate personnel.

This will ensure that all changes, testing, test exceptions and anomalies, and V&V activities are formally documented.

5 VERIFICATION AND VALIDATION ADMINISTRATION

TCBD V&V tasks require appropriate administration per this governing plan. The administration activities include the following:

- Anomaly Reporting and Resolution:

Anomaly reporting is by way of completed RCR forms for reviews of system documentation or test incident reports generated during testing of changes. All anomalies will be reviewed and dispositioned by way of correction or mitigation (with the approval of the Design Authority) of all RCR forms and/or test incident reports.

- Task Iteration Policy:

Certain V&V tasks for a given production release, during the maintenance phase, may require iteration of performance. For instance, if a test procedure was deemed inadequate during review, it may need to be rewritten and reviewed again. In cases of V&V task iteration, it is up to the Design Authority to use specific criteria to make this judgement including assessments of change, importance, cost and schedule, or quality effects.

For V&V task iteration documentation, keep the results of each iteration grouped for release with the end V&V product.

- Deviation Policy:

Only the Design Authority can authorize deviation from the TCBD V&V Plan. Such a deviation must be documented within the V&V package for a specific production release. This document can be in the form of an attached and signed letter or cc:Mail notice that states the V&V task(s) deviated from, the rationale, and any system effect.

- Control Procedure:

The V&V records are to be completed in pen only. All results of the V&V process are stored temporarily in a project file. After the V&V process is complete, these results are grouped and released into the document the *TCBD System Release and Change Record* (LMHC 1998c) per the SCMP (LMHC 1998a), and will then be under HNF document control. This will ensure that storage, retrieval, and change control are in place for all TCBD V&V records.

6 REFERENCES

HNF-PRO-491, *Software Practices – System Verification and Validation Test Plan*, Fluor Daniel Hanford, Richland, Washington.

LMHC, 1997, *Performance Measurement Control System Project Management Plan*, HNF-SD-TWR-PMP-001, Rev. 0, Lockheed Martin Hanford Company, Richland, Washington.

LMHC, 1998a, *Software Configuration Management Plan for the TWRS Controlled Baseline Database System*, HNF-2429, Rev. 0, Lockheed Martin Hanford Company, Richland, Washington.

LMHC, 1998b, *System Maintenance Test Plan for the TWRS Controlled Baseline Database System*, HNF-3186, Rev. 0, Lockheed Martin Hanford Company, Richland, Washington.

LMHC, 1998c, *TCBD System Release and Change Record*, HNF-3357, Rev. 0, Lockheed Martin Hanford Company, Richland, Washington

APPENDIX A: TCBD V&V MATRIX**TCBD V&V MATRIX****Section 1.0: SCR/PR INFORMATION**

1. Related SCR/PR Number(s):
2. Type of Maintenance: ☐ New Development ☐ Problem ☐ Enhancement ☐ Y2K

Section 2.0: DOCUMENTATION REVIEWS

Description	Reference Numbers	V&V Action	Document Release?
Project Management Plan		☐ No change required or N/A ☐ Change per SCR/PR and review management plan, attach distribution letter and RCRs from reviewers	
Software requirements Specification		☐ No change required or N/A ☐ Change per SCR/PR and review SRS, attach distribution letter and RCRs from reviewers	
Design and Implementation		☐ No change required or N/A ☐ Change per SCR/PR and review implementation, attach distribution letter and RCRs from reviewers	
Testing (e.g., TI Form, Procedure, Plan, etc.)		☐ No change required or N/A ☐ Implement per SCR/PR and review test documents, attach distribution letter and RCRs from reviewers	
Testing Results		☐ No change required or N/A ☐ Implement per SCR/PR and review test results documents, attach distribution letter and RCRs from reviewers	
Installation and Checkout		☐ No change required or N/A ☐ Implement per SCR/PR and review installation-related documents, attach distribution letter and RCRs from reviewers	
User (e.g., Manual, Procedures)		☐ No change required or N/A ☐ Change per SCR/PR and review user documents, attach distribution letter and RCRs from reviewers	

Design Authority Signature:**Date:**