OCT 19 1998

31.4-73

ENGINEERING DATA TRANSMITTAL

Page 1 of 1
1. EDT 617395

2. To: (Receiving Organization) R. W. Root	3. From: (Originating Organization) Numatec Hanford Corporation	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: Waste Management	6. Design Authority/ Design Agent/Cog. Engr.: D. F. Iwatate	7. Purchase Order No.: N/A
8. Originator Remarks: For Approval and Release		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: N/A
11. Receiver Remarks: 11A. Design Baseline Document? ☐ Yes ☒ No		12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: 10/10/98

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	Approval Designator	Reason for Transmittal	Originator Disposition	Receiver Disposition
1	HNF-3495		0	Verification and Validation Implementation Plan for the Hanford Cone Penetrometer Multi-Sensor and Soil Sampler Probe System	N/A	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)											
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1	1	JG Kristofzski (CPO)	<i>[Signature]</i>	10/13/98	S7-01	1	1	WJ Kennedy (CPO)	<i>[Signature]</i>	10/13/98	S7-03
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18. GL: <i>[Signature]</i> Signature of EDT Originator	19. <i>[Signature]</i> Authorized Representative Date for Receiving Organization	20. <i>[Signature]</i> Design Authority/ Cognizant Manager	21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments
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Implementation Plan for the Hanford Cone Penetrometer Multi-Sensor and Soil Sampler Probe System

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U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: 617395 UC: 2030
Org Code: 88200 Charge Code: 103262/E100
B&R Code: EW3130010 Total Pages: 8

Key Words: cone, penetrometer, verification, validation, soil, sampler, software

Abstract: This document describes the requirements for verification and validation (V&V) of the integrated sensor and data reduction processes for the data acquisition system developed for the Hanford cone penetrometer platform.

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[Signature] 10/19/98
Release Approval Date

OCT 19 1998			ID.
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4			73
Release Stamp			

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**Implementation Plan for the Hanford Cone Penetrometer
Multi-Sensor and Soil Sampler Probe System**

Prepared by
Numatec Hanford Corporation
October 1998

For the
United States Department of Energy
Richland Operations Office
Richland WA

Implementation Plan for the Hanford Cone Penetrometer Multi-Sensor and Soil Sampler Probe System

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Implementation Plan for the Hanford Cone Penetrometer
Multi-Sensor and Soil Sampler Probe System

1 Introduction

This document defines the implementation plan associated with the development of the Hanford Tank Initiative (HTI) vadose zone cone penetrometer (CP) multi-sensor and soil sampler probes demonstration deployment.

1.1 Scope

This document describes the requirements for verification and validation (V&V) of the integrated sensor and data reduction processes for the data acquisition system developed for the Hanford cone penetrometer platform.

1.2 Objective

The objective of this document is to identify actions which assure that the equipment and associated software meets the needs of the HTI CP demonstration project. In addition, this document establishes the delineation of activities to assure that the system is independently validated for use by Project Hanford Management Contract (PHMC) activities.

1.3 Limitations

This document is limited to discussions regarding initiation, design, system characterization, and delivery validation. The system comprises hardware sensors, electronic data conversions, and embedded control programs which are controlled by common hardware qualification testing¹ approaches.

1.4 Primary Definitions

For this document, the following primary definitions are used:

Verification: A testing process which establishes performance in relation to a requirement or specification.

Validation: An evaluation process which assures that the system can operate in the intended environment and meets the original intent.

Development Testing:

A testing process which determines the actual performance parameters of the system and provides a baseline for quality control.

Qualification: A final testing process which confirms performance established by development testing related to intent of specification.

1.5 Environment

The CP system will contain a mix of contractor developed and off the shelf (OTS) software integrated into a data acquisition system (DAS). The SELLER supplied embedded software provides control and data reduction support to the various physical sensor systems in the probe and DAS. Since the software development is controlled by contract with a SELLER², the testing process is limited to the various system documents and activities of specification, design description, user documentation, operating software, and test records per intent of various procedures¹. The supplied system contains binaries executable by a run time system; no classical source code is available. This limit is further supported by the nature of the demonstration project and the goals identified in the Statement of Work² (SOW). Testing is performed by confirmation of hardware sensor measurement results compared to known standards. The test records include test procedures, case records, and test reports.

2 Overview

The HTI is chartered to leverage new technologies for the characterization and ultimate clean-up of Hanford nuclear defense tankage and materials. Certain Hanford waste tanks are known to have leaked radioactive material into surrounding soils. Clean-up approaches and needs statements are dependent on information regarding the extent of leakage plumes in the tank farm backfill soil and vadose zone. Subsurface characterization through traditional driven wells is expensive and sensor type deployment is limited. Cone penetrometer technology was selected as a deployment platform to allow rapid soil penetration and multiple on-board chemical and physical sensors. Innovative additions which result in a multi-sensor probe (MSP) are prescribed. The MSP and an associated soil sampling system will obtain several types of data for each penetration.

3 Development Activities

The various activities identified in section 1.5 are described in the following. A summary of responsibilities for each activity is found in Table 1.

3.1 Contract Requirements

As noted, the CP demonstration requires the integration of contract and OTS software into the DAS. The performance requirements have been provided as a part of an SOW to the SELLER. The SOW and requirements were developed by the CP team, reviewed and approved by PHMC management, technical representatives, quality assurance and the SELLER. This provides the basis for the remainder of the deployment and demonstration effort and becomes the primary contract document.

3.2 Design Description

Based on the requirements, a design description is provided by the vendor. This document is verified for compliance to the SOW instructions/requirements by the users technical team. It provides information on the relationship of the various components to each other and shows how data and control flows through the system.

3.3 User Documentation

User documentation describes how the system is operated. It comprises procedures, operation basis, and maintenance documentation. It is developed by the vendor and reviewed and approved by the user technical team. It is provided as part of the deliverables for final testing phases.

3.4 Source Software Code

Software structure listings for contractor-developed portions of the system software will be provided by the vendor as a part of the final system deliverables. Listings shall be indexed, correlated with system functions, and show control between listings and executable code. The listings package and binaries will become a part of the controlled documentation for the project. Completeness shall be verified by the user technical team. This section of documentation is comparable to As Built drawings of physical components.

3.5 Development Testing

Prior to and during delivery, the system will undergo development testing. This activity will establish the baseline limits of the system such as sensor responses, algorithm performance, and process sequences. This testing is performed by the SELLER and witnessed and approved by the BUYER technical team. The criteria are defined by the requirements and a development test plan. The development test plan is provided by the SELLER. A report containing the test cases and results will be provided for system project control documentation. The results will be verified by the BUYER technical team.

3.6 Qualification Testing

During the system delivery process, a qualification test will be performed which confirms the

basic performance of the system as defined by the SOW². The purpose of this testing is to confirm that the delivered system has not significantly changed from development, meets the intent of the requirements, and shows that the system is ready to demonstrate. This testing is performed by the BUYER technical team as an independent test from the SELLER characterization. SELLER representatives will support as required. The results will become a part of the project control documentation. The results will be verified by BUYER quality assurance.

3.7 Test Records

Each of the identified activities (3.1 through 3.6) will generate a record of status regarding the completeness of the activity. Where testing occurs, the results of the tests will be validated by the BUYER technical team. A test report will be generated which attests to the completeness of the deliverables, degree of compliance to intended need, and acceptability for contract obligations. These reports will become a part of the project controlled documentation.

3.8 Post Qualification Review

Subsequent to the qualification testing, a review will be performed to provide a closeout to the development process. This review will assess completeness of records and provide formal validation of the system against the SOW. This review will assess the impact of any exceptions found during various test phases.

4 Responsibilities

The responsibilities of various project participants are identified in Table 1.

5 Documentation Control

The documentation for the CP/MSP effort is maintained as a Commercial Vendor Information (CVI) file. The file is designated as the "HTI Project File" and has an engineering tracking number ETN-97-0014. At least one copy of all generated documents describing the development, testing, reviews, and system descriptive information is maintained therein. Certain documents are subject to change as the demonstration progresses. These are governed by Engineering Change Notice per PHMC guidelines.

Table 1 Phase Responsibilities			
Activity	Vendor	User	User QA
Contract Requirements	Approve	Create	Approve
Design Description	Create	Approve	Review
User Documentation	Create	Review/Approve	
Software Source Code	Create	Review/Approve	Review
Development Testing	Create/Perform	Review/Witness/ Approve	Review
Qualification Testing	Support	Create/Control	Review/Approve
Test Reports	n/a	Create/Control	Approve
Post Qualification Review	n/a	Create	Approve

6 References

- 1) HNF-PRO-446, Rev. 1., "Testing Requirements", Project Hanford Policy and Procedure System, 1997.
- 2) HNF-2881, Rev. 0, "Preparation and Testing of Cone Penetrometer Deployable Soil Multi-Sensor and Multi-Sample Soil Sampling Probes: Phase II", Statement of Work to Applied Research Associates, June, 1998.

DISTRIBUTION SHEET

To	From	Page 1 of 1
DISTRIBUTION	Numatec Hanford Co.	Date 10-19-98
Project Title/Work Order		EDT No. 617395
Waste Management - HNF-3495, Rev. 0		ECN No.

Name	MSIN	Text With All Attach	Text Only	Attach. / Appendi x Only	EDT/ECN Only
CENTRAL FILES	B1-07	X			
PROJECT FILES - HTI	R1-41	X			
DOE/RL READING ROOM	H2-53	X			
JW Bloom	R2-89	X			
WS Callaway	S3-90	X			
MJ Horhota	B1-13	X			
JJ Huston	R2-89	X			
DF Iwatate	R2-89	X			
GP Janicek	S7-12	X			
WJ Kennedy	S7-03	X			
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