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1	1	Design Authority R. S. Nicholson	<i>Robert Nicholson</i>	5/27/99	S5-05
		Design Agent			
1	1	Cog. Eng. G. L. Edgemon	<i>G. L. Edgemon</i>	5/27/99	R1-30
1	1	Cog. Mgr. D. B. Smet	<i>D. B. Smet</i>	5-27-99	S5-06
1	1	QA W. L. Adams	<i>W. L. Adams</i>		S5-15
1	1	Safety O. M. JAKA L. E. Thomas	<i>O. M. JAKA</i> <i>L. E. Thomas</i>	5/27/99	R3-01
		Env.			
18. <i>G. L. Edgemon</i> Signature of EDT Originator Date 5/27/99		19. <i>S. H. Rifaey</i> Authorized Representative for Receiving Organization Date 5/27/99		20. <i>D. B. Smet</i> Design Authority/Cognizant Manager Date 5-27-99	
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Process Test Plan for the 241-AN-105 Multi-Function Corrosion Monitoring System

G. L. Edgemon

Lockheed Martin Hanford Corporation
Richland, WA 99352
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1.0 INTRODUCTION

A corrosion monitoring probe will be installed into 241-AN-105 in late FY 1999. There are five principle objectives of this task:

1. Acquire data on the corrosive characteristics of the existing waste in 241-AN-105.
2. Provide supporting data to the Integrity Assessment program.
3. Acquire data to support a proposed eventual change in the operation of double shell tanks to monitor and control tank corrosion through the use of corrosion probes rather than waste sampling and analysis.
4. Demonstrate that corrosion monitoring by evaluation of electrochemical noise data is possible in waste tank systems, particularly with regard to the detection of general corrosion and (if present) pitting and stress corrosion cracking.
5. Demonstrate the durability of the design of the corrosion monitoring equipment.

The long term advantage of corrosion monitoring in double shell tanks is expected to be extended tank life and reduced annual operations cost.

The design of the corrosion monitoring system is documented in HNF-4285, Rev. 0 "Design of Multi-Function Hanford Tank Corrosion Monitoring System (Edgemon, 1998). Review of this equipment is bounded by Flammable Gas Equipment Advisory Board report FGEAB-97-040, Rev. 2. Programmatic documentation for the corrosion monitoring prototype probe is found in the TWRS Life Management Program plan (Jensen, 1996) and the Evaluation of Alternatives for Upgrading Double Shell Tank Corrosion Monitoring at Hanford (Nelson, 1996).

Probe operation will be terminated and the ex-tank monitoring equipment removed in either of the following two cases: 1) when the supernate level in 241-AN-105 permanently drops below the lowest of the corrosion monitoring electrode arrays on the probe; 2) probe failure (design life is five years).

Corrosion monitoring of this tank is continuous during the operation of the probe. The data are evaluated and archived by personnel within the TWRS Life Extension Equipment Engineering organization using standard techniques for the evaluation of electrochemical noise data. The continuous monitoring focuses on rapidly detecting changes in waste chemistry that would promote stress corrosion cracking and pitting of waste tank steels. The equipment is controlled by a computer located in the 241-AN-271 instrument building. This computer operates continuously, is connected to the HLAN and can be remotely monitored from the 2750E building. In the event that the equipment fails to operate properly, a member of the Equipment Engineering staff will be sent to the 241-AN-271 building to reset or arrange for repair of the system. It is not expected that Operations will have any responsibility for the operation, maintenance, or surveillance of the system at this time.

It is intended that successful operation of this probe will provide a basis to control corrosion in double shell tanks through the use of direct corrosion monitoring rather than waste sampling and analysis.

2.0 OBJECTIVES AND CRITERIA

The long term advantage of corrosion monitoring in double shell tanks is expected to be extended tank life and reduced annual operations cost. The bases for these expectations have been described in the TWRS Life Management Program plan (Jensen, 1996) and the Evaluation of Alternatives for Upgrading Double Shell Tank Corrosion Monitoring at Hanford (Nelson, 1996)

The operation of the corrosion monitoring system will be evaluated through the measurement of corrosion current and corrosion potential of the probe electrodes. The response of the electrodes will be compared to the responses obtained in laboratory studies documented in the Technical Basis for Electrochemical Noise Based Corrosion Monitoring of Underground Nuclear Waste Storage Tanks (Edgemon, 1996). Since this test serves the dual purpose of evaluating equipment as well as acquiring actual tank corrosion information, the data obtained will be used for two distinctly different purposes. The first use of the data will be to compare the responses from the probe to those obtained during laboratory studies. Similar responses will demonstrate that the probe system is functioning as expected and returning reliable information. The second use of the data will be to provide information on the corrosivity of the waste contained in 241-AN-105. Corrosion current (amperes) and potential (volts) data returned from the probe will be evaluated to determine whether there are any unexpected corrosion processes underway in the tank. Expected corrosion processes are described in Hanford Waste Tank System Degradation Mechanisms (Edgemon, 1995) and DST Remaining Useful Life Estimates (Anantatmula, 1996). Unexpected corrosion processes will be evaluated within the Equipment Engineering organization and recommendations for a response provided to management.

3.0 DESCRIPTION

3.1 Required Changes

For this process test there are no impacts on the Authorization Basis of the waste tanks or any procedures or equipment described in the Authorization Basis. This conclusion is supported by Unreviewed Safety Question Evaluation TF-99-0307. Applicable active OSDs were reviewed for impact associated with corrosion probe installation into 241-AN-105. In particular, OSD-T-151-00007 H-19, Unclassified Operating Specifications for the 241-AN, AP, AW, AY, AZ and SY Tank Farms were reviewed for applicability. The corrosion monitoring system will have no impact on tank composition, waste chemistry, liquid level, hydrostatic head, vapor space pressure, solution temperature, concrete temperature, ventilation system, airlift circulator operation, or total fuel concentration. Therefore, there are no impacts to the existing active site OSDs.

3.2 Permissible Ranges

Corrosion monitoring of this tank is continuous during the operation of the probe. Since this is a passive monitoring of waste tank conditions, there are no anticipated tank conditions which would require shutdown of this equipment. Similarly, a failure of the corrosion monitoring equipment will have no impact tank operations.

3.3 Duration

Monitoring will be terminated and the ex-tank equipment removed in either of the following two cases: 1) when the supernate level in 241-AN-105 permanently drops below the lowest of the corrosion monitoring electrode arrays on the probe mast; or 2) probe failure (design life is five years). It is intended that the duration of the operation be open-ended, with the probe operated until failure.

4.0 TEST REQUIREMENTS

4.1 Required Materials

All required equipment for this test has been provided by Life Extension Equipment Engineering.

4.2 Support Services

Physical support services required by this test and equipment is limited to the weather protection provided by location of the probe electronics inside the 241-AN-271 building, phone service, and a source of 110V power. No supplemental air, water, compressed gas, or HVAC is required.

4.3 Data Acquired

The type of data acquired by this equipment is described in detail in Technical Basis for Electrochemical Noise Based Corrosion Monitoring of Underground Nuclear Waste Storage Tanks (Edgemon, 1996). The data acquired from the corrosion probe do not meet the definitions of "Quality-Assurance Data" as defined by HNF-PRO-222, Rev. 1 and will not be tracked under the Records Inventory and Disposition Schedule (RIDS). However, corrosion probe data will be stored on a standard desktop personal computer located in 200E/2750E/D-111 throughout the duration of this test and backed-up on a monthly basis on the Hanford Local Area Network.

4.4 Personnel Required

Approximately eight hours per week will be required to download information from the probe computer and evaluate the data. This time is provided by Life Extension Equipment Engineering. It is not expected that Operations will have any responsibility for the operation, maintenance, or surveillance of the prototype system. In the event that

the equipment fails to operate properly, a member of the Equipment Engineering staff will be sent to reset the equipment.

5.0 SAFETY

5.1 Objective Hazards

Objective hazards for this process test (tank pressurization, tank level, dome load, and flammable gas controls) have been addressed in Unreviewed Safety Question Evaluation TF-99-0307. No impacts to the Authorization Basis were identified in this evaluation.

6.0 REFERENCES

Edgemon, G. L., Design of Multi-Function Hanford Tank Corrosion Monitoring System, HNF-4285, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.

Jensen, C. E., et. al, 1996, Tank Waste Remediation Systems Life Management Program, WHC-SD-WM-PLN-068, Rev. 1, Westinghouse Hanford Company, Richland, WA.

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