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September 25, 1997

LMHC-9758456

Mr. A. M. Umek, Project Director
TWRS
Fluor Daniel Hanford, Inc. S7-40
Post Office Box 1000
Richland, WA 99352-1000

Dear Mr. Umek:

HANFORD FEDERAL FACILITY AGREEMENT AND CONSENT ORDER INTERIM MILESTONE M-45-09B, "SUBMIT ANNUAL PROGRESS REPORTS ON THE DEVELOPMENT OF WASTE TANK LEAK MONITORING/DETECTION AND MITIGATION ACTIVITIES IN SUPPORT OF M-45-08"

The attached Annual Progress Report on Leak Detection, Monitoring, and Mitigation has been prepared for submittal to the Washington Department of Ecology for completion of Hanford Federal Facility Agreement and Consent Order. Lockheed Martin Hanford Corporation has completed Interim Milestone M-45-09B, "Submit Annual Progress Reports on the Development of Waste Tank Leak Monitoring/Detection and Mitigation Activities in support of M-45-08".

This Annual Progress Report should be transmitted to the U. S. Department of Energy, Richland Operations Office (RL) prior to September 30, 1997 to support closure of milestone M-45-09B.

If you have any questions, or require further information regarding this milestone, please contact J. S. Hertzel on 372-2616, or D. F. Iwatate on 376-8856.

Very truly yours,

H. L. Boston, Vice President and Director
Tank Waste Disposal
Tank Waste Remediation System

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Attachment

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Annual Progress Report on Leak Detection, Monitoring, and Mitigation

1997
TPA Milestone M-45-09B

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COMPLETION OF TPA MILESTONE M-45-09B: ANNUAL PROGRESS REPORT ON LEAK DETECTION, MONITORING, MITIGATION

1.0 SUMMARY

The Tri-Party Agreement (TPA) Milestone M-45-09B is due on September 30, 1997. This milestone calls for the submission of an annual progress report on the development of waste tank leak detection, monitoring, and mitigation (LDMM) activities in support of TPA Milestone M-45-08. Additional LDMM summary milestones are required at the end of each fiscal year through the year 2003. This letter provides the required summary information to satisfy the milestone for FY 1997.

The LDMM activities during FY-97 were specifically planned to support TPA milestone M-45-08-T02. This milestone requires the establishment of criteria through stakeholder participation and Ecology approval for (1) determining allowable leakage volumes, and (2) acceptable LDMM measures to permit sluicing operations. Activities supporting this milestone address technical, operational, and regulatory requirements for LDMM, available and potential tools to support requirements, and the preparation of an overall strategy to integrate all findings and available tools into support for sluicing.

The LDMM strategy was transmitted to the Washington State Department of Ecology (Ecology) in December 1996. Approval of this Strategy was required of Ecology per TPA Milestone M-45-08-T02 by April 30, 1997. Mutual agreement between Ecology and the Department of Energy (DOE) has moved this approval date five months to September 30, 1997. During this five month period, stakeholder review and modifications have occurred to the document. It is the intent to release the LDMM Strategy document in the form of an "LDMM Process Document.". The Process Document will incorporate all reviewer comments and modification made to the LDMM Strategy Document.

Table 1 provides a summary of the scope and findings of the FY 1994 through FY 1997 LDMM reports and studies conducted to support TPA Milestone M-45-08. Additional information is provided later in this report.

Table 1. Summary of Scope for LDMM Supporting Documentation.

"A Survey of Existing and Emerging Technologies for External Detection of Liquid Leaks at the Hanford Site", Pacific Northwest Laboratories (PNL-10176), October 1994
This LDMM technology survey identified all known/current technologies and methods and screened the total down to those applicable to Hanford SST LDMM conditions. An evaluation was conducted for 33 candidate LDMM technologies including those employing electrical, seismic, radar, moisture sensor, radiochemical, and tracer gas detection.

"A Survey and Description of Candidate Technologies to Support Single Shell Tank Waste Retrieval Leak Detection/Monitoring/Mitigation", Pacific Northwest Laboratories (PNL-10755), September 1995

This second candidate LDMM technology survey further evaluated the initial [33] technologies against the LDMM functions and requirements. This screening identified six candidate technologies that could potentially support SST waste retrieval/sluicing.

"Technology Issues Related to Single-Shell Tank Waste Retrieval Leak Detection, Monitoring, and Mitigation: Final Report", Foster Wheeler Environmental Corp. (FWRD-WHC/4344-L-95-085), July 1995

This effort produced a qualitative assessment of factors that impact risk reduction and cost-benefit from using the leak detection technologies (i.e., mass balance (baseline method for LDMM), tracer gas, two variations of Electrical Resistance Tomography (ERT), borehole logging, Time Domain Reflectometry (TDR), and leak detection pits) identified in the technology surveys. Only mass balance was judged to be available and deployable - key requirements for LDMM tools. This report also identified programmatic and "uncontrollable" factors related to the implementation of LDMM.

"Functions and Requirements for Leak Detection, Monitoring, and Mitigation to Support Hanford Single-Shell Tank Waste Retrieval, Rev. 1", Foster Wheeler Environmental Corp. (FWRD-WHC/4344-L-96-058), May 1996

The F&R documents discussed topics such as leak rate, leak volume/size, spurious indications, operating conditions, deployment, availability, and response. This information is essential to determine the possible need for, and contribution of, LDMM tools to support SST sluicing operations. The F&R documents, together with the findings of the technology surveys, provided a complete picture regarding not only what was required, but also what tools were currently available to fulfill those requirements. The F&Rs also provided an indication of how well a tool may be required to perform, i.e., resolution, detection level, response time, where to deploy, etc.. Revision 0 to this document was prepared during FY 1995.

"Trade Study of LDMM Technologies Available for Support of Hanford SST Waste Retrieval by Sluicing", Foster Wheeler Environmental Corp. (FWRD-WHC/4344-L-96-038/WHC-SD-WM-ES-379), May 1996

The LDMM trade study evaluated the use of current baseline LDMM tools versus the six candidate technologies identified in the technology surveys (i.e., leak detection using in-tank devices and methods, mass balance; leak monitoring using ERT, borehole logging, and TDR; and leakage mitigation by applying operational controls and, equipment design and availability.)

"Operational Tank Leak Detection and Minimization During Retrieval", ARES Corporation (ARES 951126-001/WHC-SD-WM-ES-377) February 1996

This report describes the operations response to leakage that could maintain leakage below or within an established envelope by, (1) minimizing in-tank liquid level, (2) using controlled sluicing action (tank sidewall and bottom last), (3) sluicing expeditiously, (4) minimizing equipment downtime, (5) using available in-tank surveillance tools (closed-circuit TV), (6) flow rate measurement, (7) liquid level measurement), and (8) by visually assessing and confirming liquid level and in-tank conditions during normal and planned operational shutdowns.

"LDMM Criteria for Determining Allowable Leakage", Foster Wheeler Environmental Corp. (FWRD-WHC/4344-L-96-074/WHC-SD-WM-ES-392), May 1996

This document presents an initial listing of major LDMM-related issues that must be addressed/resolved to develop a final value for allowable leakage volume (ALV). Issues are addressed in an optimal order and many issues are interrelated.

The following significant findings, regarding the use of LDMM to support single-shell tank (SST) sluicing campaigns, were derived from these engineering studies:

- Technology surveys could not identify any available or deployable, externally applied technical devices, or methods, that can detect waste leakage from an SST, (1) during the duration of planned SST sluicing operations, and (2) under SST and tank farm physical and operations conditions. Technologies reviewed do not provide an improved detection capability over existing internal technologies.

- Retrieval operations must be capable of responding to detected leakage for even the most ideal, available, and deployable leak detection or monitoring tool to be valuable.

- Deployment of a leakage detection or monitoring device presents an equally difficult, if not greater, challenge than finding and developing a technique to work under actual SST tank farm conditions.

- No new (i.e., other than the current baseline approach) internally applied technical devices, or methods, have been identified that can detect waste leakage from an SST during the duration of planned SST sluicing operations.

- The candidate, pre- and post-sluicing monitoring technology, ERT, could potentially reduce the uncertainty or risk incurred due to leakage by confirming and assessing leakage as small as 1,000 gallons or less. Existing (baseline) in-tank leak determination methods currently claim a minimum detection level of 8,000 gallons. If proven, external leakage monitoring could provide significant data to support post-sluicing assessments for multi-tank campaigns and provide assurance that actual leakage volumes did not exceed, projected and accepted, accumulated risk.

These baseline findings continue to be supported by the LDMM work completed in FY-97. Technology surveys will continue to ensure no new or emerging LDMM technologies will change the present LDMM baseline.

The present baseline technology for the retrieval of the Hanford Single-shell Tanks (SSTs) continues to be past practice sluicing. In support of this sluicing technology, the following LDMM measures remain the only currently available suite of tools to support sluicing operations:

- In-tank, liquid/waste level measurement devices and methods for leak detection (i.e., mass balance techniques).
- Neutron/gamma probe "monitoring" devices, and flow modeling data, to provide pre- and post-sluicing leakage plume assessment and concurrence.
- Operational, procedural, and administrative methods, and retrieval equipment design and availability, to mitigate leakage prior to, and during, sluicing. Engineered systems are not available for deployment as barriers beneath tanks for leak mitigation.

Continued evaluation of candidate LDMM technologies, enhancement of existing technologies, and testing of these tools under actual field conditions is necessary to support the retrieval of the Hanford SSTs.

2.0 DETAILED SUMMARY OF FY-97 ACTIVITIES

2.1 PREPARATION OF LDMM PROCESS DOCUMENT

The LDMM strategy document was released for review and comment by Stakeholders and Tribal Nations during FY-97. (*"Strategy for Leak Detection, Monitoring, and Mitigation during Hanford Single-shell Tank Waste Retrieval"*, WHC-SD-WM-ES-402, Rev.0, by D. F. Iwatate, dated 11/96). Briefings and consultation meetings were held with the Hanford Advisory Board Health, Safety and Waste Management and Environmental Restoration committees, the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, the Yakima Indian Nation, Community Leaders Network, and the Defense Nuclear Facility Safety Board. Stakeholder response to this document is to be provided in support of TPA milestone M-45-08-T02. This document describes a strategy for leak detection, monitoring, and mitigation during waste retrieval from the Hanford single-shell tanks. This document also provides a summary of findings and activities that form the technical basis for the criteria to determine potential leak values.

During FY-97 a series of discussions between DOE, Ecology, and Hanford stakeholders produced comments and changes to the original strategy document to describe how the LDMM criteria/strategy can be applied. As a result of these changes, the initial LDMM strategy document has evolved into a new document (Process for Determining Potential Leakage Volumes and Applying LDMM to Support Hanford SST Sluicing) that relates the LDMM strategy and leakage determination criteria to actual ongoing and planned activities. The general intent of this approach is to keep LDMM discussions and decisions more focused on actual operational and programmatic activities, and available LDMM [technical] support options.

In FY 97, the TWRS LDMM program established a home page to inform stakeholders and Tribal Nations about the various engineering studies and technology options available to address LDMM. The home page includes copies of key reports, summaries of technologies, and information on the potential criteria for determining potential leakage losses and acceptable detection, monitoring and mitigation measures.

In early 1997, DOE and Ecology initiated consultations with stakeholders and Tribal Nations to receive input on criteria for determining allowable leakage volumes and acceptable LDMM measures necessary to support sluicing operations. These consultations were scheduled to ensure that stakeholders and Tribal Nations were provided an opportunity to give DOE input and guidance on the criteria. Input was also solicited on the criteria via a series of meetings with Hanford Advisory Board (HAB) committees and Tribal Nations. Additionally, based on the advise of the HAB Waste Management committee, DOE prepared a strategy paper that was distributed to stakeholders and Tribal Nations for review in July 1997.

In addition to the home page, DOE TWRS has consulted with stakeholders and Tribal Nations regarding a variety of TWRS programs that impact or are impacted by potential leakage losses during retrieval actions. These programs include the tank farm operations, Hanford Tanks Initiative, single-shell tank closure, tank C-106 retrieval, and vadose zone characterization. During meetings with stakeholders and Tribal Nations regarding these other TWRS projects, potential leakage losses and LDMM have been discussed as an issue that impacts or is impacted by DOE plans in each of these areas.

2.2 SOIL MULTISENSOR AND SOIL SAMPLING CONE PENETROMETER PROBES

An effort is underway within the Hanford Tanks Initiative (HTI) task to deploy vadose zone interrogation instruments, using a cone penetrometer (CP), into Hanford 241-AX tank farm. A 3-year HTI activity will deploy a soil multi-sensor probe (MSP) and a multi-sample soil sampling probe (SSP) in the vadose zone surrounding SST AX-104. If successful, this activity will provide a tool for evaluating soil regions and targeting specific soil locations for "biopsy" style soil sampling efforts. More generally, this approach will validate the potential of the CP as a deployment method for LDM tools to evaluate and map contaminant plumes in (and out of) farms. Actual deployment of the probes into 241-AX soils is planned for the last quarter of FY-98. More generally, this approach will validate the potential of the CP as a deployment method for LDM tools to evaluate and map contaminant plumes in (and out of) farms. For example, the CP method, once demonstrated within a tank farm, can then be used to deploy other standalone CP probe analytical sensors, or multiple-unit array type tools such as Electrical Resistance Tomography (ERT). Such tools cannot be deployed as efficiently, or cost effectively without the use of CP. The potential use of ERT to detect and "observe" waste plumes of less than 8000 gallons has been discussed with Ecology and stakeholders during the past few years.

Fabrication and testing of the CP MSP/SSP probes will be conducted by the Army Corps of Engineers/Waterways Experiment Station (Army/WES), Vicksburg, Mississippi. The overall HTI Plume Characterization task is a joint effort including participation from the Army/WES, EM-50/Tanks Focus Area, Pacific Northwest National Laboratories (PNNL), Hanford Contractor staff, DOE-RL, and Applied Research Associates, Inc. (ARA).

A specification was issued (*"Specification for Soil Multisensor and Soil Sampling Cone Penetrometer Probes"*, HNF-SD-HTI-SDS-001, Rev. 0, by D. F. Iwatate, dated 5/97) establishing the requirements for the (CP) probes.

The MSP will include a gamma spectroscopy system, an x-ray fluorescence system, a magnetometer, inclinometer, and basic soil stratigraphy package (cone and sleeve sensors). The SSP will be used to obtain discrete (multiple) soil samples at specified/desired depths in areas where contaminants are suspected or have been found.

The cone penetrometer tool is an enclosed tube that contains sensing or sampling technologies that are pushed by a hydraulic device connected to a small diameter pipe (usually less than 5.0 cm (2 inches) dia.) into the ground using resistance force. The CP pushing platform is typically moved to the push location by driving it into position onboard a truck or by crane lift from a transport trailer. Once the CP platform, or truck, is in place, heavy weights are attached to achieve a maximum push pressure. CP piping strings of 1 meter (3.3 feet) length are slowly pushed into the ground at a rate of 2-3 cm/sec (0.1 feet) using hydraulic gripping tools mounted to the CP platform.

The CP-probes that will be deployed under the HTI task are two separate and unique, cone penetrometer-deployable, instrument and hardware "modules" (one for passive analytical instrument interrogation of soils, and one for taking actual grab samples of soils at specific depths). The functions of the CP-probes for the HTI task are to obtain data regarding waste leakage/contaminant plume extent and content in the soils surrounding AX-104. The CP probe technology and deployment goals under HTI include the following:

- Obtain soil and data samples for analytical specification of the AX-104 tank [waste] contaminant plume
- Demonstrate the capability to obtain multiple soil samples during a single, cone penetrometer probe deployment event
- Detect and avoid sub-surface metal objects during CP probe deployment
- Employ reusable multi-sensor and soil sampling probes
- Demonstrate the capability to seal CP penetration points upon extraction of the CP probes.

The CP-probes will provide new data about an expanded suite of potential plume constituents, and that information will be combined with existing historic data to support waste retrieval and tank/tank farm closure decisions. These SST vadose zone characterization tools will contribute needed information to waste retrieval and storage functions.

3.0 FY-98 PLANNED ACTIVITIES

3.1 LDMM OPERATIONAL DOCUMENT

The LDMM process document will establish a basis for the generation of a LDMM Operational document for the Initial Single Shell Tank Retrieval System (ISSTRS) project. The ISSTRS project consists of the retrieval of four tanks by past practice sluicing. These four tanks will be analyzed using the evaluation criteria as outlined in the Process Document to determine potential leakage values (PLV) during retrieval of these tanks. Once PLVs have been determined, the appropriate operating procedures can be generated during ISSTRS design.

3.2 CONE PENETROMETER PROBE DEPLOYMENT

The HTI task to deploy CP probes in tank farm AX-241 will take place during FY 1998.

The planned period during which CP deployment into 241-AX tank farm will occur in the 3rd and 4th quarters of FY 1998. The actual lengths of time for the overall deployment activity is still in the planning phase, however, early estimates indicate that two to six CP citing points will probably be worked for five to ten days at each location. Development, fabrication, and testing of the probe instrument and sampling modules will be completed during the 2nd quarter of FY 1998.