COMPLETE

ENGINEERING CHANGE NOTICE

Page 1 of 21. ECN **Nº 620632**Proj.
ECN

2. ECN Category (mark one) Supplemental ☒ EX Direct Revision ☒ KN Change ECN ☐ Temporary ☐ Standby ☐ Supersedure ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. G. F. Vargo, Jr., 75410, H5-09, 376-5387		3a. USQ Required? ☐ Yes ☒ No	4. Date 6/16/1995
	5. Project Title/No./Work Order No. Characterization/TPCN:N4A21 In-Situ Layering Study Work Plan		6. Bldg./Sys./Fac. No. N/A	7. Approval Designator S,Q
11a. Modification Work ☐ Yes (fill out Blk. 11b) ☒ No (NA Blks. 11b, 11c, 11d)	11b. Work Package No. N/A	11c. Modification Work Complete N/A Cog. Engineer Signature & Date	11d. Restored to Original Condition (Temp. or Standby ECN only) N/A Cog. Engineer Signature & Date	
12. Description of Change This ECN is Rev.1 of "WORK PLAN FOR THE IDENTIFICATION OF TECHNIQUES FOR IN-SITU SENSING OF LAYERING/INTERFACES OF HANFORD HIGH LEVEL WASTE TANK"; WHC-SD-WP-299, Rev.0				
13a. Justification (mark one) Criteria Change ☒ Design Improvement ☐ Environmental ☐ Facility Deactivation ☐ As-Found ☐ Facilitate Const ☐ Const. Error/Omission ☐ Design Error/Omission ☐				
13b. Justification Details Program management changed scope.				
14. Distribution (include name, MSIN, and no. of copies) * ADVANCE M.L. McElroy, S1-57 (1) *G.F. Vargo, Jr. H5-09 (2) C.E. Hanson H5-09 (1) J.W. Lentsch S7-15 (1) Central Files L8-04 (1) A3-88 OSTI L8-07 (2) A3-26 Project Files H5-09 (1)			RELEASE STAMP OFFICIAL RELEASE BY WHC (21) DATE JUN 15 1995 <i>Sta. 21</i>	

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1. ECN (use no. from pg. 1)

620632

15. Design Verification Required ☐ Yes ☒ No	16. Cost Impact <div style="display: flex; justify-content: space-around;"> <div> ENGINEERING Additional ☐ \$ N/A Savings ☐ \$ N/A </div> <div> CONSTRUCTION Additional ☐ \$ N/A Savings ☐ \$ N/A </div> </div>	17. Schedule Impact (days) Improvement ☐ NA Delay ☐ NA
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18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specification	☐	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐
Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐
Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
FSAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐
Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐	Tickler File	☐
Environmental Report	☐	Inspection Plan	☐		☐
Environmental Permit	☐	Inventory Adjustment Request	☐		☐

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision

Document Number/Revision

Document Number Revision

None

20. Approvals

[illegible]

RELEASE AUTHORIZATION**Document Number:** WHC-SD-WM-WP-299, REV 1**Document Title:** WORK PLAN FOR THE IDENTIFICATION OF TECHNIQUES FOR
IN-SITU SENSING OF LAYERING/INTERFACES OF HANFORD
HIGH LEVEL WASTE TANK**Release Date:** 6/15/95

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

APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

Kara M. Broz

June 15, 1995

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SUPPORTING DOCUMENT

1. Total Pages **14**

2. Title

WORK PLAN FOR THE IDENTIFICATION OF TECHNIQUES FOR
IN-SITU SENSING OF LAYERING/INTERFACES OF HANFORD
HIGH LEVEL WASTE TANK

3. Number

WHC-SD-WM-WP-299

4. Rev No.

1

5. Key Words

Work plan, in-situ sensing, layering/interfaces,
waste tank

6. Author

Name: GF Vargo, Jr

G.F. Vargo Jr
Signature

Organization/Charge Code 75410/N4A21

7. Abstract

The purpose of this work scope is to identify a specific potential
technology/device/instrument/ideas that would provide the tank waste data.

8. RELEASE STAMP

OFFICIAL RELEASE BY WHC	21
DATE JUN 15 1995	
<i>Sta. 21</i>	

**WORK PLAN
FOR THE
IDENTIFICATION OF TECHNIQUES
FOR
IN-SITU SENSING OF LAYERING/INTERFACES
OF HANFORD HIGH LEVEL WASTE TANK**

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**WESTINGHOUSE HANFORD COMPANY
JUNE 1995**

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MASTER

WHC-SD-WM-WP-299
Rev 1

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ACRONYMS AND ABBREVIATIONS

ARO	At Receipt of Order
CBD	Commerce Business Daily
CMST-IP	Characterization Measurement Sensors Technology- Integrated Program
Cs	Cesium
DST	Double Shell Tank
GPR	Ground Penetrating Radar
HLW	High Level Waste
KPa	Kilo Pascal
Kph	Kilometers per hour
METC	DOE's Morgantown Energy Technology Center
MPa	Mega Pascal
mph	miles per hour
R/hr	Rad/hour
SST	Single Shell Tank
UST	Underground Storage Tank

WORK PLAN
FOR THE
IDENTIFICATION OF TECHNIQUES
FOR
IN-SITU SENSING OF LAYERING/INTERFACES
OF HANFORD HIGH LEVEL WASTE TANKS

1.0 INTRODUCTION

A method is needed for anticipating and/or identifying layering/interfaces and physical state (solid, liquid, gas) within the materials contained in large tanks located on the Hanford Site in Washington State. The purpose of this work scope is to identify a specific potential technology/device/instrument/ideas that would provide this tank waste data.

In the tank waste, the primary interfaces of interest are the intrinsic waste changes where the waste material transitions from hard to softer material or vice versa. Also, the state (solid, liquid, gas) of the waste is desirable.

The basis for this need is that these interfaces and state changes can adversely affect characterization sampling operations. Prior knowledge (before core sampling and analysis is completed) of this layering is of interest as information that could be used to modify the sampling operation, enhancing the ability to retrieve a more representative tank sample and as an early indicator of material changes.

2.0 SCOPE

2.1 OBJECTIVES

This task is to manage an activity that consists of an industry survey to determine the existence of currently available hardware and/or concepts which could reasonably be developed to address this need. The desired hardware/concepts shall be of the ground penetrating radar (GPR), or non-contacting-waste category. Specifically, this task is in response to the U.S. ARMY CORP OF ENGINEERS (USACE) REPORT RECOMMENDATIONS, ROTARY AND PUSH-MODE DRILLING AND SAMPLING EQUIPMENT - GENERAL, Item #3.

"Consider using geophysics (acoustical imaging) to help identify hard /soft areas in the waste before drilling."

The study will be limited to GPR and non-contacting-waste technologies.

2.1.1 FOCUS OF SURVEY

The search field for this work has been divided into the three groups shown below.

Group A (To be conducted by WHC):

- DOE Technology Development
 - CMST-IP
 - METC
 - UST-ID

- National Labs
- Private Sector (Via CBD inquiry)
- Oceanography
- Highway/transportation

Group B (Contractor)

- Department of Defense (including classified)
- Department of Defense -GPR
- LANL - GPR

Group C (Contractor)

- University and Institutions
- Oil and Gas
- Mining (US Bureau of Mines)
- Corps of Engineers, Waterways Experiment Station

2.2 DELIVERABLES

The following deliverables are shown in the task schedule below:

D-1. Contact Lists:

Within the first 30 days after contract placement, each contractor will submit a list of contacts and the technologies identified to WHC. This will be an informal letter report.

D-2. Preliminary Report:

This preliminary report will list the attributes of each candidate considered as well as a cursory assessment of readiness for operational deployment. A preliminary report is due 30 days after the issuance of the authorization or purchase order/contract. This is not the final but an informal letter report.

D-3. Final Report:

The final report will include an update and completion of the preliminary report with emphasis on identifying common attributes, relative maturity and a recommendation(s) of the "best" strategy to pursue for early success. This report will be due 30 days after the Preliminary Report or 60 days ARO.

2.2.1 TELEPHONE REPORTS

In addition to the written deliverables described above, the vendor shall call the WHC lead project engineer and report the status of the contract by the close of business of each Friday of the contract duration. This is a minimum requirement. Telephone calls, electronic communication, and fax transmissions are encouraged at any time.

2.2.2 REPORT FORMATS

Three (3) copies of each written report shall be delivered. Prior to the delivery of the final report, the contractor will supply written permission to copy any vendor information, sheets from advertisers manuals, brochures, or any other information referenced or copied in the final report. This includes the Department of Energy, Battelle Pacific Northwest Laboratories, etc. or any other agencies as are appropriate for WHC to perform normal business functions.

2.2.3 OTHER REQUIREMENTS

Prior to initiating any contracted work, each contractor shall identify the principal and major contributors that will be working on the contract tasks. The PI shall notify WHC of any changes in personnel prior to initiating a change. The major concern is diligence and continuity must be maintained to complete this task within the expected short time schedule.

3.0 DESCRIPTION

3.1 BACKGROUND

The Hanford storage tanks (USTs) are underground and are typically 75 feet in diameter, 40 feet high, with about a 1 million gallon capacity. There are 149 single shell tanks (SST) and 28 double shell tanks (DST) in which HLW waste material has been stored. Access to the tank interiors is provided by a limited number of risers penetrating to the surface ground plane, which range in size from 4 to 42 in. in diameter. The total length of a riser within a tank is variable (8 to 30 ft.) with some riser extending into the wastes and others terminating above the waste in the tank head-space area. Tank penetrations and other features vary considerably because the tanks were built

at different times over an 15-20 year time period.

The tank materials generally consist of mixtures of hazardous chemicals and radionuclides typically found as layered salt cake, sludge, and supernatant liquids. The tank waste is known to be layered, but the distribution of the layers is not known or readily predictable from the current tank data. These layers have varying physical properties that range from a liquid to a sludge to a crystalline solid, each with a varying degree of hardness. The need is to identify the location of the hard/soft material interfaces which mark the boundaries of layers of material within the tank. The resolution of these measurements needs to be on the order of 25 millimeters (1 inch) or better.

At present, tank wastes are characterized by physically removing core samples and are then chemically analyzed in laboratory hot cells capable of safely handling radioactive materials. The core sample recovery process can be adversely affected by the presence of hard/soft layering, resulting in non-representative sampling of the tank materials.

3.2 ENGINEERING TASKS

3.2.1 PROGRAM MANAGEMENT

The program management task will include the generation and management of all WHC schedules, funding allocations, and final authority on all major decisions.

3.2.2 PROCUREMENT

The procurement task will include the generation of the Work Scope statement, to the vendor, and assistance to the WHC Purchasing Agent in preparation of the vendor contract. Also, all technical requirements concerning the high level waste tank(s) existing conditions and operating parameters shall be addressed.

3.2.3 VERIFICATION

The verification task will include the administering of the contract to the vendor with sufficient reviews to ensure that a quality product is received. This shall include the following:

- the documenting of at least one phone call per week during the duration of the contract;
- the receipt and review of Deliverable 1 and 2 after 30 days of the contract duration.
- If possible, one (1) televideo conference between the contractors

and WHC to be scheduled mid-range duration.

4.0 ORGANIZATIONAL RESPONSIBILITIES

4.1 MITIGATION AND CHARACTERIZATION EQUIPMENT (MCE)

MCE shall have the overall responsibility for the project. This shall include the management of the project and the coordination of all aspects of the project. Specifically, this is addressed in 3.2.1, 3.2.2, and 3.2.3.

Project Manager: J. W. Lentsch
Cognizant Manager: C. E. Hanson
Project Engineer: G. F. Vargo, Jr.

5.0 SCHEDULE

The target goal to have a system ready for in situ tank use/deployment on or before September 1996. The task described above is a key step in this process with its goal being to set the GPR or non-contacting-waste technology direction to pursue. Timely communication of data and questions arising from in-progress search to the WHC principal investigator is essential to the completion of this task. Prior to developing the final report, a verbal review of the results to date will be conducted. This expected to be conducted via telephone with FAX and electronic mail (e-mail) document transfers.

IN-SITU SENSING OF LAYERING TECHNIQUES

Task Name	Duration	Start	End	Responsible	Cost	% Complete
IN-SITU SENSING OF LAYERING TECHNIQUES						
GENERATE WORK PLAN	87.00 d	03/Apr/85	17/Aug/85		40.00	7
APPROVE WORK PLAN	5.00 d	03/Apr/85	07/Apr/85	G. V. Rao	10.00	85
GENERATE VENDOR WORK SCOPE (DOD GROUP B)	10.00 d	10/Apr/85	21/Apr/85	G. V. Rao	10.00	0
GENERATE VENDOR WORK SCOPE (DOD GROUP B)	5.00 d	10/Apr/85	14/Apr/85	F. Rajah	10.00	80
GENERATE SOLE SOURCE PROCUREMENT DOC. (DOD GROUP B)	5.00 d	10/Apr/85	14/Apr/85	F. Rajah	10.00	0
REQUEST FOR BID (DOD GROUP B)	10.00 d	17/Apr/85	28/Apr/85	F. Rajah	10.00	0
EVALUATION OF BID (DOD GROUP B)	5.00 d	01/May/85	05/May/85	F. Rajah	10.00	0
AWARD CONTRACT (DOD GROUP B)	10.00 d	08/May/85	17/May/85	F. Rajah	10.00	0
KICK-OFF (DOD GROUP B)	1.00 d	22/May/85	22/May/85	F. Rajah	10.00	0
RECEIPT OF CONTACT LIST (GROUP B)	30.00 d	23/May/85	08/Jul/85	F. Rajah	40.00	0
RECEIPT OF PRELIMINARY REPORT (GROUP B)	1.00 d	08/Jul/85	08/Jul/85	F. Rajah	10.00	0
RECEIPT OF FINAL REPORT (GROUP B)	30.00 d	07/Aug/85	17/Aug/85	F. Rajah	10.00	0
GENERATE VENDOR WORK SCOPE (GROUP C)	82.00 d	10/Apr/85	17/Aug/85		10.00	4
GENERATE SOLE SOURCE PROCUREMENT DOC. (GROUP C)	5.00 d	10/Apr/85	14/Apr/85	B. Mesh	10.00	80
REQUEST FOR BID (GROUP C)	10.00 d	17/Apr/85	28/Apr/85	B. Mesh	10.00	0
EVALUATION OF BID (GROUP C)	5.00 d	01/May/85	05/May/85	B. Mesh	10.00	0
AWARD CONTRACT (GROUP C)	10.00 d	08/May/85	17/May/85	B. Mesh	10.00	0
KICK-OFF (GROUP C)	1.00 d	22/May/85	22/May/85	B. Mesh	10.00	0
RECEIPT OF CONTACT LIST (GROUP C)	30.00 d	23/May/85	08/Jul/85	B. Mesh	40.00	0
RECEIPT OF PRELIMINARY REPORT (GROUP C)	1.00 d	08/Jul/85	08/Jul/85	B. Mesh	10.00	0
RECEIPT OF FINAL REPORT (GROUP C)	30.00 d	07/Aug/85	17/Aug/85	B. Mesh	10.00	0

6.0 COST ESTIMATE

The cost estimate for this survey is estimated at \$75K.

7.0 QUALITY ASSURANCE

Class IV, or no Quality Assurance.

8.0 REFERENCES

1. Standard Engineering Practices WAC-CM-6-1

APPENDIX

TANK AND MATERIAL ENVIRONMENTAL PROPERTIES

Generic Waste Properties:

Tank materials consist primarily of various salts (solids, slurries, and liquid forms) that can have a wide range of moisture content. The materials are radioactive and caustic as indicated below.

Specific Gravity: 1.2 to 2.0 for solid or liquid
Waste Surface Material (maximum expected salt cake values):

Compression Pressure: 28 MPa (4000 psi)
Shear Strength: 10 MPa (1450 psi)
Tensile Strength: 2.2 MPa (320 psi)
Penetrometer Resistance 386 MPa (56080 psi)

In Situ Tank Environment:

Components to be used within the tank should be able to withstand the following environmental parameters:

Temperature: 10° - 66°C (50° - 150°F) (head space temperature is at the lower end of this range)
Relative Humidity: 10% - 100%
Operating Pressure: Atmospheric ± 2.5 kPa (± 10 " H₂O) in head space
Dust: May contain abrasive NaNO₃ dust.
Chemical: Condensed vapors - pH from 8 to 14
liquids - pH from 8 to 14
solids - pH from 8 to 14
Radiation Field: 5 - 2000 R/hr
Total Dose: Gamma - .661 Mev (Cs 137), 1600R/application
Hazardous location: Potentially Class 1, Division 1, Group B per NFPA 70 (NEC Article 500).

External Tank Farm Environment:

Systems located external to the tank inside the tank farm perimeter shall be able to withstand exposure to the following environment:

Ambient Temperatures: Ranging from -28°C to 46°C (-20°F to 115°F)
Relative Humidity: From 4% to 100%
Wind Speeds: 0 to 64 kph (40 mph) w/blowing dust
Moisture: Rainfalls up to 5 cm/hr (2 in/hr)

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Dust:	Snowfall 61 cm (2 ft) total
Exposure:	Severe dust storms
Radiation Dose Rate:	Direct sunlight without degrading
	In the immediate vicinity of the tank risers
	dose rates range from less than 0.5 mR/hr to 70
	mR/hr. Background less than 0.5 mR/hr.
Traffic:	Light vehicle traffic over cables to/from
	operations trailer