JAN 11 1996 Sta. 21

21 ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT No 611687

2. To: (Receiving Organization)	3. From: (Originating Organization)	4. Related EDT No.:
See Distribution List	Nuclear Analysis and Characterization	NA
5. Proj./Prog./Dept./Div.:	6. Cog. Engr.:	7. Purchase Order No.:
Characterization		NA
8. Originator Remarks: See attached work plan for acceptance testing the Surface Moisture Measurement System for your approval.		9. Equip./Component No.: NA
		10. System/Bldg./Facility: NA
11. Receiver Remarks:		12. Major Assm. Dwg. No.: NA
		13. Permit/Permit Application No.: NA
		14. Required Response Date: ASAP

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Impact Level	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1.	WHC-SD-WM-WP-318	All	0	Surface Moisture Measurement System Acceptance Testing Work Plan	~~3~~ NA G.L.L 1/10/96	1		

16. KEY

Impact Level (F)	Reason for Transmittal (G)	Disposition (H) & (I)
1, 2, 3, or 4 (see MRP 5.43)	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 Impact Level for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.
1		~~Proj~~ ~~Cog~~. Eng.				RR Smith	RR Smith	1-4-96	N1-41	1	1
1	1	~~Proj~~ ~~Cog~~. Mgr.	Con Hans	1/8/96	H5-09	KL Bennett	Kenneth L. Bennett	1/4/96	N1-21	1	1
		QA				DS Dutt	Dale Dutt	1-4-96	N1-21	1	1
		Safety				WT Watson	W. T. Watson	1/9/96	H0-38	1	1
		Env.				DB Smet	D B Smet	1-9-96	N1-46	1	1
1	1	Proj. Eng. GF Vargo Jr	G F Vargo	1-8-96	H5-09	DR Burstad	D R Burstad	12/11/95	N2-50	1	1
1	1	Other TI Stokes	T I Stokes	1-8-96	L6-37						

18.	19.	20.	21. DOE APPROVAL (if required) Ltr. No.
G. A. Ritter 1/8/96 Signature of EDT Originator Date	C. C. Hanson ~~G. T. Dukelow~~ 1/10/96 Authorized Representative for Receiving Organization Date	C. B. Hanson 1/8/96 Project Engineer's Manager Date	[] Approved [] Approved w/comments [] Disapproved w/comments

BD-7400-172-2 (07/91) GEF097

BD-7400-172-1

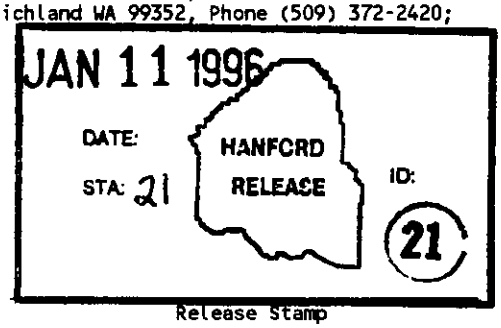
Surface Moisture Measurement System Acceptance Testing Work Plan

Glenn A. Ritter
Westinghouse Hanford Company, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

EDT/ECN: 611685 UC: 706
Org Code: 8M720 Charge Code: N4H4F
B&R Code: YM720000 Total Pages: 15

Key Words: moisture measurement, neutron probe, work plan, acceptance test

Abstract: This work plan addresses testing of the Surface Moisture Measurement System (SMMS) at the Fuels and Materials Examination Facility (FMEF). The purpose of this plan is to define the scope of work, identify organizational responsibilities, describe test control requirements, and provide estimated costs and schedule associated with acceptance testing.



Karen A. Noland 1/11/96
Release Approval Date

Release Stamp

Approved for Public Release

TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 SCOPE 1
2.1 OBJECTIVES 1
2.2 DELIVERABLES 2

3.0 DESCRIPTION 2
3.1 SYSTEM DESCRIPTION 2
3.2 ACCEPTANCE TEST DESCRIPTION 4
3.3 FACILITY INTERFACE REQUIREMENTS 5
3.4 TEST CONTROL DESCRIPTION 5

4.0 ORGANIZATIONAL RESPONSIBILITIES 7
4.1 FMEF/308 ENGINEERING & OPERATIONS 8
4.2 REMOTE SYSTEM AND SENSOR APPLICATIONS 8
4.3 INSTRUMENT SYSTEMS INTEGRATION 8
4.4 400 AREA FACILITIES RADIATION CONTROL 8
4.5 WHC SMMS NEUTRON SOURCE CUSTODIAN 9
4.6 SMMS PROJECT ENGINEER 9
4.7 SMMS RESPONSIBLE ENGINEERS 9
4.8 SMMS TEST PERFORMER [AS APPROVED BY THE RESPONSIBLE ENGINEER(S)] 10
4.9 QUALITY ASSURANCE ENGINEER (QE) 10
4.10 QUALITY CONTROL INSPECTORS (QC) 10

5.0 SCHEDULE 11

6.0 COST ESTIMATE 11

7.0 REFERENCES 12

SURFACE MOISTURE MEASUREMENT SYSTEM ACCEPTANCE TESTING WORK PLAN

1.0 INTRODUCTION

This work plan addresses testing of the Surface Moisture Measurement System (SMMS) at the Fuels and Materials Examination Facility (FMEF). The purpose of this plan is to define the scope of work, identify organizational responsibilities, describe test control requirements, and provide estimated costs and schedule associated with acceptance testing.

The SMMS is a developmental system and therefore SMMS engineers will be responsible for leading acceptance testing. At the completion of testing, Operations will be trained in the use of the equipment to prepare for deployment in tank farms.

2.0 SCOPE

2.1 OBJECTIVES

The primary tasks associated with this work plan are listed below. These tasks apply to primarily FMEF facility personnel. A more detailed description of the specific acceptance testing objectives are provided in section 3.0 and the organizational responsibilities are given in section 4.0.

- Prepare FMEF to accept the SMMS equipment as follows:
  - Provide two selected mock-up risers for installation of the SMMS deployment device and camera in room 500
  - Provide space for the data acquisition van on the FMEF ground level in room 300 (or directly outside room 351) as required
  - Set up a radiation area on ground level (below mock-up risers in room 351) and provide a Radiation Work Permit (RWP) for handling the neutron source (16 microgram, 9.1 mCi, californium-252 [^{252}Cf] neutron source)*
  - Set up a temporary Material Balance Area (MBA) for storing the neutron source.*
- Prepare Job Control System (JCS) work package to include WHC-SD-WM-ATP-153, *Surface Moisture Measurement System Acceptance Test Procedure* (WHC 1996[1]) that will be provided by SMMS personnel. This work package will include other tasks associated with acceptance testing.

[1]To be issued.

- Provide FMEF facility orientation training for SMMS engineers and technicians to support testing work in FMEF.
- Provide technician and craft support as required to install (and remove) the SMMS deployment device (requires a two-crane pick) and camera in the selected mock-up risers.
- Provide Radiological Control Technician (RCT) support as required for testing the SMMS with the neutron source.*

The tasks listed above with a "*" will not be required if the neutron source is not used during testing at FMEF.

2.2 DELIVERABLES

There are no deliverables associated with the tasks outlined in this work plan.

3.0 DESCRIPTION

3.1 SYSTEM DESCRIPTION

A brief description of the SMMS is provided in this section. A more detailed description of the SMMS including operating procedures is provided in WHC-SD-WM-OMM-024, *Surface Moisture Measurement System Operation and Maintenance Manual* (WHC 1995). The SMMS is shown in Figure 1 and consists of the following components:

- A sensor (surface neutron probe) that consists of a neutron source, three neutron detectors, high voltage power transformer, temperature sensors, and supporting electronics.
- A deployment device that consists of a support mast, an arm, and winch systems to lower and raise the arm and probe.
- A data acquisition van (DAV) that is equipped with the following:
  - Control console with flat panel computer system
  - Video monitor and video cassette recorder (VCR)
  - Generator to power the batteries
  - Batteries to power the equipment
  - Electrical distribution system
  - Data processing electronics
  - Electric-powered cable reel with remote controller (for LOWMMS only)

- Rotating boom with guide pulleys (for LOWMMS only).

- A decontamination system that consists of a high pressure spray ring that mounts on the riser, a gas-powered pressure washer, a gas-powered feed pump, a water tank, totalizers, and various hoses and fittings.

The surface sensor package is a neutron probe that infers the moisture content of the top layers of the waste surface by measuring the neutron moderating properties. These properties are a strong function of the hydrogen concentration of the waste which is related primarily to the water content. The probe obtains penetrating moisture data up to a maximum depth of about 16 cm for very dry waste. The penetration depth decreases for higher moisture waste. Three moisture indications are recorded: one near the surface (about 5 cm for 15 wt% moisture), at the mid-point (about 7 cm for 15 wt% moisture), and at the maximum depth (about 10 cm for 15 wt% moisture) are recorded. The probe measures moisture in the range of 0 to 40 percent by weight of water. The SMMS was designed to be operated in a National Electric Code (NEC) hazardous area classified as Class I, Division 2, Group B. The neutron source used with the SMMS probe is an encapsulated 16-μg ^{252}Cf source.

The deployment device consists of a vertical support mast with a rotating arm, which can be vertically rotated through a controlled angle to position the probe at a radius between 0 and 2 m (6 ft) from the riser centerline. A deployment cable, guided over the arm, mechanically lowers the probe to the waste surface. The arm also houses an inclinometer and associated cable.

The deployment device will be installed in a 4-inch or larger waste tank riser using a crane. The deployment device interfaces with a DAV that controls the sensor operation and records pertinent data. The DAV is a stand-alone system and connections to existing tank farms utilities are not required. Electrical power for the SMMS components is provided from one of three sources: the DAV's batteries, the DAV's generator, or a site service receptacle. Interconnecting cables will be placed above ground and routed between the van and the deployment device. The SMMS and supporting equipment are portable and only temporarily installed in a waste tank. The deployment device will be packaged in a weather-tight container for storage and transportation. The SMMS neutron source will be stored and transported in U.S. Department of Transportation (DOT) 7A Type A shipping container located inside of the DAV.

During measurement sequences, the arm will be raised to a specified angle and the deployment device will rotated to a specified orientation. The probe then will be mechanically lowered until it makes contact with the waste surface. The probe is not intended to penetrate the waste. A separate in-tank camera installed in an adjacent riser will provide visual feedback for all in-tank operations including probe deployment and placement. A video monitor will be located next to the riser to help the operator position the probe. Approximately 15 percent of the surface area within a 4 m (12 ft) diameter region will be scanned per the tank-specific test plan. Measurements will be made in such a way as to avoid large gaps in the data. The system allows any measurement to be repeated and allows for a higher spatial resolution to fill in missing gaps.

The data acquisition van also controls the deployment of the Liquid Observation Well Moisture Measurement System (LOWMMS), but this system will not be tested at FMEF. Also, the SMMS decontamination system will not be tested at FMEF.

3.2 ACCEPTANCE TEST DESCRIPTION

The primary purpose of acceptance testing at FMEF is to mock-up the operation of the SMMS deployment device as it would be used in the field. A preliminary check-out of the SMMS will be performed at the 306E Facility in the 300 area. Several tests will be performed to verify that each SMMS component/subsystem is functioning satisfactorily before the equipment is shipped to FMEF. The primary objectives of testing at FMEF are as follows.

- Verify basic equipment functions and mechanical interfaces.
- Demonstrate that sustained, repeated execution of the deployment sequence does not have adverse effects on the mechanical operability of the system.
- Verify that probe placement using the deployment device can be performed using only the view from an "in-tank" camera that is located up to 9.1 m (30 ft) away in an adjacent riser (the operator controlling the winches will only be able to see the camera view on a remote video monitor).
- Train Operations personnel to prepare for field deployment in tank farms.
- OPTIONAL: perform overall "loop check" on the system by measuring moisture concentration in moisture standards (barrels full of sand and hydrated alumina with known moisture concentrations) to verify that the neutron probe and supporting electronics are functioning satisfactorily.

The last objective listed above is optional. The Light Duty Utility Arm (LDUA) program requires the use of FMEF on March 1, 1996. The neutron probe may not be available for testing at FMEF by this date and therefore the overall loop check may be performed at 306E as part of probe calibration. It is not necessary to perform this loop check with the deployment device in the vertical position as it would be at FMEF. If the neutron probe is not available for testing at FMEF, then the neutron source will not be used at FMEF.

The basic test sequence is as follows.

- Install the SMMS deployment device (see Figure 1) in the selected mock-up riser and connect instrument cables to the data acquisition van.
- Install the camera in the selected mock-up riser adjacent to the deployment device.
- Lower the probe to the ground level and install the neutron source (OPTIONAL).

- Supply power to the system (using data acquisition van's batteries or 110 V receptacle).
- Using the camera video monitor and deployment device winches, position the probe (or mock-up probe) on a selected moisture standard (or target).
- Perform several moisture measurements for each moisture standard, repositioning the probe as required (OPTIONAL).
- Disable power to the system.
- Lower the probe to ground level and remove the neutron source (OPTIONAL).
- Remove the deployment device and camera from the mock-up risers.

3.3 FACILITY INTERFACE REQUIREMENTS

The facility space requirements, power requirements, and crane requirements are as follows.

- A 110 V, 20 A standard receptacle is required to power the data acquisition van on the ground level (in room 300 or directly outside room 351).
- A 110 V, 20 A standard receptacle is required to power the camera system in room 500.
- Two mock-up risers are required for the deployment device and camera in room 500. A minimum 1.3 m (4 ft) radius must be cleared around the riser to allow room for the equipment.
- The minimum crane hook height required (from the floor in room 500 to the crane hook) is 10.9 m (35.8 ft). Two cranes will be requiring for installing the deployment device in the mock-up riser.
- A 2.4 m (8 ft) by 6.7 m (22 ft) area is required for the data acquisition van on the ground level in either room 300 or directly outside room 351. The van must be located such that the 150-foot long cables can be connected between the van and deployment device.

3.4 TEST CONTROL DESCRIPTION

An acceptance test procedure (ATP) will be prepared by SMMS personnel and will include detailed test procedures. This procedure will be incorporated into the JCS work package. The procedure will be reviewed and approved by FMEF/308 Engineering & Operations and 400 Area Facilities Radiation Control. The test control procedures, including safety precautions and controls, will be specified in WHC-SD-WM-ATP-153. The primary controls are also summarized in the following sections.

3.4.1 Test Data

- All test data, pertinent observations, and off-normal events shall be recorded in WHC-SD-WM-ATP-153.

- An acceptance test report (ATR) shall be prepared by SMMS personnel to publish all data gathered during testing activities.

3.4.2 Procedure Control

A 400 Area JCS work package shall be used for controlling testing and shall include as a minimum single copies of the following:

- Acceptance test procedure, WHC-SD-WM-ATP-153.

- Operation and maintenance manual, WHC-SD-WM-OMM-024.

- Installation and assembly drawings.

The package may also include other information that is applicable to testing.

Changes to the test procedure are permitted. Minor procedure changes such as editorial changes to a step, clarification of a step or steps, elimination or addition of a step, or limited sequential changes of steps shall be noted in the procedure by redline entries and noted in the test procedure package giving the reason for the change. Redlined changes shall be documented in the ATR. The test performer shall red-ink changes with the concurrence of the responsible engineer. Approvals will be documented by the responsible engineer's initials on the redlined item. Lack of immediate redline approval does not constitute a test hold. For changes other than editorial changes, the red-ink changes will also be approved by the FMEF facility representative. Continued test progress will be at the discretion of the responsible engineer and the FMEF facility representative.

3.4.3 Retest Procedure Control

- If a retest is required, additional copies of the applicable procedure sections or data sheets of WHC-SD-WM-ATP-153 may be used or new procedures may be used.

- The addition of procedure sections to be used for retest shall be added to the test procedure package, concurred with by the WHC QE representative, and formally released in the ATR.

3.4.4 Exceptions to Acceptance Test

Exceptions to the test are dispositioned and agreed to by all witnesses. Actions taken regarding disposition are noted on the "Exception to SMMS Acceptance Test" sheets to be supplied with WHC-SD-WM-ATP-153.

3.4.5 Safety Precautions and Controls

Only the responsible engineers and/or their approved personnel shall operate the SMMS during performance of the acceptance test. A Hanford Job Hazards Analysis Checklist will be completed under the guidance of a representative from Industrial Health and Safety. A pre-job meeting will be held prior to the test performance to brief test personnel on the hazards unique to the SMMS equipment and to review all procedures, drawings, and other engineering documents required to complete the test. Safety precautions for operation of the SMMS are identified in WHC-SD-WM-OMM-024. Safety precautions applicable to the acceptance test will be specified in WHC-SD-WM-ATP-153. Safety precautions for the neutron source are specified below.

3.4.6 Controls for the Neutron Source

The neutron source used with the SMMS probe is an encapsulated 16 microgram Californium-252 (Cf-252) source. The neutron source is owned by Westinghouse Hanford Company (WHC). The source will be included on the WHC site inventory list and will have a current Radioactive Source Inventory and Integrity Test Record. The source will be maintained by the source custodian as indicated in section 4.0. The ATP will contain procedures for handling and controlling the neutron source. In addition, a source inventory procedure will be prepared for controlling the MBA.

An RWP for both the use of and temporary storage of the source will be obtained prior to shipping the source to FMEF. RCTs will perform a receipt survey of the source when it arrives at FMEF. The RCTs will set up a temporary radiation area (or high radiation area based on dose rate measurements) each time the source is removed from its storage container. Personnel inside the radiation area must wear the appropriate dosimetry as determined by the RWP. The ATP will include specific steps for maintaining neutron exposure to As-Low-As-Reasonably-Achievable (ALARA) levels. Special long-handled tools have been developed to handle the source to minimize personnel exposure. It is NOT expected that any person will receive a neutron exposure in excess of 100 mrem.

The source will be stored inside its storage cask in a temporary MBA. The MBA will be set up by FMEF facility management and the source custodian and approved by WHC Safeguards and Security.

4.0 ORGANIZATIONAL RESPONSIBILITIES

The task descriptions and responsibilities are outlined in the following sections. Signatures on the engineering data transmittal (EDT) form for this document indicate agreement for the task responsibility, schedule, and estimated costs by the responsible organization.

4.1 FMEF/308 ENGINEERING & OPERATIONS

Ronald R. Smith (FMEF facility representative for Dan Danko)

- Prepare the JCS work package to support testing.
- Approve the ATP.
- Approve field changes (other than editorial changes) to the ATP.
- Set up a temporary Material Balance Area (MBA) with the source custodian for storing the neutron source in FMEF.
- Provide technician and craft support as required to support testing including installing (and removing) the SMMS deployment device (requires a two-crane pick) and camera in the selected mock-up risers.
- Provide FMEF facility orientation training for SMMS engineers and technicians to support testing work in FMEF.

4.2 REMOTE SYSTEM AND SENSOR APPLICATIONS

Kenneth L. Bennett (representative for Dale S. Dutt)

- Provide space for SMMS equipment including two selected mock-up risers for installation of the SMMS deployment device and camera.
- Coordinate activities of ongoing Light Duty Utility Arm Cold Test Facility preparation and Operations Control Trailer check out with the SMMS responsible engineers.

4.3 INSTRUMENT SYSTEMS INTEGRATION

David B. Smet

- Provide camera system including two video monitors and a video cassette recorder for supporting acceptance testing.

4.4 400 AREA FACILITIES RADIATION CONTROL

Ruben B. Silvas (lead RCT)

- Set up and remove temporary radiation area on FMEF ground level (below mock-up risers) as required and provide Radiation Work Permit (RWP) for handling neutron source (16 microgram, 9.1 mCi, Cf-252 neutron source).
- Approve the ATP.
- Perform a receipt survey of neutron source when it arrives at FMEF.

- Provide RCT support as required for testing the SMMS with the neutron source.
- Work with the test performer to provide shielding as required in room 351.

4.5 WHC SMMS NEUTRON SOURCE CUSTODIAN

W. Todd Watson

- Approve the ATP.
- Prepare source inventory procedure for the SMMS neutron source.
- Prepare safe operating and emergency procedures for handling the SMMS neutron source.
- Set up and maintain a temporary Material Balance Area (MBA) with FMEF facility management for storing the neutron source in FMEF.
- Control all access to the neutron source.

4.6 SMMS PROJECT ENGINEER

G. F. Vargo Jr.

- Identify and specify testing requirements for the SMMS.
- Approve the ATP and ATR.
- Provide technical expertise during testing of the SMMS.
- Approve acceptability of test activities and results.
- Coordinate training with Operations.

4.7 SMMS RESPONSIBLE ENGINEERS

Overall System Engineer: T. I. Stokes
Mechanical (ME): D. B. Graves and/or G. A. Ritter
Probe Electrical (EE): J. H. Bussell
DAV Electrical (EE): M. Gimera

NOTE: The responsible engineer may perform test performer activities.

- Act as the person in charge for test preparation and performance.
- Identify equipment and facilities for testing.
- Ensure informal testing and inspection is complete.

- Act as a liaison with the Quality Assurance Engineer (QE) and other participants for testing activities, as required.
- Ensure Hanford Job Hazards Analysis checklist is complete.
- Conduct prejob briefing/readiness review prior to initiating test.
- Provide overall responsibility for maintaining and controlling testing to ensure compliance with the ATP including obtaining daily release from the FMEF work control center.
- Approve field changes to the ATP.
- Take necessary action to resolve exceptions to the ATP.
- Approve acceptability of test activities and results.

4.8 SMMS TEST PERFORMER [AS APPROVED BY THE RESPONSIBLE ENGINEER(S)]

- Perform testing in accordance with the ATP.
- Record test data and observations as specified in the ATP.
- Record authorized field changes to the ATP.
- Record exceptions to the ATP on "Exception to SMMS Acceptance Test" sheets (provided with the ATP).
- Prepare/issue the ATR.
- Work with the RCTs to provide shielding as required in room 351.

4.9 QUALITY ASSURANCE ENGINEER (QE)

M. L. McElroy

- Review and approve the ATP and ATR.
- Ensure that quality requirements are defined and satisfied for the test.
- Witness conductance of acceptance testing as required. Testing may proceed per the ATP without a QE present.

4.10 QUALITY CONTROL INSPECTORS (QC)

- Monitor test activities and provide signature verification, as required by the ATP. The QE or the responsible engineer may request QC witness of testing not specifically requested in the ATP.

5.0 SCHEDULE

Acceptance testing is currently scheduled to begin on January 22, 1996. The testing will be complete by March 1, 1996. The approximate breakdown of the testing activities is provided below in terms of working days. Note that several days time is provided in the schedule for troubleshooting but is not specifically shown below.

- Receive SMMS equipment and set up moisture standards or targets — 2 days
- Install deployment device & camera in mock-up risers — 1 day
- Test mechanical features of deployment device (without neutron source attached to probe) — 5 days
- OPTIONAL: perform loop check/complete mock up as described in Section 3.2 (with neutron source attached to probe) — 5 days
- Train Operations personnel — 10 days
- Remove SMMS equipment — 2 days

6.0 COST ESTIMATE

The cost breakdown for testing at FMEF is given below. Note that the cost of SMMS personnel is not included.

- Rental fee for facility space, 25 days @ $200/day (organization code 8A800) — $5 K
- FMEF Facility support (including JCS work package preparation) (organization code 19200) — $5 K
- RCT, craft, and technician support as required (organization code 19200) — $5 K
- Technician support (G. W. Lanham, 0.5 FTE) (organization code 19200) — $5 K

TOTAL — $20 K

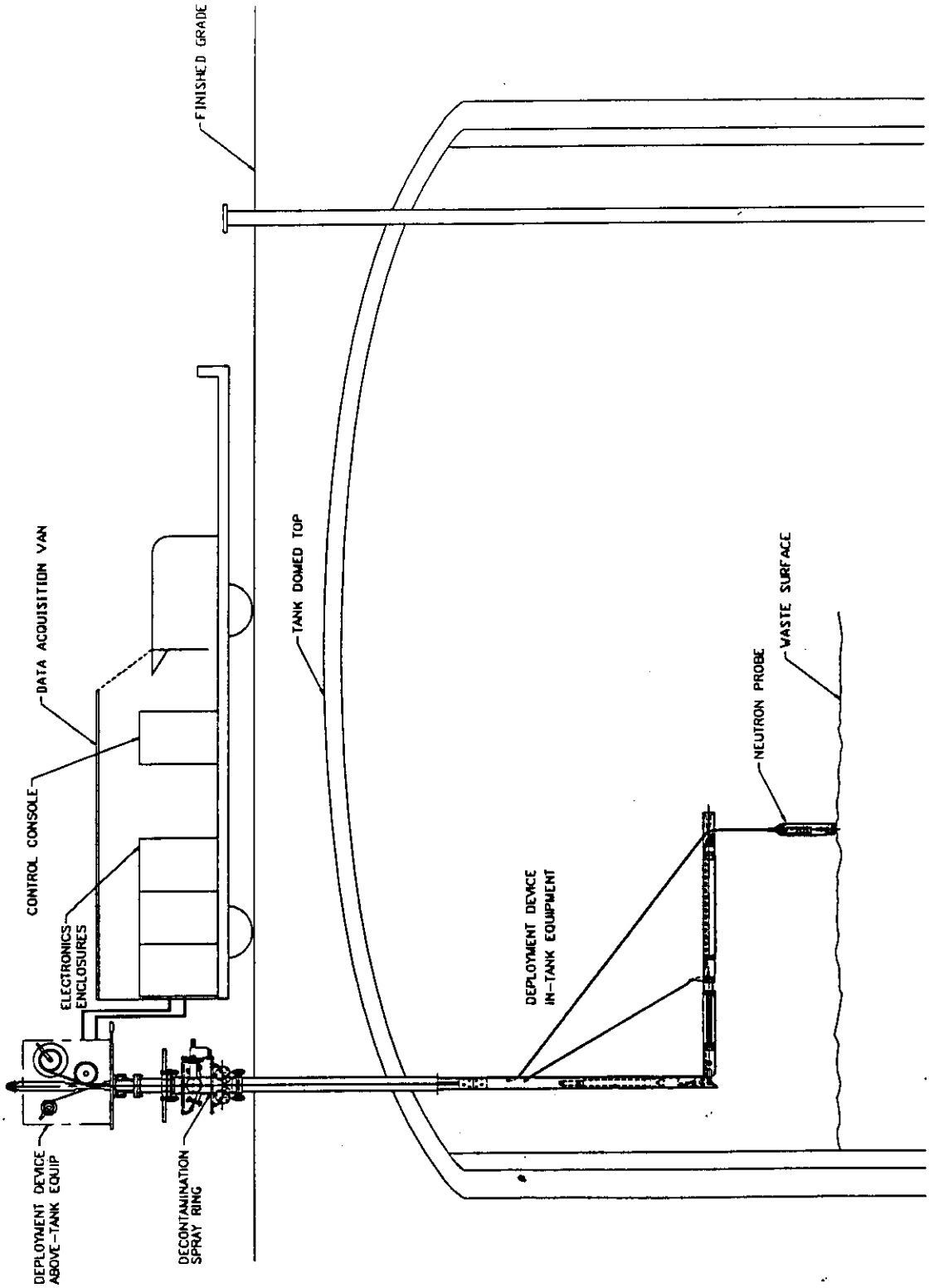
Work orders will be written to the specified organizations above for covering these estimated costs.

7.0 REFERENCES

WHC, 1995, *Surface Moisture Measurement System Operation and Maintenance Manual*, WHC-SD-WM-OMM-024, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1996, *Surface Moisture Measurement System Acceptance Test Procedure*, WHC-SD-WM-ATP-153, Draft, Westinghouse Hanford Company, Richland, Washington.

Figure 1-1. Surface Moisture Measurement System.



DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	G. A. Ritter	Date 1/9/95
Project Title/Work Order		EDT No. 611687
Surface Moisture Measurement System Acceptance Testing Work Plan		ECN No. NA

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
J. M. Bates	K7-15				
K. L. Bennett	N1-21				
D. R. Burstad	N2-50				
J. H. Bussell	L6-38				
R. D. Crowe	H0-38				
P. R. Deichelbohrer	S7-12				
G. T. Dukelow	S7-15				
M. Gimera	L6-37				
D. B. Graves	L6-37				
C. E. Hanson	H5-09				
L. S. Krogsrud	R3-08				
M. L. McElroy	S1-07				
G. A. Ritter	H0-38				
J. S. Schofield	S7-12				
R. R. Smith	N1-41				
T. I. Stokes	L6-37				
G. F. Vargo Jr.	H5-09				
A. E. Waltar	H0-32				
W. T. Watson	H0-38				
Project Files	H5-09				
Central Files (orig + 2)	~~L8-04~~ A3-88				
~~OSTI (2)~~	~~L8-07~~				