MAY 28 1996

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT 604984

2. To: (Receiving Organization) See Distribution List	3. From: (Originating Organization) Nuclear Analysis and Characterization	4. Related EDT No.: NA
5. Proj./Prog./Dept./Div.: Characterization	6. Cog. Engr.: CA Esvelt	7. Purchase Order No.: NA
8. Originator Remarks: See attached acceptance test report for 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					(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.	WHC-SD-WM-ATR-153	A11	0	Surface Moisture Measurement System Hardware Acceptance Test Report	SQ	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	4. Review			1. Approved	4. Reviewed no/comment				
		2. Release	5. Post-Review			2. Approved w/comment	5. Reviewed w/comment				
		3. Information	6. Dist. (Receipt Acknow. Required)			3. Disapproved w/comment	6. Receipt acknowledged				
17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)											
(G)	(H)									(G)	(H)
Reason	Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	Reason	Disp.
1	1	Cog.Eng. CA Esvelt	<i>CA Esvelt</i>	5/1/96	ST-12	DB Graves	<i>DB Graves</i>	5/15/96	L6-37	1	1
1	1	Cog. Mgr. JS Schofield	<i>JS Schofield</i>	5/15/96	ST-12	M Gimera	<i>M Gimera</i>	5/15/96	L6-37	1	1
1	1	QA ML McElroy	<i>ML McElroy</i>	5/15/96	ST-07	JH Bussell	<i>JH Bussell</i>	5/15/96	L6-38	1	1
1	1	Safety LS Krogsrud	<i>LS Krogsrud</i>	5/15/96	ST-08	WT Watson	<i>WT Watson</i>	5/15/96	H0-32	1	1
1	1	Ops. DP Niebuhr	<i>DP Niebuhr</i>	5/15/96	ST-16	TI Stokes	<i>TI Stokes</i>	5/15/96	H5-09	1	1
1	1	Proj. Eng. GF Vargo Jr	<i>GF Vargo Jr</i>	5/15/96	ST-09						
1	1	Proj. Mgr. CE Hanson	<i>CE Hanson</i>	5/15/96	H5-09						

18. Signature of EDT Originator <i>G. A. Ratter</i> Date: 5/8/96	19. Authorized Representative Date for Receiving Organization <i>G. A. Ratter</i> Date: 5/24/96	20. Cognizant Manager Date <i>J. S. Schofield</i> Date: 5/19/96	21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments
--	---	---	---

Surface Moisture Measurement System Hardware Acceptance Test Report

Glenn A. Ritter

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

EDT/ECN: 604984	UC: 706
Org Code: 8M720	Charge Code: N2249
B&R Code: EW3120074	Total Pages: 142

Key Words: moisture measurement, neutron probe, liquid observation well, tank safety, acceptance test report

Abstract: This document summarizes the results of the hardware acceptance test for the Surface Moisture Measurement System (SMMS). This test verified that the mechanical and electrical features of the SMMS functioned as designed and that the unit is ready for field service. The bulk of hardware testing was performed at the 306E Facility in the 300 Area and the Fuels and Materials Examination Facility in the 400 Area. The SMMS was developed primarily in support of Tank Waste Remediation System (TWRS) Safety Programs for moisture measurement in organic and ferrocyanide watch list tanks.

TRADEMARK DISCLAIMER. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

Printed in the United States of America. To obtain copies of this document, contact: WHC/BCS Document Control Services, P.O. Box 1970, Mailstop H6-08, Richland, WA 99352, Phone (509) 372-2420; Fax (509) 376-4989.

Glenn A. Ritter 5-28-96
Release Approval Date

Approved for Public Release

CONTENTS

1.0 INTRODUCTION	1
2.0 DESCRIPTION OF TEST	1
3.0 TEST METHOD AND TEST RESULTS	3
3.1 TEST PERSONNEL	3
3.2 ELECTRICAL CONTINUITY CHECKS	3
3.3 ELECTRICAL SYSTEMS PREOPERATIONAL CHECKOUT	3
3.4 DATA ACQUISITION VAN HVAC SYSTEM TEST	4
3.5 DEPLOYMENT DEVICE PREOPERATIONAL TEST	5
3.6 MISCELLANEOUS PROBE HARDWARE TESTS	7
3.7 DECONTAMINATION SYSTEM TEST	8
3.8 DEPLOYMENT DEVICE TEST AT FMEF	9
3.9 PROBE PLACEMENT TEST	10
4.0 CONCLUSIONS AND RECOMMENDATIONS	12
5.0 REFERENCES	12
APPENDIX A - SMMS ATP TEST CONTROL COPY	A-1

LIST OF FIGURES

1. Comparison of Detector Count Rates in Calibration Fixture #1 for the Probe Drop Tests	14
2. Comparison of Detector Count Rates in Calibration Fixture #2 for the Probe Drop Tests	15

LIST OF TABLES

1. SMMS Test Personnel	13
----------------------------------	----

LIST OF TERMS

ATP	acceptance test procedure
CP	Characterization Project
DAV	Data Acquisition Van
ECN	Engineering Change Notice
EE	Electrical Engineer
EP	Engineering Practice
FMEF	Fuels and Materials Examination Facility
HVAC	heating, ventilating, and air conditioning
LOW	liquid observation well
LOWMMS	Liquid Observation Well Moisture Measurement System
ME	Mechanical Engineer
OMM	operations and maintenance manual
OTP	operational test procedure
SMMS	Surface Moisture Measurement System
SSC	structures, systems, and components
TWRS	Tank Waste Remediation System
UPS	uninterruptible power supply
WHC	Westinghouse Hanford Company

SURFACE MOISTURE MEASUREMENT SYSTEM HARDWARE ACCEPTANCE TEST REPORT

1.0 INTRODUCTION

This document summarizes the results of the hardware acceptance test for the Surface Moisture Measurement System (SMMS) as specified in WHC-SD-WM-ATP-153, *Surface Moisture Measurement System Hardware Acceptance Test Procedure* (Ritter 1996). The purpose of this acceptance test was to verify that the mechanical and electrical features of the SMMS function as designed and that the unit is ready for field service. The successful completion of the acceptance test procedure (ATP) confirmed that the primary design requirements for the hardware specified in WHC-SD-WM-DRD-002, *Design Requirements Document for the Surface Moisture Measurement System* (Stokes et al. 1995), have been satisfied. The SMMS will be used primarily in support of Tank Waste Remediation System (TWRS) Safety Programs for moisture measurement of organic and ferrocyanide watch list tanks.

The first part of this acceptance test was performed at the Fuels and Materials Examination Facility (FMEF) from January 31, 1996 to March 11, 1996. Characterization Operations personnel participated in the testing as part of an informal hands-on training program. The final part of the test was completed at HiLine Engineering and Fabrication and at the 306E Facility in the 300 area from March 12, 1996 to April 15, 1996. The 306E Equipment Development group and HiLine conducted this part of acceptance testing under the direction of the test director (see Section 3.1 for a listing of personnel responsible for testing).

2.0 DESCRIPTION OF TEST

The primary objectives for this acceptance test were as follows.

- Verify basic equipment functions and mechanical interfaces.
- Verify the deployment device winches are self-locking and will not allow unintentional spooling.
- Verify torque limiters for the winches are functioning satisfactorily.
- Verify the deployment device bagged with containment sleeving will fit inside the shipping container.
- Verify the deployment device winch enclosure is sufficiently leak tight.
- Verify that the SMMS probe housing is water-tight and that the probe can withstand a specified impact/shock without damage.
- Perform pre-operational check of the electrical system.

- Perform continuity tests of electrical wiring for the SMMS.
- Verify the data acquisition van's battery-backed uninterruptible power supply (UPS) can supply power to the SMMS for up to 6 hours.
- Verify that the intrinsic safety barriers have been installed correctly.
- Verify the data acquisition van's heating, ventilating, and control (HVAC) system will allow vehicle idling for several hours without overheating.
- Verify performance of decontamination spray system is adequate.
- Measure the weights of SMMS components.
- Verify the positioning accuracy of the SMMS deployment hardware/software.
- 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 30 feet away (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 and verify that Operations personnel can easily operate the deployment device.

This acceptance test essentially encompassed testing/design verification of SMMS hardware that was not covered by probe calibration and the software ATP, WHC-SD-WM-ATP-158, *Software Acceptance Test Procedure for the Surface Moisture Monitor* (Gimera 1996).

The Engineering Practices Manual (WHC-CM-6-1, *Standard Engineering Practices*, Rev. 5, Change 1, EP-4.2, "Testing Requirements," dated 2/14/95) states that:

Operational testing is performed by the operator with items in their final in-service configuration (including interfaces) to verify that functional, operational, and design requirements have been met. The tested and accepted structures, systems, and component (SSCs) are integrated-and-tested-through various operational levels to verify that they will function as required by the Functional Design Criteria and other design criteria. This testing may include both normal and off-normal conditions.

The strategy for testing the SMMS does not include conducting a formal Operational Test Procedure (OTP). With the SMMS, operational testing was completed during the Acceptance Testing of this equipment. All aspects of the SMMS operation were tested using Characterization Project (CP) operators and the staff that will utilize this equipment in the field. This operational

testing that was conducted during the ATP satisfies the requirements of the above-mentioned Engineering Practice (EP).

A brief description of the SMMS is provided in WHC-SD-WM-ATP-153. The test control copy of this ATP is provided in Appendix A. A more complete description of the SMMS, including detailed operating instructions, is provided in WHC-SD-WM-OMM-024, *Surface Moisture Measurement System Operation and Maintenance Manual* (Ritter et al. 1995).

3.0 TEST METHOD AND TEST RESULTS

This section provides a listing of the test personnel, summarizes the test results, and also provides a brief description of the test methods. The test exceptions are also described in detail in the following sections. A total of 14 exceptions were noted. Most of them were minor, but some resulted in significant rework and retesting. The exceptions were dispositioned by the responsible engineer and approved by Quality Assurance, the SMMS lead engineer, and a test witness. Appendix A is the test control copy of the ATP, which contains the raw data for the test, observation sheets, and test exception sheets. The following sections are in the same order as the test sections specified in the ATP.

3.1 TEST PERSONNEL

Table 1 lists the personnel who participated in hardware acceptance testing. Their signatures are given next to each section in which they participated in the test control copy of the ATP (Appendix A).

3.2 ELECTRICAL CONTINUITY CHECKS

The electrical continuity checks were performed by the test director, responsible EE, and an independent electrical reviewer. The measured resistance of each conductor was recorded next to the termination point on the test control copy of the drawings. Exception #6 documented that initialing and dating next to each termination point was not done (as specified in the ATP) because a resistance was recorded next to each point. Instead, the responsible EE or independent reviewer initialed and dated each drawing sheet or section of the drawing as it was completed. Also, any discrepancies were noted as redlines on the test control drawings. These drawings will be used to prepare Engineering Change Notices (ECNs) to the released drawings. Exception #6 was accepted as-is. The continuity checks were completed successfully.

3.3 ELECTRICAL SYSTEMS PREOPERATIONAL CHECKOUT

The purpose of this test was to document that the electrical system for the SMMS functions as intended. This was a straightforward test that consisted of powering up the system using the three available power sources: van batteries, van generator, and site service receptacle. It was then

verified that power was available for all the components and that they were functional. It was noted that the generator takes a few minutes to warm up. Initially, the van's uninterruptible power supply (UPS) gives a "line failure" warning until the generator warms up and the frequency is within specification. Normally, the generator would just be used to recharge the batteries. It was also verified that the SMMS data acquisition and control systems in the van can run for a minimum of 6 hours on battery power (the system was run for 14 hours and still no "low battery warning" was observed). Test Exception #8 documented that all tests for the Liquid Observation Well (LOW) system will be postponed and not tested as part of this ATP. Exception #8 was accepted as-is (rerun of the acceptance test is unnecessary).

The intrinsic safety barriers were verified to be functioning correctly by measuring resistance, open circuit voltage, and short circuit current to verify that they are within manufacturer's specifications. Exception #5 noted that the measured open circuit voltage for the Elcon model 1072 barrier drifted. The disposition by the Responsible EE given in Appendix A provides an explanation as to why this occurred. The barriers were determined to be functioning satisfactorily. Exception #5 was accepted as-is. It was also verified that the barriers were properly grounded.

The deployment device may be installed in flammable gas watchlist tanks and must be properly grounded. The electrical system check included a verification that all in-tank equipment will be adequately grounded. See the ATP in Appendix A for the measured resistances. Exception #14 documented that the measured resistance for the probe semi-conductive cable was approximately 6 megohms, which exceeded the acceptance criteria of 1 megohm. The disposition by the Responsible EE for Exception #14 in Appendix A justifies why this measured resistance is acceptable. Exception #14 was therefore accepted as-is.

3.4 DATA ACQUISITION VAN HVAC SYSTEM TEST

This test verified that the van's heating, ventilating, and air conditioning (HVAC) system will allow the vehicle to idle for several hours in the heat of summer without overheating. A larger fan was installed in the van for this purpose.

A large plastic shroud was placed around the front of the van to block air flow to the radiator and control the air temperature in front of the van/radiator. The van was then turned on and idled for approximately 1 hour and 45 minutes (until a steady-state condition was reached). The air temperature in front of the radiator reached 48 °C (118 °F) and the steady state radiator temperature (measured on the outside of the radiator) was 100 °C (212 °F). The van engine did not overheat and the results were therefore found to be acceptable.

3.5 DEPLOYMENT DEVICE PREOPERATIONAL TEST

3.5.1 Weight Measurements

The weights of the components to be installed on the riser were measured and recorded in the test control copy of the ATP. Exception #12 documented that the probe weight is too light. Additional weight must be added to the top of the probe (above the electronic boards) to ensure that the probe cable winds uniformly and does not become tangled on the probe winch. The need for additional weight was observed after performing the deployment tests at FMEF. Exception #12 was accepted on the contingency that 4.1 kg (9 lb.) is added to the probe.

3.5.2 Torque Limiter Test

As part of the preoperational test, the torque limiters for the arm and probe winch were adjusted and tested. The torque limiters are intended to prevent the winch operators from exerting excessive loads on the probe cable and deployment device components. Exception #2 documented that the initial arm elbow was not strong enough to withstand the loads generated by raising the arm all the way until it hits the stop on the mast (if the arm winch operator continues to crank until the torque limiter slips). When the arm hits the stop, the relatively large moment arm (from the elbow to where the arm cable attaches to the arm) induces large stresses in the elbow pins. To prevent excessive stresses, the torque limiter would have to be set so low that there would not be enough torque to raise the arm. Therefore, the elbow was redesigned and rebuilt, and the torque limiter for the arm winch was retested. The deployment device operability test was also repeated (see Section 3.8.1). The retest sheets are provided in Appendix A following the exception sheets. Exception #2 was accepted after a successful retest was performed. The torque limiter settings for the arm and probe winch handles were 14 N-m (10 ft-lbf) and 8 N-m (6 ft-lbf), respectively.

3.5.3 Load Tests

Load tests on the arm and probe winches were performed to verify that the winches will not allow unintentional spooling. The initial load test was acceptable but was later repeated because the arm winch was also replaced. Representatives for Characterization Operations participated in testing and recommended that the original arm winch be replaced because it was physically difficult to crank. A winch with a larger gear ratio was therefore installed and a brake system for this new winch was designed and fabricated. The arm winch brake was set at approximately 5 N-m (4 ft-lbf). The load test for the new winch and brake was repeated and found to be acceptable. The retest sheets are provided in Appendix A following the data sheet for Exception #2. In addition, these tests were recorded on video and the videotapes will be stored in project files.

3.5.4 Bell Crank Retraction Test

This test was performed to verify that the bell crank on the arm retracts reliably without interfering with or damaging the probe cable. The results of this test were found to be acceptable. The arm and probe were placed in the worst case configuration as described in the ATP. The winch operator then attempted to tangle the probe cable with the bell crank but no tangling or binding was observed. However, the following test (Operational Test with Reduced Arm Length) proved to be the worst case scenario (see below).

3.5.5 Operational Test with Reduced Arm Length

The arm on the deployment device has extensions that can be removed to shorten the arm length. The extensions were removed and the arm was cycled up and down to verify that it still functions in this configuration. It was observed that the bell crank did not retract reliably, but rather became hung up on the probe cable. The reduced arm length increased the angle between the probe cable and the bell crank and therefore applied enough upward force to prevent the bell crank from retracting (an upward force exists because the bell crank extends slightly past 90°). Exception #13 documented this discrepancy. Three modifications were performed to correct this problem. First, a shorter spring on the bell crank was used to provide more retracting force. Second, the edges of the bell crank were rounded to allow the probe cable to slip by the bell crank. Third, a stop was added to limit the bell crank extension to 60°, instead of greater than 90°. Any force exerted on the bell crank by the probe cable would then help push it back into its slot. Exception #13 was accepted after a successful retest was performed. The retest sheets follow Exception #13 in Appendix A. This test was also videotaped.

3.5.6 Deployment Device Insertion into Shipping Container

This test was performed to verify that the deployment device, wrapped in plastic containment sleeving as it would be after being removed from a waste tank, could be easily installed in the shipped container. Two discrepancies were observed. The arm elbow brace had several sharp edges that caught on a weld bead on the inside of the container. The second discrepancy was that the mounting flange on the deployment device, which has a 4-inch bolt pattern, did not mate up with the flange on the shipping container, which has a 6-inch bolt pattern. Exception #10 documented these discrepancies and was accepted based on the contingency that the arm brace edges are chamfered and the flanges are modified (an adapter may be needed for the shipping container). A retest was not required. This test was also videotaped as part of Operations training.

3.5.7 Winch Enclosure Box Leak Test

The inside of the winch box will be open to the tank environment (via the mast) and therefore must be sufficiently leak tight to provide adequate containment. The box must also be able to withstand the vacuum pressure on tanks with active ventilation. The measured leak rate was 2370 cm³/min

(0.084 ft³/min) at a positive pressure of 250 Pa (1.0 in. H₂O), which was acceptable. A vacuum of 1250 Pa (5.0 in. H₂O) was applied to the box and it was verified that the box remained structurally intact. The results of these tests were acceptable without exceptions.

3.6 MISCELLANEOUS PROBE HARDWARE TESTS

3.6.1 Probe Housing Leak Test

The probe housing must be leak tight to survive decontamination and this test verified that the housing can be adequately sealed. There is no room for gaskets or o-rings on the housing, so it must be sealed with silicone RTV sealant. A bead of silicone sealant was applied on the outside of the housing at the two probe head joints. The housing was then placed in water such that there was a minimum of 30 cm (12 in.) of water above the top of the probe. The probe housing was then removed and disassembled for inspection. No water had leaked into the housing and the results were therefore acceptable.

3.6.2 Probe Shock Test

The probe housing and electronics inside the housing must be rugged enough to withstand impacts/shocks during an in-tank deployment. To simulate a relatively large impact, the prototype probe was dropped from a height of 30 cm (1 ft) onto a 1.3 cm (1/2 in.) thick steel plate (uniformly supported on the 306E concrete floor) in 5 different orientations as specified in the ATP. Exception #9 documented that a smaller neutron source was used so that test performer exposure was reduced and the need for setting up a high radiation area was eliminated. The counting time was therefore increased from 2 to 3 minutes. The probe was placed in each of the calibration fixtures after each drop to verify it functioned satisfactorily. The smaller source was placed at the bottom of the calibration fixtures. The source placement within these fixtures was not controlled and is likely responsible for some portion of the observed differences in the measured count rates, because it had to be moved between the two calibration fixtures after each drop. Table 6-1 in Appendix A provides the data for the count rates and temperature readings. The temperature readings increased slightly as the test progressed. This is expected because the probe electronics dissipate heat which then increases the air temperature inside the housing.

No damage to the probe housing was observed. The probe was disassembled after all of the drops were completed and the internals were inspected. Two damaged areas were noted on the observation sheets and sketch given in Appendix A. The anode wire on detector #1 was slightly bent and the tube holder for detector #3 was slightly out of plumb. These discrepancies are also documented in Exception #9. Figures 1 and 2 compare the measured count rates in calibration fixture #1 and calibration fixture #2, respectively. The highest and lowest measured count rates are shown to indicate the spread in the data. The error bars on the plots represent the statistical uncertainty of the count rates, which is defined as 3 standard deviations as specified in the ATP. If the variation in the count rates are less than 3 standard deviations, then it is assumed that no damage was done to the probe (statistically, the count rates are the same). The results of the shock test

were very favorable. The variation in the count rates were very small as shown in the figures. However, the count rate for detectors #2 and #3 in calibration fixture #1 slightly exceeded the specified statistical uncertainty as can be seen in Figure 1. For detector #2, this discrepancy is most likely due to an inconsistent source placement in the calibration fixture. This conclusion was reached because the uncertainty was not exceeded for calibration fixture #2 as shown in Figure 2. For detector #3, the error may have been caused by the slight damage that was done to the tube holder as previously described.

To prevent damage to the internals of the probe, two modifications must be made. First, the tack weld size for the detector #3 tube holder will be increased. The tack welds for the prototype probe were relatively small. Second, detector #1 must be positively secured or a protective block must be installed around the anode wire of detector #1 to prevent damage from probe impacts. Exception #9 was accepted based on the contingency that these modifications are performed.

3.6.3 Source Handling Tool Test

This test was performed to determine if the source holder could be damaged by improper use of the handling tool. With the probe in the horizontal position and secured in the deployment device socket, the tool was attached to the spare source holder (without an actual neutron source inside) and released. It was expected that the weight of the tool would simply cause the probe to rotate 90° without damaging the source or tool. However, the probe rotates but sticks occasionally without rotating the full 90°. The weight of the probe causes it to tilt down in the arm socket when the probe cable relaxes. The axis of the probe will usually not be aligned with the arm and therefore it tends to bind. The tool and spare source holder were inspected and found to be slightly damaged. The spare source holder tube section was out-of-round and the tool's threaded rod was slightly bent. Exception #11 documents that the results of the test were unacceptable. However, the operators (from Characterization Operations) had no difficulty using the tool during informal training. Therefore, Exception #11 was accepted based on the contingency that warnings are added to the operating procedure to handle the neutron source with care to prevent damage to the holder or tool.

3.7 DECONTAMINATION SYSTEM TEST

The decontamination system for the deployment device was assembled as it would be in the field and operated to verify that it functioned satisfactorily. Two fittings on the spray ring were found to leak. These fittings were tightened and subsequently no longer leaked. The measured flow rate was 16.7 L/min (4.4 gallons/minute) at full throttle of the high pressure pump, which corresponds to 9.0 MPa (1300 psi).

The suction of the spray ring that is caused by the water spray (because the nozzles are angled downward) was measured by sealing a clear plastic plate to the top of the spray ring and connecting a differential vacuum gage to a

port on the plastic plate. The system was operated at full throttle and the vacuum was measured to be approximately -820 Pa (-3.3 in. H₂O).

As part of operator training, a full-scale decontamination system test was performed over the test pit at the 306E facility. A plastic sleeve was connected from the mock-up riser on the test pit to a drum down on the floor of the test pit to catch the water draining from the deployment device. The spray ring, rubber wiper, and impact plate were assembled on a mock-up riser, as they will be in the field. The deployment device was then installed and subsequently removed from the riser to simulate an actual removal. The water spray was observed as well as the effectiveness of the rubber wiper. The suction of the spray ring kept the water spray contained and only a few drops of water were found on the top of the rubber wiper. The wiper was also found to be effective at removing the water from the outside of the deployment device. There were a couple of spots on the deployment device that were not completely self-draining--the elbow and the slot on the arm. It was estimated that less than 2 - 3 cm³ of water remained on the device. The results of these decontamination system tests were found to be acceptable without exceptions. This test was videotaped as part of Operations training.

3.8 DEPLOYMENT DEVICE TEST AT FMEF

3.8.1 Deployment Device Arm Operability and Reliability Test

This test was intended to demonstrate that repeated execution of the deployment sequence did not have adverse effects on the mechanical operability and reliability of the deployment device. The deployment sequence was repeated 50 times and this test was observed by the test director/responsible ME to verify that specific conditions (given in the ATP) were satisfied. The only discrepancy found was that the plastic coating on the arm cable was wearing excessively. The coating was completely worn off in several places. Exception #7 documented this discrepancy. This plastic coated cable was replaced with an uncoated stainless steel cable. A retest was required because the elbow was modified (see Section 3.5.2) and a new arm cable was installed. A retest was performed at the 306E Facility by hanging the device from the penthouse crane and securing (by strapping) the device to the stand next to the test pit. The arm was cycled up and down 50 more times (the winch operator was located on the lower catwalk of the penthouse) and the results were found to be acceptable. The retest sheets are provided in Appendix A following the data sheet for Exception #7. Exception #7 was accepted after a successful retest was performed. In addition, these tests were videotaped.

3.8.2 Probe Cable Wear Test

This test demonstrated that raising and lowering the probe does not have adverse effects on the probe cable or cause excessive wear. A 60 cm (2 ft) section of cable was cycled up and down over the rounded surface on the end of the arm a total of 100 times. The average cable diameter before the test was compared to the average cable diameter after 100 cycles to determine if it changed significantly. A significant change was defined as 6 standard deviations difference. The initial average cable diameter was 1.016 ± 0.0043 cm (0.3999 ± 0.0017 in.) based on 20 measurements along the 60 cm

section of cable. The average cable diameter after 100 cycles was 1.012 ± 0.0030 cm (0.3983 ± 0.0012 in.). The difference corresponded to 1.6 standard deviations, which was not significant. The results of this test were found to be acceptable. This test was also videotaped.

3.8.3 Stop Clamps Functional Test

While the deployment device was installed on a mock-up riser at FMEF, the stop clamps were set up to verify that they functioned satisfactorily. The stop clamps were set at various angles and approximately 450 N (100 lbf) was applied to the box to determine if the clamps would limit rotation. The results were found to be acceptable without exceptions.

3.9 PROBE PLACEMENT TEST

The deployment device is equipped with an electronic compass, inclinometer, and encoders for positioning the probe on the waste surface. However, a relatively flat surface is required for positioning the probe to perform an accurate moisture measurement. For an in-tank deployment, it will not be known exactly where the preferred measurement positions are located. Therefore, given an approximate sampling position, the deployment device operator must be able to adjust the probe position using only the view from the camera, such that the probe is positioned in good contact with a relatively flat surface for moisture measurement.

This test demonstrated that an operator can position the probe on selected targets using the deployment device and only the view from a camera located up to 9.1 m (30 ft) from the targets. The acceptance criteria was based on the time it took the operator to place the probe on 29 targets (one riser deployment).

Two separate camera locations were used for this test. The first camera location was in an adjacent mock-up riser located 6.4 m (21.1 ft) from the deployment device. Because this riser was relatively close to the deployment device, a second test was performed with the camera on the ground floor of FMEF positioned 9.1 m (30 ft) from the deployment device (FMEF did not have a mock-up riser that was 9.1 m away from the riser in which the deployment device was installed). The camera was located outside the cell and viewed the inside of the cell through one of the windows. These tests were performed by representatives from Characterization Operations. In addition, these tests were recorded on video and the videotapes will be stored in project files.

A representative from Operations also found that the ease of operation of the deployment device was acceptable and signed off the appropriate sections of the ATP.

3.9.1 Functional Test for Camera Located in Adjacent Riser

The operators began this test with no practice placing the probe, so the time it took to position the probe decreased substantially as the test progressed. The total time for placing the probe on all 29 targets was

1:53:06 (hours:minutes:seconds). After some practice, the operators were able to place the probe within about an inch of the center of the target in less than 3 minutes. The camera was located at two different heights above the cell floor (elevation of targets): approximately 1.8 m (6 ft) and 7.6 m (25 ft). Exception #4 documented that the van was not available for this initial test so the probe placement repeatability test was deferred until later. Basically, this test was broken into two parts: probe placement on targets and probe placement repeatability. Exception #4 was accepted as-is.

The probe placement repeatability test determined how close the probe returned to an initial position for the "repeat" sample points. The initial position was marked on the cell floor and the compass and inclinometer readings were recorded. The probe was then moved from that position while changing the arm angle as well. The probe was then placed back to the initial position according to the compass and inclinometer readings. The maximum center-to-center difference for the initial and final positions was 3.2 cm (1.25 in.). A total of seven points were repeated. The results of these tests were acceptable.

3.9.2 Functional Test for Camera Located in Room 351 (outside cell)

The probe placement test was repeated for the camera located outside the cell looking through the window. Exception #3 documented that not all 29 targets could be seen by the camera at this location. The targets located furthest away (worst case scenario) were used--a total of 7 instead of 29. Exception #3 was accepted as-is. The camera was measured to be 9.1 m (30 ft) away and approximately 1.5 m (5 ft) above the cell floor. This shallow angle made it a little more difficult for the operators to place the probe. For one case, the probe was placed almost 10 cm (4 in.) from the center of the target. For the other targets, the probe was generally positioned within 2.5 cm (1 in.) from the center of the target. The total time for placing the probe on 7 targets was 18:01 (minutes:seconds).

3.9.3 Probe Placement on Irregular Surfaces

The tank waste surface that the probe will be positioned on is not flat or smooth like the targets in the previous tests. For these tests, the probe was positioned on selected surfaces per the responsible ME's and/or Operations Representative's direction. For each surface, a description of the surface was recorded in Table 7-5 of the ATP (Appendix A). The probe placement operation was then videotaped.

The different surfaces consisted of placing the probe perpendicular to a domed surface (hardhat), placing the probe on inclined saltcake-like surfaces at various angles, and placing the probe on soft wet surfaces (wet sand) into which the probe will sink. These tests were performed using only the view from the camera. After the winch operator was satisfied with the probe placement, appropriate parameters to describe the placement accuracy were measured. The tests were videotaped and the results are as follows. For the domed surface placement, the probe could be consistently positioned within 5° of vertical. For the inclined saltcake surfaces, the steepest angle surface the probe could be placed perpendicular to was about 30°. The largest gap

between any point on the bottom of the probe and the inclined surface was typically less than 0.6 cm (0.25 in.). The operators then attempted to place the probe on a 15 cm (6 in.) diameter mound of wet sand without letting the probe sink in. A maximum gap/offset of 2.5 cm (1 in.) was measured between the back side of the probe bottom and the mound. The probe placement repeatability was also determined for the inclined saltcake surfaces. Typically, the probe could be returned to within 5 cm (2 in.) of the original position, which was slightly worse than the probe placement repeatability on a flat surface. These results were found to be acceptable.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The results of these tests were found to be satisfactory and the system functions as intended. All 14 test exceptions have been dispositioned and accepted. Some of these exceptions still require modifications to be performed. Actions required (open items) regarding these exceptions will be tracked on a punchlist. All open items must be completed prior to the completion of the Operations Readiness Review.

One test that was not performed as part of this ATP was an overall loop check with the probe connected to the deployment device. All previous testing and calibration of the neutron probe has been done through the use of a mock-up of the deployment device electronics. It was decided that this overall loop check will be performed as part of probe calibration. Upon completion of probe calibration and the open items specified in this ATR, the SMMS will be ready for field deployment.

5.0 REFERENCES

- Gimera, M., 1996, *Software Acceptance Test Procedure for the Surface Moisture Monitor*, WHC-SD-WM-ATP-158, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- Ritter, G. A., K. L. Pearce, T. I. Stokes, 1995, *Surface Moisture Measurement System Operation and Maintenance Manual*, WHC-SD-WM-OMM-024, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- Stokes, T. I. W. T. Watson, M. Gimera, J. H. Bussell, A. Dabiri, D. T. Holtslin, F. Johansen, 1995, *Design Requirements Document (DRD) for the Surface Moisture Measurement System*, WHC-SD-WM-DRD-002, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-6-1, *Standard Engineering Practices*, Westinghouse Hanford Company, Richland, Washington.

Table 1. SMMS Test Personnel.

NAME	ORGANIZATION	RESPONSIBILITY
George F. Vargo Jr.	Characterization Equipment Development	SMMS Lead Engineer
Glenn A. Ritter	Nuclear Analysis & Characterization	Test Director & Responsible Mechanical Engineer (ME)
Jim M. BusseII	Instrument Systems Integration	Responsible Electrical Engineer (EE)
Steve C. Cantrell	Instrument Systems Integration	Independent Electrical Reviewer
Mike Gimera	Hiline Engineering & Fabrication	Responsible EE
Troy I. Stokes	Hiline Engineering & Fabrication	Responsible ME
Mike E. Dahl	306E Equipment Development	Test Performer
Dennis B. Graves	306E Equipment Development	Responsible ME
Frank L. Bolson	306E Equipment Development	Test Performer
Jason B. Gunter	Hiline Engineering & Fabrication	Test Performer
W. Todd Watson	Nuclear Analysis & Characterization	Test Performer
Dan P. Niebuhr	Characterization Operations	Test Performer
Bruce A. Watkins	Characterization Operations	Test Performer
Vicki L. Goodenow	Characterization Operations	Test Performer
Don J. Reddout	Characterization Operations	Test Performer
Vernon P. Matthews	Characterization Operations	Test Performer

Figure 1. Comparison of Detector Count Rates in Calibration Fixture #1 for the Probe Drop Tests.

Figure 2. Comparison of Detector Count Rates in Calibration Fixture #2 for the Probe Drop Tests.

APPENDIX A

**SMMS ATP
TEST CONTROL COPY**

REFERENCE: WHC-SD-WM-ATP-153, Rev. 0

TEST CONTROL COPY

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	G. A. Ritter	Date 2/1/96
Project Title/Work Order		EDT No. 604983
Surface Moisture Measurement System Hardware Acceptance Test Procedure		ECN No. NA

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
J. M. Bates	K7-15	X			
K. L. Bennett	N1-21	X			
D. R. Burstad	N2-50	X			
J. H. Bussell	L6-38	X			
R. D. Crowe	H0-38	X			
P. R. Deichelbohrer	S7-12	X			
G. T. Dukelow	S7-15	X			
M. Gimera	L6-37	X			
D. B. Graves	L6-37	X			
C. E. Hanson	H5-09	X			
L. S. Krogsrud	R3-08	X			
M. L. McElroy	S1-07	X			
D. P. Niebuhr	S7-03	X			
G. A. Ritter *	H0-38	X			
J. S. Schofield	S7-12	X			
R. R. Smith	N1-41	X			
T. I. Stokes	L6-37	X			
G. F. Vargo Jr.	H5-09	X			
A. E. Waltar	H0-32	X			
W. T. Watson	H0-38	X			
Project Files	H5-09	X			
Central Files (orig + 2)	A3-88	X			

*ADVANCED COPY

TEST CONTROL COPY

FEB 01 1996				ENGINEERING DATA TRANSMITTAL				Page 1 of 1 1. EDT 604983			
2. To: (Receiving Organization) See Distribution List				3. From: (Originating Organization) Nuclear Analysis and Characterization				4. Related EDT No.: NA			
5. Proj./Prog./Dept./Div.: Characterization				6. Cog. Engr.: JS Schofield				7. Purchase Order No.: NA			
8. Originator Remarks: See attached acceptance test procedure for the Surface Moisture Measurement System for your approval.				9. Equip./Component No.: NA				10. System/Bldg./Facility: NA			
				12. Major Assem. Dwg. No.: NA				13. Permit/Permit Application No.: NA			
11. Receiver Remarks:				14. Required Response Date: ASAP							
15. DATA TRANSMITTAL											
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted				(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1.	WHC-SD-WM-ATP-153	A11	0	Surface Moisture Measurement System Hardware Acceptance Test Procedure				SQ	1		
16. KEY											
Approval Designator (F)				Reason for Transmittal (G)				Disposition (H) & (I)			
E, S, Q, D or N/A (See WHC-CM-3-S, Sec. 12.7)				1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Diet. (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)											
(G)	(H)	(J) Name	(K) Signature	(L) Date	(M) MSN	(N) Name	(O) Signature	(P) Date	(Q) MSN	(R) Reason	(S) Disposition
1	1	Cog. Eng. N/A	[Signature]	1/23/96	57-12	DB Graves	[Signature]	1/23/96	16-37	1	1
1	1	Cog. Mgr. JS Schofield	[Signature]	1/23/96	12	M Gimera	[Signature]	1/23/96	16-37	1	1
1	1	QA ML McElroy	[Signature]	1/23/96	31-07	JH Bussell	[Signature]	1/23/96	16-38	1	1
1	1	Safety LS Krogerud	[Signature]	1/23/96	R3-08	VT Watson	[Signature]	1/23/96	NO-38	1	1
1	1	Eng. J.R. TWELVE	[Signature]	1/23/96	16-38	FD DeLina Bohrer	[Signature]	1/23/96	57-12	1	1
1	1	Proj. Eng. GF Vargo	[Signature]	1/23/96	89-09	TI Stokes	[Signature]	1/23/96	16-37	1	1
1	1	Proj. Mgr. CE Hanson	[Signature]	1/23/96	NS-09	DP Niedera	[Signature]	1/23/96	57-03	1	1
18. Signature of EDT Originator				19. Authorized Representative Date				20. Cognate Manager Date			
[Signature] 1/23/96				[Signature] 2/1/96				[Signature] 1/25/96			
21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments											

TEST CONTROL COPY

WHC-SD-WM-ATP-153, Rev. 0

Surface Moisture Measurement System Hardware Acceptance Test Procedure

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

EDT/ECN: 604983 UC: 706
Org Code: BM720 Charge Code: N2249
B&R Code: EW3120074 Total Pages: 76

Key Words: moisture measurement, neutron probe, liquid observation
well, tank safety, acceptance test procedures

Abstract: The purpose of this acceptance test procedure is to verify that the mechanical and electrical features of the Surface Moisture Measurement System are operating as designed and that the unit is ready for field service. This procedure will be used in conjunction with a software acceptance test procedure, which addresses testing of software and electrical features not addressed in this document. Hardware testing will be performed at the 306E Facility in the 300 Area and the Fuels and Materials Examination Facility in the 400 Area. These systems were developed primarily in support of Tank Waste Remediation System (TWRS) Safety Programs for moisture measurement in organic and ferrocyanide watch list tanks.

TRADEMARK DISCLAIMER. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

Printed in the United States of America. To obtain copies of this document, contact: WHC/BCS Document Control Services, P.O. Box 1970, Mailstop H6-08, Richland WA 99352, Phone (509) 372-2420; Fax (509) 376-4989.

James Bishop 2-1-96
Release Approval Date

Approved for Public Release

ref
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

CONTENTS

1.0	INTRODUCTION	1
1.1	PURPOSE	1
1.2	SCOPE	1
1.3	GENERAL EQUIPMENT DESCRIPTION	3
2.0	REFERENCES	5
3.0	TEST CONTROLS	7
3.1	RESPONSIBILITIES ASSOCIATED WITH TESTING AT 306E	7
3.2	RESPONSIBILITIES ASSOCIATED WITH TESTING AT FMEF	9
3.3	TEST DATA	9
3.4	TEST CONFIGURATION	9
3.5	PROCEDURE CONTROL	9
3.6	RETEST PROCEDURE CONTROL	11
3.7	EXCEPTIONS TO ACCEPTANCE TEST SECTION	11
4.0	TEST CONDITIONS AND EQUIPMENT REQUIRED	11
4.1	TEST FACILITY	11
4.2	EQUIPMENT REQUIRED FOR TESTING AT 306E	12
4.3	EQUIPMENT REQUIRED FOR TESTING AT FMEF	12
5.0	SAFETY PRECAUTIONS AND CONTROLS	13
5.1	PERSONNEL PRECAUTIONS	13
5.2	EQUIPMENT PRECAUTIONS	13
5.3	ADMINISTRATIVE CONTROLS FOR THE SOURCE AND VEHICLE	14
6.0	306E TEST PROCEDURE	14
6.1	PREREQUISITES	14
6.2	ELECTRICAL CONTINUITY CHECKS	14
6.3	ELECTRICAL SYSTEMS OPERATIONAL CHECKOUT	15
6.4	DATA ACQUISITION VAN HVAC SYSTEM TEST	25
6.5	DEPLOYMENT DEVICE PREOPERATIONAL TEST	26
6.6	MISCELLANEOUS PROBE HARDWARE TESTS	34
6.7	DECONTAMINATION SYSTEM TEST	37
7.0	FMEF TEST PROCEDURE	41
7.1	PREREQUISITES	41
7.2	DEPLOYMENT DEVICE TEST	42
7.3	PROBE PLACEMENT TEST	45
	APPENDIX A - SURFACE MOISTURE MEASUREMENT SYSTEM FUNCTIONAL TESTING OBSERVATION/RESULTS SHEET	A-1
	APPENDIX B - EXCEPTION TO SMMS ACCEPTANCE TEST	B-1
	APPENDIX C - PREJOB SAFETY MEETING FORM AND ATTENDANCE ROSTER	C-1

WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

LIST OF FIGURES

1-1. Surface Moisture Measurement System	51
6-1. Circuit Breaker Panel Layout	52
6-2. SMMS and LOWMMS Instrument Cable Connections	53
6-3. SMMS Deployment Device Lift Points and Required Rigging	54
6-4. Winch Enclosure Box Leak Test Setup	55
6-5. SMMS Decontamination System Block Diagram	56
7-1. Sampling Point/Target Layout	57

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

LIST OF TABLES

6-1. Probe Drop Test Measurements (Section 6.6.2)	58
7-1. Sampling Point/Target Locations	59
7-2. Probe Cable Diameter Measurements (Section 7.2.3)	60
7-3. Probe Placement Measurements (Section 7.3.2)	61
7-4. Probe Placement Measurements (Section 7.3.4)	62
7-5. Probe Placement on Irregular Surfaces (Section 7.3.5)	63

ref
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

LIST OF TERMS

ALARA	as low as reasonably achievable
ATP	acceptance test procedure
CO	carbon monoxide
DAV	Data Acquisition Van
DOT	U.S. Department of Transportation
JCS	Job Control System
LOW	liquid observation well
LOWMMS	Liquid Observation Well Moisture Measurement System
NEC	National Electrical Code
OMM	operations and maintenance manual
SMMS	Surface Moisture Measurement System
TWRS	Tank Waste Remediation System
VCR	video cassette recorder
WHC	Westinghouse Hanford Company

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

SURFACE MOISTURE MEASUREMENT SYSTEM
HARDWARE ACCEPTANCE TEST PROCEDURE

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this acceptance test procedure (ATP) is to verify that the mechanical and electrical features of the Surface Moisture Measurement System (SMMS) are operating as designed and that the unit is ready for field service. Successful completion of this ATP, along with probe calibration, design analyses, and the software ATPs will confirm that the primary design requirements specified in WHC-SD-WM-DRD-002, *Design Requirements Document for the Surface Moisture Measurement System* (Stokes et al. 1995), have been satisfied. The design verification method appropriate for the SMMS is qualification testing as described in WHC-CM-6-1, *Standard Engineering Practices*, EP-4.1, "Design Verification Requirements."

Completion of this procedure will also verify that equipment operation complies with the safety controls specified in the unresolved safety question review, TF-95-0089, *Surface Moisture Monitoring of Hanford Tank Waste by Neutron Activation*. The accepted SMMS and LOWMMS will be used primarily in support of Tank Waste Remediation System (TWRS) Safety Programs for moisture measurement of organic and ferrocyanide watch list tanks.

1.2 SCOPE

This procedure shall be used in conjunction with the software ATP, WHC-SD-WM-ATP-158, *Software Acceptance Test Procedure for the Surface Moisture Monitor* (Gimera 1996), which includes testing of software and electrical features not addressed in this ATP. The Liquid Observation Well Moisture Measurement System (LOWMMS) will be tested in accordance with WHC-SD-WM-ATP-159, *Software Acceptance Test Procedure for the LOW Moisture Monitor* (Gimera 1996a*).

This ATP addresses testing of the SMMS hardware described in section 1.3. Hardware testing will be performed at the 306E Facility in the 300 Area and the Fuels and Materials Examination Facility (FMEF) in the 400 Area. The scope of tests to be performed at the two facilities is described in the following sections.

*To be issued.

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

1.2.1 Testing Objectives at the 306E Facility

- Verify basic equipment functions and mechanical interfaces.
- Verify the deployment device winches are self-locking and will not allow unintentional spooling.
- Verify torque limiters for the winches are functioning satisfactorily.
- Verify that the SMMS probe housing is water-tight and that the probe can withstand a specified impact/shock without damage.
- Perform pre-operational check of the electrical system.
- Perform continuity tests of electrical wiring for the SMMS and LOWMMS.
- Verify the data acquisition van's battery-backed uninterruptible power supply (UPS) can supply power to the SMMS for up to 6 hours.
- Verify that the intrinsic safety barriers have been installed correctly.
- Verify the data acquisition van's heating, ventilating, and control (HVAC) system will allow vehicle idling for several hours without overheating.
- Verify performance of decontamination spray system is adequate.
- Measure the weights of SMMS components.

1.2.2 Testing Objectives at FNEF

- Verify basic equipment functions and mechanical interfaces.
- Verify the positioning accuracy of the SMMS deployment hardware/software.
- 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 30 feet away (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 and verify that Operations personnel can easily operate the deployment device.
- 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.

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

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. In this case, the deployment device will be shipped back to 306E after testing at FMEF. It is not necessary to perform this loop check with the deployment device in the vertical position as it would be at FMEF.

1.3 GENERAL EQUIPMENT DESCRIPTION

A more complete description of the SMMS, including detailed operating instructions, is provided in WHC-SD-WM-OMM-024, *Surface Moisture Measurement System Operation and Maintenance Manual* (Ritter et al. 1995).

1.3.1 Surface Moisture Measurement System

The SMMS is shown in Figure 1-1 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 pulley (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.

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

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 1, Group B. The neutron source used with the SMMS probe is an encapsulated 16- μ g, 9.1 mCi, californium-252 (^{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, which weighs approximately 590 kg (1300 lb), 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 standalone 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. The source will be stored in a locked, shielded cask when not in use.

During measurement sequences, the arm will be raised to a specified angle and the deployment device will be 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. This in-tank camera is mandatory for successful SMMS operation. A video monitor will be located next to the riser to help the operator position the probe. Approximately 36 percent of the surface area within a 4 m (12 ft) diameter region will be scanned per the tank-specific test plan. Each probe measurement interrogates a region of approximately 40 cm (16 in.) in diameter. 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.

ref -
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

2.0 REFERENCES

- DOE-RL-92-36, *Hanford Site Hoisting and Rigging Manual*, Department of Energy, Richland, Washington.
- Gimera, M., 1996, *Software Acceptance Test Procedure for the Surface Moisture Monitor*, WHC-SD-WM-ATP-158, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- Gimera, M., 1996a, *Software Acceptance Test Procedure for the LOW Moisture Monitor*, WHC-SD-WM-ATP-159, Rev.0, Westinghouse Hanford Company, Richland, Washington.
- HSRCM-1, *Hanford Site Radiological Control Manual*, latest revision, Westinghouse Hanford Company, Richland, Washington.
- Ritter, G. A., K. L. Pearce, T. I. Stokes, 1995, *Surface Moisture Measurement System Operation and Maintenance Manual*, WHC-SD-WM-OMM-024, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- Ritter, G. A., 1996, *Surface Moisture Measurement System Acceptance Testing Work Plan*, WHC-SD-WM-WP-318, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- Stokes, T. I. W. T. Watson, M. Gimera, J. H. Bussell, A. Dabiri, D. T. Holslin, F. Johansen, 1995, *Design Requirements Document (DRD) for the Surface Moisture Measurement System*, WHC-SD-WM-DRD-002, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
- TF-95-0089, *Surface Moisture Monitoring of Hanford Tank Waste by Neutron Activation*, Westinghouse Hanford Company, Richland, Washington.
- TO-020-141, *In-Tank Video Procedure*, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-6-1, *Standard Engineering Practices*, latest revision, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-2-14, *Hazardous Material Packaging and Shipping*, latest revision, Westinghouse Hanford Company, Richland, Washington.
- WHC-CM-1-6, *WHC Radiological Control Manual*, latest revision, Westinghouse Hanford Company, Richland, Washington.
- WHC-IP-0972, Rev. 1, *Source Movement Procedure*, Westinghouse Hanford Company, Richland, Washington.
- WHC-IP-1019, latest revision, *Material Control and Accountability Plan*, Westinghouse Hanford Company, Richland, Washington.
- WHC-SD-QAPP-001, latest revision, *Quality Assurance Program Plan for Source Control*, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- WHC, 1996a, *Surface Moisture Monitoring System Installation Assembly*, drawing H-14-100458, draft, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996b, *Surface Moisture Monitoring System Deployment Enclosure*, drawing H-14-100459, draft, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996c, *Surface Moisture Monitoring System Deployment Arm*, drawing H-14-100460, draft, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996d, *Surface Moisture Monitoring System Neutron Detector Assembly*, drawing H-14-100461, draft, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996e, *Surface Moisture Monitoring System Decon System Assembly*, drawing H-14-100462, draft, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996f, *Surface Moisture Monitoring System Impact Limiter Assembly*, drawing H-14-100463, draft, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996g, *Surface Moisture Monitoring System Vehicle Modifications*, drawing H-14-100464, draft, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996h, *Surface Moisture Monitoring System Block Diagram*, drawing H-14-100467, draft, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996i, *Operator Control Enclosure Surface Moisture Measurement System Wiring*, drawing H-14-100469, draft, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996j, *Driver Side Electronics Enclosure Surface Moisture Measurement System Wiring*, drawing H-14-100471, draft, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996k, *Passenger Side Electronics Surface Moisture Measurement System Wiring*, drawing H-14-100473, draft, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996l, *Surface Moisture Measurement System Loop Diagram*, drawing H-14-100475, draft, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996m, *Surface Moisture Measurement System Schematic Diagram*, drawing H-14-100475, draft, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996n, *Surface Moisture Monitoring System Cable Assemblies*, drawing H-14-100477, draft, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996o, *Surface Moisture Measurement System Deployment Enclosure Wiring*, drawing H-14-100485, draft, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1996p, *Liquid Observation Well Deployment Device Wiring Diagram*, drawing H-14-100486, draft, Westinghouse Hanford Company, Richland, Washington.

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

3.0 TEST CONTROLS

3.1 RESPONSIBILITIES ASSOCIATED WITH TESTING AT 306E

3.1.1 306E Facility Management

D. G. Panther, J. R. Thielges

- Approve the ATP.
- Provide space in the 306E high bay for performing testing.
- Provide personnel to perform testing.

3.1.2 WHC SMMS Project Engineer

G. F. Vargo Jr.

- Identify and specify testing requirements for the SMMS.
- Approve the ATP and acceptance test report (ATR).
- Provide technical expertise during testing of the SMMS.
- Approve acceptability of test activities and results.

3.1.3 SMMS Design Authority

Representative: P. R. Deichelbohrer

- Approve the ATP and acceptance test report (ATR).

3.1.4 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.

WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 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.
- Approve field changes to the ATP.
- Take necessary action to resolve exceptions to the ATP.
- Approve acceptability of test activities and results.

3.1.5 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.

3.1.6 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.

3.1.7 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.

The names of the test performers and responsible engineers for this ATP shall be documented in the ATR.

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

3.2 RESPONSIBILITIES ASSOCIATED WITH TESTING AT FMEF

The responsibilities and additional test controls associated with testing at FMEF are defined in WHC-SD-WM-WP-318, *Surface Moisture Measurement System Acceptance Testing Work Plan* (Ritter 1996). This work plan also provides information on the organizations responsible for supplying test equipment including the camera system.

3.3 TEST DATA

- All test data, pertinent observations, and off-normal events shall be recorded in Section 6.0 (306E) and Section 7.0 (FMEF) of this ATP. If additional space is required, the data shall be recorded on an observation/results data sheet (provided in Appendix A) or equivalent.
- An ATR shall be prepared by SMMS personnel to publish all data gathered during testing activities.

3.4 TEST CONFIGURATION

- The drawings and engineering documents that establish the equipment test configuration are listed in Section 2.0.
- Additional documents required to perform, document, or validate a test (sketches, calibration sheets, etc.) will be referenced in or attached to the ATR.

3.5 PROCEDURE CONTROL

A controlled test procedure package shall be used for testing and shall include as a minimum single copies of the following:

- This ATP.
- Software ATP, WHC-SD-WM-ATP-158.
- Operation and maintenance manual, WHC-SD-WM-OMM-024.
- Critical lift procedure (for uprighting SMMS deployment device at FMEF, to be provided under JCS work package #4M-96-009/W).
- H-14-100458, *Surface Moisture Monitoring System Installation Assembly* (WHC 1996a*).
- H-14-100459, *Surface Moisture Monitoring System Deployment Enclosure* (WHC 1996b*).

*To be issued.

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- H-14-100460, Surface Moisture Monitoring System Deployment Arm (WHC 1996c*).
- H-14-100461, Surface Moisture Monitoring System Neutron Detector Assembly (WHC 1996d*).
- H-14-100462, Surface Moisture Monitoring System Decon System Assembly (WHC 1996e*).
- H-14-100463, Surface Moisture Monitoring System Impact Limiter Assembly (WHC 1996f*).
- H-14-100464, Surface Moisture Monitoring System Vehicle Modifications (WHC 1996g*).
- H-14-100467, Surface Moisture Monitoring System Block Diagram (WHC 1996h*).
- H-14-100469, Operator Control Enclosure Surface Moisture Measurement System Wiring (WHC 1996i*).
- H-14-100471, Driver Side Electronics Enclosure Surface Moisture Measurement System Wiring (WHC 1996j*).
- H-14-100473, Passenger Side Electronics Surface Moisture Measurement System Wiring (WHC 1996k*).
- H-14-100475, Surface Moisture Measurement System Loop Diagram (WHC 1996l*).
- H-14-100476, Surface Moisture Measurement System Schematic Diagram (WHC 1996m*).
- H-14-100477, Surface Moisture Monitoring System Cable Assemblies (WHC 1996n*).
- H-14-100485, Surface Moisture Measurement System Deployment Enclosure Wiring (WHC 1996o*).
- H-14-100486, Liquid Observation Well Deployment Device Wiring Diagram (WHC 1996p*).

The package may also include other information that is directly 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

*To be issued.

WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

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. Continued test progress is at the discretion of the responsible engineer.

3.6 RETEST PROCEDURE CONTROL

- If a retest is required, then data sheets, additional procedures, or additional copies of the applicable procedure sections of this ATP 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 WMC QE representative, and formally released in the ATR.

3.7 EXCEPTIONS TO ACCEPTANCE TEST SECTION

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" (Appendix B) sheet. If "reject" is selected for a particular test item, then an exception sheet shall be completed and dispositioned. Typical dispositions are:

- Test approved with exception (i.e., rerun of the acceptance test unnecessary).
- ATP step(s) affected to be repeated after the discrepancy has been corrected.
- Entire acceptance test to be repeated after the discrepancy has been corrected.

Note that all changes to the ATP, including redline changes and test exceptions, will be documented in the ATR, which will be reviewed and approved by all who approved the ATP.

4.0 TEST CONDITIONS AND EQUIPMENT REQUIRED

4.1 TEST FACILITY

Acceptance testing of the SMMS will be conducted at two separate facilities: the 306E Facility in the 300 area and FMEF in the 400 area. The bulk of testing will be performed at the 306E Facility, in the building high bay or area adjacent to the facility. A full scale mock-up of the SMMS deployment device as it would be operated in the field will be performed at FMEF.

refer
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

4.2 EQUIPMENT REQUIRED FOR TESTING AT 306E

The following equipment will be required for testing at 306E. Readily available tools, such as standard wrenches and screwdrivers, are not included.

- SMMS deployment device
- SMMS decontamination system (including spray ring, feed pump, high pressure pump, water tank, totalizers, and hoses)
- Data acquisition van
- SMMS interconnecting cables
- SMMS neutron probe (source not required)
- Test weight for SMMS neutron probe
- SMMS source handling tool
- LOWMMS spider assembly
- LOWMMS neutron probes (source not required)
- LOWMMS interconnecting cables
- Electrician's hand tools and multimeter for continuity testing and troubleshooting of electrical system
- electronic level with a minimum precision of $\pm 5^\circ$
- ohmmeter with a minimum range of 1 to 10 megohms
- 1-ton (minimum), 3 ft (minimum) spreader bar (supplied with deployment device) and rigging accessories for lifting deployment device
- Vacuum pump with a minimum capacity of 1250 Pa vacuum (5 in. H₂O vacuum)
- Differential pressure gage with a minimum range of 0 to 1250 Pa (0 to 5 in. H₂O) and a minimum precision of ± 25 Pa (0.1 in. H₂O)
- Flow meter with a minimum range of 0 to 4.7×10^{-4} m³/s (0 to 1 ft³/min) and a minimum precision of $\pm 4.7 \times 10^{-5}$ m³/s (0.1 ft³/min)
- Load cell/scale with a minimum range of 0 to 910 kg and a minimum accuracy of $\pm 5\%$
- Thermocouples and a readout unit with a minimum range of 0 to 200 °C and a minimum precision of $\pm 5^\circ\text{C}$
- Calibrated torque wrench with a minimum range of 0 to 50 N-m and a minimum accuracy of $\pm 5\%$

4.3 EQUIPMENT REQUIRED FOR TESTING AT FMEF

The following equipment will be required for testing at FMEF.

- SMMS deployment device
- Data acquisition van
- SMMS interconnecting cables
- SMMS neutron probe (optional--see Section 1.2.2)
- 1-ton (minimum), 3 ft (minimum) spreader bar (supplied with deployment device) and rigging accessories for lifting deployment device
- tape measurer with a minimum range of 0 to 9.1 m (0 to 30 ft)
- electronic level with a minimum precision of $\pm 5^\circ$
- dial calipers with minimum range of 0 to 2.5 cm (0 to 1 in.), and a minimum precision of ± 0.025 cm (± 0.01 in.)
- Vitus II camera system including two video monitors, video cassette recorder, and interconnecting cables (see Section 3.2)

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

5.0 SAFETY PRECAUTIONS AND CONTROLS

Only the responsible engineers and/or their approved personnel shall operate the SMMS during performance of this ATP. A Hanford Job Hazards Analysis (JHA) Checklist will be completed under the guidance of a representative from Industrial Health and Safety. This representative will be from the FFIF & Fuel Facility Safety group, which has responsibility for the 300 and 400 areas. 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 this ATP have been repeated here and are listed in the sections below. THESE PRECAUTIONS SHALL BE FOLLOWED FOR THE PERFORMANCE OF THIS ATP.

5.1 PERSONNEL PRECAUTIONS

- 5.1.1 In case of fire or other emergency in the van, all power shall be secured (if this operation can be done quickly and safely) by moving circuit breaker CB-1 to the OFF position (the main circuit breaker located on the power distribution panel, see Figure 6-1).
- 5.1.2 A carbon monoxide (CO) monitor is located in the DAV. If the CO monitor warning signal occurs, turn off the van engine, and exit the van leaving the doors open. Wait for a minimum of 5 minutes for the CO to dissipate. The CO monitor warning signal will automatically stop and reset when the unsafe CO level no longer exists.
- 5.1.3 Exhaust piping becomes hot during operation and remains hot for a while after stopping an engine (e.g., van, generator, decon pumps). Be careful not to touch a muffler while or exhaust piping it is hot.
- 5.1.4 The cables routed from the van to the SMMS deployment device equipment present a personnel trip/fall hazard. The cables shall be isolated by barricades to the extent possible to alleviate the trip hazards.
- 5.1.5 Electrical test equipment shall only be used by qualified personnel who are trained on the operation and limitation of the equipment.

5.2 EQUIPMENT PRECAUTIONS

- 5.2.1 Supply power to a subsystem must be OFF when connecting or disconnecting any electrical equipment or cables to that subsystem.
- 5.2.2 Failure to hook up or remove the power and interconnecting cables in the sequence prescribed in this manual could result in generation of unacceptable equipment voltages and in electrical arcing or sparking.
- 5.2.3 The SMMS deployment device could be bent if not supported and/or lifted correctly when in the horizontal position.

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

5.2.4 The generator is a potential source of electrical shock if misused. Do not expose the generator to moisture, rain, or snow. Do not operate the generator if it is wet, or if the operator is wet.

5.2.5 The exhaust systems get hot enough to ignite some materials. Keep the generator at least 1 m away from buildings and other equipment during operation. The generator is mounted to a platform on the front of the DAV. Do not enclose the generator in any structure and keep flammable materials away from the exhausts. Refer to the specific operation manual (e.g., generator, feed pump, high pressure pump) for operating and refueling precautions.

5.3 ADMINISTRATIVE CONTROLS FOR THE SOURCE AND VEHICLE

If the neutron source is to be used with testing at FMEF, then the applicable controls specified in section 3.3 of WHC-SD-WM-OMM-024 shall be followed.

6.0 306E TEST PROCEDURE

6.1 PREREQUISITES

6.1.1 Prejob Meeting

Conduct a "prejob meeting" of operations including a review of all procedures, drawings, safety hazards, and other engineering documents required to complete the test. Personnel who have attended the prejob meeting shall sign the attendance form given in Appendix C.

6.1.2 Stage Equipment

Verify that the equipment listed in Section 4.2 is staged in the test area. Verify that no interconnections have been made.

Test Engineer's signature

BC L. Hitt

Date

3/11/76

6.2 ELECTRICAL CONTINUITY CHECKS

Electrical continuity measurements of all SMMS and LOWMMS wiring shall be performed in this section. The following wiring diagrams shall be used to check electrical continuity.

- H-14-100469, Operator Control Enclosure Surface Moisture Measurement System Wiring.
- H-14-100471, Driver Side Electronics Enclosure Surface Moisture Measurement System Wiring.

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- H-14-100473, Passenger Side Electronics Surface Moisture Measurement System Wiring.
- H-14-100475, Surface Moisture Measurement System Loop Diagram. EXCEPT SHEETS 2 AND 4 - SEE EXCEPTION #8
- H-14-100485, Surface Moisture Measurement System Deployment Enclosure Wiring.
- H-14-100486, Liquid Observation Well Deployment Device Wiring Diagram. SEE EXCEPTION #8

For each drawing listed above, a test control copy shall be identified by clearly marking in red ink "TEST CONTROL COPY" above the title block on the drawing. Using a multimeter set up to measure resistance, the responsible EE and an independent electrical reviewer will verify continuity (maximum 1 ohm resistance) of each conductor from end to end on each drawing. The responsible EE or independent electrical reviewer will initial and date next to each termination point verified on the test control copy of the drawing. The test control copies of the drawings shall be saved in project files. Record instrument# for continuity tester below.

Instrument #: 804-45-08-010

Calibration expiration date: 3-13-97

WARNING

Verify that circuits are de-energized before performing continuity checks.

Electrical continuity checks on the drawings listed above have been completed. Discrepancies, if any, have been listed on exception sheets (Appendix B).

Accept/Reject (circle one) SEE EXCEPTION #8

Responsible EE's signature [Signature]

Date 9/15/96

Independent Reviewer signature [Signature]

Date 4-15-96

6.3 ELECTRICAL SYSTEMS OPERATIONAL CHECKOUT

The SMMS is a stand-alone system with no connections to existing tank farm utilities required. Power for the system operation is supplied as part of the data acquisition van, but can also be supplied by a site service receptacle. The van has a 120 VAC power generation system with a battery-backed UPS to stabilize and provide uninterrupted power. The SMMS must be able to operate for at least 6 hours on battery power. If site electrical power is to be used instead of the generator or batteries, the SMMS requires a 120 VAC, 20 amp site service receptacle. This ATP will verify adequate system

WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL CAY

operation from all three power supplies. The decontamination system feed pump and high-pressure pump are gasoline engine powered and will be tested in Section 6.7.

6.3.1 SMMS Electrical Cable Connections

Set the mode selector switch on the power distribution panel to SMMS. This switch directs the appropriate position encoder signal (SMMS or LOWMMS probe) to the computer and the appropriate probe signal to the NIM bin.

Verify that the following circuit breakers and disconnect switches are in the OFF position:

- Van power distribution panel: all circuit breakers, CB-1 through CB-15 (see Figure 6-1)
- Van generator: AC circuit breaker.

Connect the electrical cables to the equipment as follows.

- W1 to DAV J1 and to SMMS electrical junction box J11 (probe signals)
- W7 to DAV J7 and to SMMS electrical junction box J17 (auxiliary instrument signals)
- W8 to DAV J8 and to SMMS electrical junction box J18 (auxiliary instrument signals)
- W9 to DAV J9 and to SMMS electrical junction box J19 (probe signals)

NOTE: Electrical cabling interconnections are shown in Figure 6-2. Depending on whether a SMMS or LOWMMS scan is being performed some cables will not be connected, as identified above.

Test Engineer's signature GC H [Signature]

Date 4/9/96

6.3.2 Test Battery Power Supply for SMMS

- 6.3.2.1 Move the van power distribution panel circuit breaker switches CB-1, CB-2, CB-4, CB-5, CB-7, CB-8, CB-10, CB-11, and CB-13 (Figure 6-1) to the ON position.

NOTE: The uninterruptible power supply (UPS) will beep when the batteries are low.

- 6.3.2.2 Verify that power is available for the following components:

- computer and flat panel computer display
- NIM bin
- probe

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- deployment device instrumentation (compass, encoder, inclinometer)
- video monitor and video cassette recorder.
- van service receptacle

Accept/Reject (circle one)

Responsible EE's signature

[Signature]

Date 4/9/96

- 6.3.2.3 Leave the power turned on to the above electrical components for a minimum of 6 hours to verify the battery power is available and the equipment functions satisfactorily for this length of time.

ACCEPTANCE CRITERIA: 6 hours of available battery power (minimum)

Accept/Reject (circle one)

Responsible EE's signature

[Signature]

Date 4/15/96

- 6.3.2.4 With the power turned on to the above electrical components, disconnect and reconnect (see Figure 6-2 for cabling interconnections) each of the SMMS cables and verify that this causes no damage to the components.

ACCEPTANCE CRITERIA: no damage to electrical components

Accept/Reject (circle one)

Responsible EE's signature

[Signature]

Date 4/9/96

- 6.3.2.5 Move the van power distribution panel circuit breaker switches CB-1, CB-2, CB-4, CB-5, CB-7, CB-8, CB-10, CB-11, and CB-13 (Figure 6-1) to the OFF position.

6.3.3 Test Site Service Receptacle Supply for SMMS

- 6.3.3.1 The SMMS requires a 120 VAC three-prong receptacle with 20 amp service. To prevent damage to SMMS hardware, verify the selected site service receptacle is the correct type specified per the responsible EE's direction. Using a multimeter, verify that the voltage across hot and neutral on the site service receptacle is 120 VAC. Verify that the voltage across neutral and ground is approximately zero.

- 6.3.3.2 Plug the extension cord into the van receptacle (connect W2 to DAV P3 per Figure 6-2).

NOTE: The van line voltage receptacle is located at the front of the van near the generator.

- 6.3.3.3 Plug the extension cord into the site service receptacle.

ref.
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 6.3.3.4 Move the van power distribution panel circuit breaker switches CB-1, CB-2, CB-4, CB-5, CB-7, CB-8, CB-10, CB-11, and CB-13 (Figure 6-1) to the ON position.
- 6.3.3.5 Verify that power is available for the following components:
- computer and flat panel computer display
 - NIM bin
 - probe
 - deployment device instrumentation (compass, encoders, inclinometer)
 - video monitor and video cassette recorder
 - van service receptacle.

Accept/Reject (circle one)

Responsible EE's signature

[Signature]

Date

4/2/86

- 6.3.3.6 Move the van power distribution panel circuit breaker switches CB-1, CB-2, CB-4, CB-5, CB-7, CB-8, CB-10, CB-11, and CB-13 (Figure 6-1) to the OFF position.

6.3.4 Test Generator Power Supply for SMMS

Testing of the generator must be performed outside of the 306E Facility or the generator must be temporarily plumbed such that the exhaust is outside of the building. The number of hours of generator power available from one tank of gas will also be measured as part of this test.

WARNING

Generator exhaust piping becomes hot during operation and remains hot for a while after it is turned off. Do not touch the muffler while it is hot.

WARNING

The generator is a potential source of electrical shock if misused. Do not expose the generator to moisture, rain, or snow. Do not operate the generator if it is wet, or if the operator is wet.

WARNING

If the CO monitor warning signal occurs, turn off the van engine and/or generator, exit the van, and ventilate the van. Wait for a minimum of 5 minutes for the CO to dissipate. The CO monitor warning signal will automatically stop and reset when the unsafe CO level no longer exists.

WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

6.3.4.1 Perform preoperation check.

NOTE: Engine oil is a major factor affecting engine performance and service life. Nondetergent and 2-stroke engine oils will damage the engine and are NOT to be used.

1. Check the oil level BEFORE EACH USE with the generator on a level surface with the engine stopped. If the level is low, add SAE 30W SF/SG or equivalent oil to the upper mark on the dipstick.
2. Check the fuel level gauge. Refill the tank so that the fuel tank is full. Do not fill above the shoulder or the fuel strainer, and never refuel if the generator is running or is hot.

6.3.4.2 Plug ~~one end of the extension cord into the AC receptacle on the generator, and the other end into the van receptacle (connect W3 to generator J3 according to Figure 6-2).~~

NOTE: The van line voltage receptacle is located at the front of the van near the generator.

6.3.4.3 Make sure that the generator AC circuit breaker is in the OFF position. The generator may be hard to start if a load is connected.

6.3.4.4 Turn the fuel valve to the ON position, turn the choke lever to the CLOSE position, and turn the engine switch to the ON position.

6.3.4.5 Pull the starter grip until compression is felt, then pull briskly.

NOTE: Do not allow the starter grip to snap back. Return it slowly by hand to prevent damage to the starter.

6.3.4.6 Turn the choke lever to the OPEN position as the engine warms up.

6.3.4.7 Switch ON the generator AC circuit breaker and continue to run the generator per the responsible EE's direction.

6.3.4.8 Move the van power distribution panel circuit breaker switches CB-1, CB-2, CB-4, CB-5, CB-7, CB-8, CB-10, CB-11, and CB-13 (Figure 6-1) to the ON position.

6.3.4.9 Verify that power is available for the following components:

- computer and flat panel computer display
- NIM bin
- probe
- deployment device instrumentation (compass, encoders, inclinometer)
- video monitor and video cassette recorder
- van service receptacle.

TEST CONTROL COPY

WHC-SD-WM-ATP-153 Rev. 0

Accept/Reject (circle one)

Responsible EE's signature

Michael J. Smith

Date

4/9/96

- 6.3.4.10 Move the van power distribution panel circuit breaker switches CB-1, CB-2, CB-4, CB-5, CB-7, CB-8, CB-10, CB-11, and CB-13 (Figure 6-1) to the OFF position.

6.3.5 LOWMMS Electrical Cable Connections

SEE EXCEPTION # 8

Set the mode selector switch on the power distribution panel to LOWMMS. Verify that the following circuit breakers and disconnect switches are in the OFF position:

- Van power distribution panel: all circuit breakers, CB-1 through CB-15 (see Figure 6-1)
- Van generator: AC circuit breaker.

Connect the electrical cables as follows.

- W4 to spider box J4 (remote pendant controller)
- W5 to DAV J5 and to spider box J15 (probe cable)
- W6 to DAV J6 and to spider box J16 (spider cable)

NOTE: Electrical cabling interconnections are shown in Figure 6-2. Depending on whether a SHMS or LOWMMS scan is being performed some cables will not be connected, as identified above.

Test Engineer's signature

Date

6.3.6 Test Battery Power Supply for LOWMMS

SEE EXCEPTION # 8

- 6.3.6.1 Move the van power distribution panel circuit breaker switches CB-1, CB-4, CB-6, CB-7, CB-9, CB-10, and CB-13 (Figure 6-1) to the ON position.

- 6.3.6.2 Verify that power is available for the following LOWMMS components:

- probe
- cable reel
- spider assembly instrumentation
- computer and flat panel computer display
- NIM bin.

- 6.3.6.3 Verify that battery power is available (without recharging) to lower and raise the LOWMMS probe 30 ft (minimum) a minimum of 5 times.

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Accept/Reject (circle one)

Responsible EE's signature _____

Date _____

- 6.3.6.4 With the power turned on to the above electrical components, disconnect and reconnect (see Figure 6-2 for cabling interconnections) each of the LOWMMS cables and verify that this causes no damage to the components.

ACCEPTANCE CRITERIA: no damage to electrical components

Accept/Reject (circle one)

Responsible EE's signature _____

Date _____

- 6.3.6.5 Move the van power distribution panel circuit breaker switches CB-1, CB-4, CB-6, CB-7, CB-9, CB-10, and CB-13 (Figure 6-1) to the OFF position.

- 6.3.7 Test Site Service Receptacle Supply for LOWMMS

SEE EXCEPTION #8

- 6.3.7.1 Plug the extension cord into the van receptacle (connect W2 to DAV P3 per Figure 6-2).

- 6.3.7.2 Plug the extension cord into the site service receptacle.

- 6.3.7.3 Move the van power distribution panel circuit breaker switches CB-1, CB-4, CB-6, CB-7, CB-9, CB-10, and CB-13 (Figure 6-1) to the ON position.

- 6.3.7.4 Verify that power is available for the following LOWMMS components:

- probe
- cable reel
- spider assembly instrumentation
- computer and flat panel computer display
- NIM bin.

Accept/Reject (circle one)

Responsible EE's signature _____

Date _____

- 6.3.7.5 Move the van power distribution panel circuit breaker switches CB-1, CB-4, CB-6, CB-7, CB-9, CB-10, and CB-13 (Figure 6-1) to the OFF position.

- 6.3.8 Test Generator Power Supply for LOWMMS

SEE EXCEPTION #8

- 6.3.8.1 Start up generator by performing steps 6.3.4.1 through 6.3.4.7.

WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

6.3.8.2 Move the van power distribution panel circuit breaker switches CB-1, CB-4, CB-6, CB-7, CB-9, CB-10, and CB-13 (Figure 6-1) to the ON position.

6.3.8.3 Verify that power is available for the following LOWMMS components:

- probe
- cable reel
- spider assembly instrumentation
- computer and flat panel computer display
- NIM bin.

Accept/Reject (circle one)

Responsible EE's signature _____ Date _____

6.3.8.4 Move the van power distribution panel circuit breaker switches CB-1, CB-4, CB-6, CB-7, CB-9, CB-10, and CB-13 (Figure 6-1) to the OFF position.

6.3.9 Intrinsic Safety Barrier

6.3.9.1 Measure the resistance between the intrinsic safety barriers mounting bus bar (DIN rail) and the SMMS deployment device ~~which enclosure box~~. Record equipment calibration information. QC
INTRINSIC WIRE Verify reading.

Instrument #: 804-45-08-010

QC Initial/Date BGA/04/02/97
Barbara J. Hug

Calibration expiration date: 3/13/97

Reading 0.013 Ω

QC Initial/Date BGA/04-02-97

ACCEPTANCE CRITERIA: 1 ohm (maximum)

6.3.9.2 For the two Stahl model 9002/77-150-300-00 barriers, measure the resistance from pin 1 to pin 3 and from pin 2 to pin 4. Record the readings below and verify that they are within the range of the acceptance criteria (manufacturer's specifications).

Barrier#1: pin 1 to pin 3 reading 125 ohm

Barrier#1: pin 2 to pin 4 reading 121 ohm

Barrier#2: pin 1 to pin 3 reading 121 ohm

Barrier#2: pin 2 to pin 4 reading 122 ohm

ACCEPTANCE CRITERIA: 118 $\pm$ 12 ohms

Accept/Reject (circle one)

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Responsible EE's signature J. Bunnell

Date 3/15/96

6.3.9.3 For the two Stahl model 9351/10-14-10 barriers, connect a 100 ohm resistor across the output (pin 7 to pin 8). Apply 24 VDC across pin L+ and pin 3. Using an ammeter, measure the current that flows through the resistor for each barrier. Record the readings below and verify that they are within the range of the acceptance criteria (manufacturer's specifications).

Barrier#1 reading 101 mA

Barrier#2 reading 99 mA

ACCEPTANCE CRITERIA: 80 - 110 mA

Accept/Reject (circle one)

Responsible EE's signature J. Bunnell

Date 3/15/96

6.3.9.4 For the one Elcon model 1072 barrier, apply 24 VDC across the 24 V supply bus and the 0 V supply bus. Measure the open circuit voltage and the short circuit from pin A to pin B, pin A to pin C, pin B to pin C, pin D to pin E, pin D to pin F, and pin E to pin F. Record the readings below and verify that they are within the range of the acceptance criteria (manufacturer's specifications).

Pin A to pin B: open circuit voltage 9 mV DC ^{* SEE EXCEPTION #5}
short circuit current .00013 mA DC

Pin A to pin C: open circuit voltage -105 mV DC
short circuit current .518 mA DC

Pin B to pin C: open circuit voltage 102 mV DC ^{* SEE EXCEPTION #5}
short circuit current 0 mA DC

Pin D to pin E: open circuit voltage 25 mV DC ^{* SEE EXCEPTION #5}
short circuit current .0001 mA DC

Pin D to pin F: open circuit voltage -105 mV DC
short circuit current .518 mA DC

Pin E to pin F: open circuit voltage 88 mV DC ^{* SEE EXCEPTION #5}
short circuit current 0 mA DC

ACCEPTANCE CRITERIA: open circuit voltage < 13.1 V
short circuit current < 96 mA

Accept/Reject (circle one) SEE EXCEPTION #5

Responsible EE's signature J. Bunnell

Date 3/15/96

WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 6.3.9.5 Visually inspect the intrinsic barriers and verify that they are adequately installed per H-14-100426* and the manufacturer's installation instructions. ^{485 G.A.A. 7/15/96}

Responsible EE's signature Q. Bunnell Date 4/8/96Fire Protection Engineer's signature R.B. Huchfeldt Date 4/8/96

6.3.10 Grounded and Bonded Equipment

All in-tank hardware (deployment device and neutron probe) must be grounded and bonded when the equipment is installed in a waste tank. Grounding is the assurance that a given component has very little to no potential voltage difference with respect to earth ground. Bonding is the assurance that individual components have little to no potential with respect to each other. The following section will perform loop checks to verify that all in-tank hardware is bonded to the deployment device winch box. When the equipment is installed in a waste tank, the deployment device winch box will be grounded to the tank riser.

- 6.3.10.1 Using an ohmmeter (with a minimum range of 0 - 10 megaohms), measure the resistance between the end of the arm and the deployment device winch enclosure box. Verify the resistance is less than 25 ohms. Record equipment calibration information.

Instrument #: 804-45-08-010

GROUNDING LOG

Calibration expiration date: 3-13-97Reading < 0.1 Ω

ACCEPTANCE CRITERIA: 25 ohms (maximum)

☒ Accept ☐ Reject (circle one)Responsible EE's signature Q. Bunnell Date 4/8/96

- 6.3.10.2 Measure the resistance between the neutron probe housing and the deployment device winch enclosure box. Verify the resistance is less than 25 ohms. ^{INTRINSIC GROUND}

Reading 0.6 Ω

ACCEPTANCE CRITERIA: 25 ohms (maximum)

☒ Accept ☐ Reject (circle one)Responsible EE's signature Q. Bunnell Date 4/3/96

*To be issued.

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 6.3.10.3 Measure the resistance between the neutron probe cable (outside) and the deployment device winch enclosure box. Verify the resistance is less than 1 megaohm.

Reading ~ 6 MΩ (MEASURED AT FULL LENGTH OF CABLE) GROUNDING LUG

ACCEPTANCE CRITERIA: 1 megaohm (maximum)

Accept/Reject (circle one) SEE EXEMPTION #14

Responsible EE's signature J. Bunell Date 4/3/96

- 6.3.10.4 Measure the resistance between the arm cable and the deployment device winch enclosure box. Verify the resistance is less than 1 megaohm.

Reading < 0.1 Ω (CABLE WAS REPLACED WITH UNLEADED CABLE) GROUNDING LUG

ACCEPTANCE CRITERIA: 1 megaohm (maximum)

Accept/Reject (circle one)

Responsible EE's signature J. Bunell Date 4/3/96

6.4 DATA ACQUISITION VAN HVAC SYSTEM TEST

This section will verify that the DAV's HVAC system will allow vehicle idling for several hours without overheating.

TEST PERFORMED BY: T. I. STOKES J. I. Stokes
6.4.1 Equipment Setup G. M. RITTER

- 6.4.1.1 Park the DAV outside the 306E Facility in a location where there is adequate ventilation.

- 6.4.1.2 Set up to measure the radiator temperature, by attaching a thermocouple to the outside of the radiator, and insulating the back side of the thermocouple. Connect the thermocouple to the readout unit. Record instrument calibration information below.

Instrument #: 679-79-06-004

Calibration expiration date: 3-22-97

- 6.4.1.3 Set up a heater(s) to heat the ambient air in front of the radiator.

6.4.2 Functional Test

- 6.4.2.1 Turn on the van engine, and allow it to warm up for several minutes. Turn on the heater(s) and allow the air in front of the

ref-
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

115 °F
radiator (within 15 cm) to warm up to at least 46°C (120°F).
Record air temperature in front of the radiator and the ambient
temperature below.

Air in front of radiator temperature reading 48 °CAmbient temperature reading 14 °C

6.4.2.2 Turn the air conditioning on to the MAX position, turn the fan to the MAX position, turn on all instrumentation, and close the vehicle doors.

6.4.2.3 Allow the DAV to idle until a steady radiator temperature is reached. Record this temperature below. If a steady temperature is reached without the engine overheating, then the HVAC system is functioning adequately. *RAW FOR 1 HA 45 MIN*

Steady state temperature reading (212 °F) 100 °C

ACCEPTANCE CRITERIA: engine idles without overheating

Accept/Reject (circle one)

Responsible ME's signature

Date 3/27/96

6.5 DEPLOYMENT DEVICE PREOPERATIONAL TEST

The following sections are intended to perform an initial checkout of the mechanical operability of the deployment device before it is shipped to FMEF for extensive testing. Specific measurements will also be obtained to provide information for field procedures.

6.5.1 Weight Measurements

Weigh the SMMS deployment device assembly (winch housing, rotation bearing, mast, arm, neutron probe), neutron probe (by itself), decontamination spray washer (including wiper and impact plate), and impact limiters. Heavy equipment may be weighed using a load cell and suspending the item from a crane. The minimum accuracy of weight measurements shall be $\pm 5\%$. Record results and instrument calibration information below.

Instrument #: 678-66-01-001Calibration expiration date: 5/30/96

(Acceptance Criteria are shown in bold)

SMMS Deployment Device Assembly:

547-67-26-002

EXP. 3/29/97

(1198 lbs) kg (lbs.)

[614 kg (1350 lbs.) maximum]

(w/PLATE (HOUSING ONLY))
(w/OUT 4' MAST EXTENSION)

ref-
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Neutron Probe:

SEE EXCEPTION #12

(16 lbs.) kg (lbs.)

[11.4 kg (25 lbs.) maximum]

Decontamination Spray Washer:

(88 lbs.) kg (lbs.)

IMPACT PLATE: 76 lbs

[45.5 kg (100 lbs.) maximum]

4" BALL VALVE: 96 lbs

Short Impact Limiter:

(35 lbs.) kg (lbs.)

[22.7 kg (50 lbs.) maximum]

Tall Impact Limiter:

(70 lbs.) kg (lbs.)

[22.7 kg (50 lbs.) maximum]

Accept/Reject (circle one) SEE EXCEPTION #12

Responsible ME's signature

CL A [Signature]

Date 4/10/96

* SEE EXCEPTION SHEET #1

6.5.2 Torque Limiter Test

PERFORMED AS FMEF BY:

G.L. Lima + F. Boulson: FZB [Signature]

The deployment device winch handles have torque limiters to prevent overloading the arm and probe cables. This section is intended to verify that the torque limiters are functioning satisfactorily. The torque limiters consist of a friction plate (similar to a brake or clutch) and a pressure plate. If the torque limit is exceeded, the pressure plate will slip on the friction plate and the winch will not rotate. The torque limit can be adjusted by tightening/loosening a nut to increase/decrease the force between the pressure plate and the friction plate.

6.5.2.1 Secure the probe winch handle in a vise such that the handle is fixed but the extension (that connects the handle to the winch) is free to rotate.

6.5.2.2 Attach a calibrated torque wrench to the probe winch handle extension using an adapter per the responsible ME's direction. Record calibration information below.

Instrument #: 678-88-01-004

Calibration expiration date: 1-17-97

6.5.2.3 Using the torque wrench, apply an increasing amount of torque to the probe winch handle extension and observe the torque at which the extension slips/rotates--the breakaway torque. Record the breakaway torque below.

Breakaway torque: ABOVE RANGE OF N-m (ft-lbf)
TO EXCEED WINCH, > 200 in-lbf

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 6.5.2.4 If the breakaway torque is not within the range of the acceptance criteria, adjust the nut per the responsible ME's direction and repeat steps 6.5.2.2 and 6.5.2.3 until the breakaway torque meets the acceptance criteria. NA below if no adjustment is required.

Breakaway torque (after adjustment): (8 ft-lbf) N-m (ft-lbf)

ACCEPTANCE CRITERIA: 8.1 - 13.6 N-m (6 - 10 ft-lbf)

Accept/Reject (circle one)

Responsible ME's signature

GLH LittDate 2/8/96

- 6.5.2.5 Secure the arm winch handle in a vise such that the handle is fixed but the extension (that connects the handle to the winch) is free to rotate.
- 6.5.2.6 Attach the calibrated torque wrench to the arm winch handle extension using an adapter.
- 6.5.2.7 Using the torque wrench, apply an increasing amount of torque to the probe winch handle extension and observe the torque at which the extension slips/rotates--the breakaway torque. Record the breakaway torque below.

Breakaway torque: ABOVE RANGE OF TORQUE WRENCH > 200 in-lbf N-m (ft-lbf)

- 6.5.2.8 If the breakaway torque is not within the range of the acceptance criteria, adjust the nut per the responsible ME's direction and repeat steps 6.5.2.6 and 6.5.2.7 until the breakaway torque meets the acceptance criteria. NA below if no adjustment is required.

Breakaway torque (after adjustment): (12 ft-lbf) N-m (ft-lbf)

ACCEPTANCE CRITERIA: 12.2 - 19.0 N-m (9 - 14 ft-lbf)

* SEE EXCEPTION #2 AND RETEST SHEETS

Accept/Reject (circle one)

Responsible ME's signature

GLH LittDate 2/8/96

- 6.5.2.9 Attach the winch handles to the winches and lift the deployment device from horizontal to vertical with the appropriate rigging and suspend the device from the crane in the 306E penthouse per a 306E Building Certified Crane Operator's direction. Uprighting the deployment device requires two cranes/hoists with a minimum 910 kg (1 ton) capacity. See Figure 6-3 for lift points and required rigging.
- 6.5.2.10 Secure the deployment device in-place by strapping the mast to the stand next to the test pit to prevent movement when the arm is lifted per the Responsible ME's direction. Position the deployment device winches such that winch handles can be reached by test personnel on the lower catwalk in the penthouse.

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 6.5.2.11 306E Certified Crane Operator and Responsible ME sign below to indicate that the deployment device has been safely secured.

Certified Crane Operator signature N/A - SECURED IN MILK-UP RIGGED AT FUEL Date
Responsible ME's signature GLA Little Date 2/8/96

- 6.5.2.12 With test personnel positioned on the lower catwalk of the penthouse, perform the following to verify the probe winch torque limiter is functioning satisfactorily. With the probe fully secured in the arm socket, turn the probe winch handle clockwise to try to raise the probe and verify that the probe winch handle turns but the probe winch does not rotate.

- 6.5.2.13 Verify that no damage to the deployment device occurred. In particular, visually inspect the probe cable and cable head to verify no damage occurred.

ACCEPTANCE CRITERIA: no damage to deployment device

Accept/Reject (circle one) SEE OBSERVATIONS/RESULTS SHEET

Responsible ME's signature GLA Little Date 2/9/96

- 6.5.2.14 The following will test the effect of raising the arm before the probe has been released from the arm socket (operating procedure violation). With the probe fully secured in the arm socket, perform the following to verify the arm winch torque limiter is functioning satisfactorily. Turn the arm winch handle clockwise to raise the arm. After the arm has been raised to the horizontal position, verify that the arm winch handle turns but the arm winch does not rotate.

- 6.5.2.15 Verify that no damage to the deployment device occurred. In particular, visually inspect the arm cable, bell crank, probe cable, and probe cable head to verify no damage occurred.

ACCEPTANCE CRITERIA: no damage to deployment device

Accept/Reject (circle one) SEE EXCEPTION SHEET #2 - RETEST REQUIRED

Responsible ME's signature GLA Little Date 2/9/96

- 6.5.2.16 Determine the following for the arm winch and probe winch. Note that too many turns of the winches indicates that the torque limiters are set too low and significant slippage is occurring.

(Acceptance Criteria are shown in bold)

arm winch--number of turns from vertical to horizontal:

30

(30 turns maximum)

WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

probe winch--number of turns per foot of deployment (average): 8

(15 turns maximum)

Accept/Reject (circle one)Responsible ME's signature GLA [Signature]Date 4/10/96* SEE EXCEPTION SHEET #1
6.5.3 Load TestsTEST PERFORMED BY: FAIR

G.A. R. [Signature]

F. BOLSON: 4/10/96

The winches were designed to be self-locking to prevent unintentional spooling. This section will verify that the winches will hold a load of at least 2 times the weight of the probe. An electronic level may be used to determine the angle of the arm if the inclinometer is not available.

- 6.5.3.1 With the deployment device suspended from the crane in the 306E penthouse, lower the probe (or mock-up probe) to the floor level and attach a test weight such that the combined weight of the probe and test weight is at least 22.7 kg (50 lb). Record the applied load below.
- 6.5.3.2 Using the arm winch, raise and lower the arm and verify that it remains stationary after releasing the arm winch handle for the following angles of the arm: 10, 20, 30, 45, 60, and 90 degrees with respect to vertical (the arm winch handle should not rotate more than 1/20 of a revolution after releasing).
- 6.5.3.3 Using the probe winch, raise and lower the probe several feet and verify the probe remains stationary after releasing the probe winch handle (the probe winch handle should not rotate more than 1/20 of a revolution after releasing).

Applied Load: 25 (BUNNY 1/462) + 32 lbs = 57 lbs kg (lbs.)

ACCEPTANCE CRITERIA: no unintentional spooling of cable

Accept/Reject (circle one)Responsible ME's signature GLA [Signature]Date 2/9/966.5.4 Bell Crank Retraction Test TEST PERFORMED BY: GA RIFTER
F. BOLSON: 4/10/96

This test will verify that the bell crank on the arm retracts reliably without damaging the probe cable. The configuration for this test is intended to be the worst case scenario for which the probe cable has the highest probability of interfering with the bell crank.

- 6.5.4.1 With the deployment device suspended from the crane in the 306E penthouse, lower the deployment device such that it is approximately 30 cm (1 ft) from the floor level.

ref-
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 6.5.4.2 Verify that the arm is in the vertical position (aligned with the mast). Raise the bell crank out of the arm by turning the arm winch handle clockwise.
- 6.5.4.3 Lower the probe (or mock-up probe) to the floor by turning the probe winch handle counterclockwise. Continue to turn the probe winch handle counterclockwise to pay out several inches of slack cable. Note any interference between the probe cable and bell crank on Observation/Results sheets (Appendix A).
- 6.5.4.4 Retract the bell crank by turning the arm winch handle counterclockwise. Closely observe whether the bell crank retracts reliably without becoming tangled with or damaging the probe cable.
- 6.5.4.5 Raise the probe by turning the probe winch handle clockwise and verify that it seats reliably in the arm socket.
- 6.5.4.6 Repeat steps 6.5.4.2 through 6.5.4.5 a minimum of 20 times as directed by the responsible ME to verify that the bell crank retracts reliably each time. Indicate acceptance below.

ACCEPTANCE CRITERIA: no damage to probe cable
no interference between bell crank and probe cable

Accept/Reject (circle one)

Responsible ME's signature

GCA [Signature]

Date 4/10/96

6.5.5 Operational Test with Reduced Arm Length TEST PERFORMED BY: GA LITTE
F. BOLSON, J. BOLSON 4/10/96

The arm on the deployment device has extensions that can be removed to shorten the arm length. A reduced arm length will allow the deployment device to be installed in tanks with limited headspace, because the overall length of the device is reduced. This test will verify that the deployment device functions satisfactorily with the extensions removed from the arm.

- 6.5.5.1 Remove the extensions from the arm by removing the screws at the extension joints and reattaching the end piece per the responsible ME's direction.
- 6.5.5.2 With the deployment device suspended from the crane in the 306E penthouse and personnel positioned on the lower catwalk of the penthouse, lower the probe approximately 6 inches to allow raising the arm.
- 6.5.5.3 Raise and lower the arm several times as directed by the responsible ME. Verify that the motion is smooth and that the shortened arm functions satisfactorily. Indicate acceptance below.

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

ACCEPTANCE CRITERIA: rotational motion is smooth
no binding, pinching, or jamming
no damage or excessive wear

SEE EXCEPTION # 13

SEE RETEST SHEETS

Accept/Reject (circle one)

Responsible ME's signature

G. L. A. [Signature]

Date 4/10/96

6.5.6 Deployment Device Insertion into Shipping Container

The deployment device will be contaminated after the first in-tank deployment. It will therefore be shipped from tank farm to tank farm in an approved shipping container. This test will verify that the deployment device can be inserted into the shipping container when bagged with plastic sleeving as it would be after being removed from a waste tank.

- 6.5.6.1 Wrap the deployment device with the plastic sleeving material in accordance with the responsible ME's and Operations representative's direction.
- 6.5.6.2 Using two cranes, lift the deployment device in the horizontal position and carefully insert it into the shipping container in accordance with the responsible ME's direction.
- 6.5.6.3 Observe the plastic sleeving as the device is inserted to verify that the sleeving does not tear. Record comments on the Observation/Results sheets (Appendix A). Indicate acceptance below.

ACCEPTANCE CRITERIA: device fits inside container
no tearing of plastic sleeving

SEE EXCEPTION # 10

Accept/Reject (circle one)

Responsible ME's signature

G. L. A. [Signature]

Date 4/5/96

Ops representative's signature

[Signature]

Date 4/5/96

6.5.7 Winch Enclosure Box Leak Test

TEST PERFORMED BY: G.A. RITTER
FA BOLSON: F. L. Bolson 4/8/96

The SMMS deployment device winch enclosure box is open to the tank environment through the mast section. Therefore, this box must be leak tested to verify that it is sufficiently leak tight and will provide adequate containment. This leak test will also verify that the assembly is sufficiently weatherproof. Excessive leaks, as determined by the responsible ME, shall be repaired and the assembly shall be retested.

- 6.5.7.1 Isolate the winch box assembly by disconnecting the mast at the extension joint nearest the winch box. Place and seal a plug to the mast opening. The plug must have pass throughs for the cables.

rf
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 6.5.7.2 Connect the differential pressure gage (range: 0 to 1250 Pa [0 to 5 in. H₂O]) to a tee fitting that is connected to the port on the winch box. Connect the flow meter (minimum range: 0 to 4.7 x 10⁻⁴ m³/s [0 to 1 ft³/min]), valve, and nitrogen source to the tee fitting as shown in Figure 6-4.

Instrument #: 679-80-02-022 (pressure gage)

Calibration expiration date: 3-18-97

Instrument #: 679-28-03-024 (flow meter)

Calibration expiration date: 9-8-96

Test Engineer's signature GLA Mitt Date 4/8/96

- 6.5.7.3 Slowly open the valve from the ^{NITROGEN} building ~~air~~ supply and fill the winch box with ~~air~~ until the internal gage pressure reaches 250 Pa (1.0 in. H₂O). ^{NITROGEN}

- 6.5.7.4 Allow the internal pressure to stabilize. Adjust the control valve until a steady-state condition is obtained, i.e., the flow rate into the system equals the leak rate out of the system such that the internal gage pressure is maintained at a minimum of 250 Pa (1.0 in. H₂O). Record the steady state flow rate (leak rate) and pressure below.

Flow/leak rate: 2370 cm³/min (0.084 ft³/min)

Pressure reading: 1.045 in. H₂O

- 6.5.7.5 Repair leaks and retest as required. Verify the winch box remains structurally intact. Indicate acceptance below.

ACCEPTANCE CRITERIA: leak rate < 4.7 x 10⁻⁴ m³/s (< 1.0 ft³/min)

Accept/Reject

Responsible ME's signature GLA Mitt Date 4/8/96

- 6.5.7.6 Connect a vacuum pump to the tee fitting (in place of the nitrogen supply) and slowly pull 1250 Pa (5.0 in. H₂O) vacuum (minimum) on the winch box and verify that the enclosure remains structurally intact. Indicate acceptance below.

ACCEPTANCE CRITERIA: no damage to winch box

Accept/Reject

Responsible ME's signature GLA Mitt Date 4/8/96

ref
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

6.6 MISCELLANEOUS PROBE HARDWARE TESTS

The following tests are intended to test features of the probe that are not tested as part of the software ATP or probe calibration.

6.6.1 Probe Housing Leak Test

The probe housing must be water tight to survive decontamination and to ensure that no damage occurs if the probe is accidentally lowered too far into liquid waste.

- 6.6.1.1 Verify that the probe housing has been properly sealed.
- 6.6.1.2 Lower the probe into a barrel full of water such that there is a minimum of 30 cm (12 in.) of water above the top of the probe. Keep the probe under water for a minimum of 5 minutes.
- 6.6.1.3 Remove the probe from the water and dry the outside thoroughly. Remove the cable head from the probe and visually verify that no water has leaked into the probe housing. Indicate acceptance below.

TEST PERFORMED BY:

ACCEPTANCE CRITERIA: no leakage

FA BOLSON: JI Bolson 3-14-96
GA KITTER

Accept/Reject (circle one) see observations sheet.

Responsible ME's signature

[Signature]

Date

3/14/96

6.6.2 Probe Shock Test TEST PERFORMED BY: NT WATSON
GA KITTER

The probe housing and electronics inside the housing must be rugged enough to withstand small impact/shocks during an in-tank deployment. The following test will verify that an impact (typical of what would be expected during normal operation) on the probe housing will not damage the probe.

WARNING

Failure to handle the probe and source carefully or keep it at a maximum distance can result in severe neutron overexposure. Approximate dose rate at 1 m (3 ft) is 6 mrem/h.

CAUTION

Thread damage may occur without proper care in handling of the probe.

ref.
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 6.6.2.1 Verify the probe is functioning satisfactorily by placing the probe (with neutron source installed) into the two calibration fixtures and counting for 2 minutes. Record the count rates (CR) for the three detectors and the two temperature readings in Table 6-1.
- 6.6.2.2 Drop the probe housing (axis horizontal to drop surface) from a height of 30 cm (1 ft) onto a minimum 1.3 cm (1/2 in.) thick steel plate (uniformly supported on a concrete floor) in the 4 orientations described below. Perform the drops with the spare source holder inserted in the bottom of the probe. After each drop, thoroughly inspect the probe for damage and repeat the probe calibration check as outlined in steps 6.6.2.3 through 6.6.2.6. Also after each drop, remove and reinstall the spare source holder from the bottom of the probe to verify that the source holder can still be easily removed. Record comments on the Observation/Results sheets (Appendix A).
1. Along the axis of detector #1 on the anode side.
 2. Perpendicular to the axis of detector #1, on the side closest to detector #2 (rotated 90 degrees from orientation 1)
 3. Along the axis of detector #1 on the side opposite the anode side (rotated 180 degrees from orientation 1)
 4. Perpendicular to the axis of detector #1, on the side opposite of detector #2 (rotated 270 degrees from orientation 1)

NOTE: The spare source holder must be removed after each drop so that the actual source can be installed for checking probe calibration. After the probe calibration check, remove the actual source and reinstall the spare source holder for the next drop. Verify that the source holder can still be easily removed/installed after each drop.

- 6.6.2.3 Drop the probe onto the surface in orientation 1. Inspect the probe for damage, install the actual source, place the probe into each of the calibration fixtures, and count for 2 minutes. Remove the source and reinstall the spare source holder. Record count rates and temperature readings in Table 6-1.
- 6.6.2.4 Drop the probe onto the surface in orientation 2. Inspect the probe for damage, install the actual source, place the probe into each of the calibration fixtures, and count for 2 minutes. Remove the source and reinstall the spare source holder. Record count rates and temperature readings in Table 6-1.
- 6.6.2.5 Drop the probe onto the surface in orientation 3. Inspect the probe for damage, install the actual source, place the probe into each of the calibration fixtures, and count for 2 minutes. Remove the source and reinstall the spare source holder. Record count rates and temperature readings in Table 6-1.

ref.
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

3

- 6.6.2.6 Drop the probe onto the surface in orientation 4. Inspect the probe for damage, install the actual source, place the probe into each of the calibration fixtures, and count for 2 minutes. Remove the source and reinstall the spare source holder. Record count rates and temperature readings in Table 6-1.
- 6.6.2.7 Drop the probe oriented vertically such that the probe bottom impacts the surface (with the probe bottom parallel to the drop surface). Use the same drop height and impact surface described in 6.6.2.2. Inspect the probe for damage, install the actual source, place the probe into each of the calibration fixtures, and count for 2 minutes. Remove the source and reinstall the spare source holder. Record count rates and temperature readings in Table 6-1. 3
- 6.6.2.8 Calculate the statistical standard deviation (SD) of each count rate by dividing the square root of the total number of counts by the time interval. Record the standard deviations in Table 6-1.
- 6.6.2.9 Compare the count rates and temperature readings after the drops to the count rates and temperature readings before the drops to verify that the readings did not change significantly. A significant change in the count rate is defined as more than 3 standard deviations difference. Verify that no significant damage to the probe occurred and indicate acceptance below.

ACCEPTANCE CRITERIA: count rate < 3 standard deviations difference
no damage to probe

Accept/Reject (circle one)

SEE EXCEPTION # 9

Responsible EE's signature

4/16/96

Date 4/16/96

Responsible ME's signature

GC A

Date 4/1/96

6.6.3 Source Handling Tool Test

The following test will verify that the source handling tool cannot damage the source holder when the source is removed from the bottom of the probe.

- 6.6.3.1 With the deployment device in the horizontal position and the neutron probe attached inside the arm socket, screw the spare source holder (with no source inside) into the probe bottom.
- 6.6.3.2 Attach the source handling tool to the nut on the source holder by turning the center handle clockwise.
- 6.6.3.3 Carefully let go of the source handling tool and verify that the tool's weight causes the probe to rotate without damaging the source holder. Record comments on the Observation/Results sheets (Appendix A). Remove the source holder from the probe bottom and visually inspect to verify that it was not damaged.

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

ACCEPTANCE CRITERIA: no damage to source holder

Accept/Reject (circle one) SEE EXCEPTION # 11

Responsible ME's signature

GL A Ritter

Date 4/9/96

6.7 DECONTAMINATION SYSTEM TEST

The decontamination system provides cold water for washing the SMMS deployment device assembly (mast, arm, and neutron probe). A rubber wiper is used during withdrawal of the in-tank hardware. The nozzles on the spray ring are angled downward. Therefore, because of the Venturi effect, high velocity water flow through the nozzles causes a suction at the top of the spray ring. The approximate suction created by the operation of the spray ring will also be measured as part of this test.

TEST PERFORMED BY: GA RITTER

JB GUNTER 3/14/96

6.7.1 Equipment Setup

- 6.7.1.1 Prepare a testing area on the concrete pad outside the 306E building.
- 6.7.1.2 Connect the decontamination equipment hoses to the water supply tank, feed pump, high pressure washer, and decontamination spool piece as specified in H-14-100462*. Figure 6-5 shows the basic layout of the decontamination system.
- 6.7.1.3 Verify the detergent valve on the high pressure pump is in the closed position.
- 6.7.1.4 Verify by visual inspection that the tank is filled with clean water.
- 6.7.1.5 Verify that the hoses are secure from movement.

Test Engineer's signature

GL A Ritter

Date 3/14/96

6.7.2 Functional Test

- 6.7.2.1 Open valves HV-1 and HV-2.

WARNING

The feed pump and high pressure pump exhaust piping becomes hot during operation and remains hot for a while after it is turned off. Do not touch a muffler while it is hot.

*To be issued.

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

CAUTION

Do not run the feed pump for more than 5 minutes with water flowing through HV-1. Never run the high-pressure pump without adequate water supply. Pump and system overheating can occur.

- 6.7.2.2 Start up the feed pump and the high pressure pump.
- 6.7.2.3 Visually observe the spray patterns of the nozzles to verify that water distribution is uniform. A non-uniform water spray may indicate a plugged nozzle. If a nozzle appears to be plugged, shut down the pumps, clean the nozzle, and repeat steps 6.6.2.1 through 6.6.2.3 as required.
- 6.7.2.4 Carefully inspect the decontamination spool piece, hoses, and fittings for leakage. Repair leaks as required.

ACCEPTANCE CRITERIA: uniform spray pattern, no leakage

Accept/Reject (circle one)

Responsible ME's signature

GL L Pitt

Date 3/14/96

- 6.7.2.5 Determine the approximate flow rate (gpm) by recording the change in the totalizer reading over a 5 minute period. The flow rate is calculated by dividing the change in the totalizer reading by the time interval. Indicate acceptance below.

Start time: 0:00 (mm:ss) Totalizer reading: 143 GALLONS

Stop time: 5:00 (mm:ss) Totalizer reading: 165 GALLONS

Calculated flow rate: 4.4 gpm (@ FULL THROTTLE ~ 1300 PSI)

ACCEPTANCE CRITERIA: 2 - 5 gpm flow rate

Accept/Reject (circle one)

Responsible ME's signature

GL L Pitt

Date 3/14/96

- 6.7.2.6 Shut down the pumps, and close valve HV-2.
- 6.7.2.7 Seal up the top opening of the decontamination spool piece (with a blind flange or equivalent). Verify that a small hole has been threaded through the center of the blind flange for installing a pressure gage.

ref.
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 6.7.2.8 Connect one port of a differential pressure gage (minimum range: 0 to 1250 Pa [0 to 5 in. H₂O]) to the small opening on the top of the spool piece and leave the other port open to atmosphere. Record instrument calibration information below.

Instrument #: 679-80-02-022

Calibration expiration date: 3/18/97

- 6.7.2.9 Open valve HV-2, and start up the feed pump and the high pressure pump.
- 6.7.2.10 Record the reading on the differential pressure gage. Indicate acceptance below.

Reading N - 3.3 m. H₂O @ FULL THRUSTLE (1700 psi)
(oscillated between -3.1 m - 3.5 m. H₂O)

ACCEPTANCE CRITERIA: < 0 Pa (vacuum required)

Accept/Reject (circle one)

Responsible ME's signature

GL L. L. L.

Date 3/18/96

- 6.7.2.11 Shut down the pumps, close valves HV-1 and HV-2, and disassemble equipment.

6.7.3 Full-Scale Test TEST PERFORMED BY: M.E. DATE MID 4/4/96
G.A. RITON

This test will verify that the deployment device can be easily removed and decontaminated through the decontamination spool piece. It will also verify that all of the surfaces of the deployment device are self-draining and that the cables will not be damaged from the high pressure spray.

- 6.7.3.1 Install an adapter plate across the top of the 306E test pit to mock-up a 4-inch riser flange. Install the decontamination spool piece, rubber wiper, and impact plate on top of the adapter plate.
- 6.7.3.2 Position a 55-gallon drum at the bottom of the test pit directly below the adapter plate. Attach a plastic sleeve to the adapter plate and place the other end inside the drum to catch water draining from the spool piece.
- 6.7.3.3 Lift the deployment device from horizontal to vertical with the appropriate rigging and lower the device through the spool piece per a 306E Building Certified Crane Operator's direction. Uprighting the deployment device requires two cranes/hoists with a minimum 910 kg (1 ton) capacity. See Figure 6-3 for lift points and required rigging. Note that setting the deployment device down onto the impact plate/spool piece assembly is optional.
- 6.7.3.4 Set up the decontamination system in accordance with Section 5.2.8 of WMC-SD-WM-OMM-024.

ref -
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 6.7.3.5 Slowly lift/remove the deployment device while operating the decontamination system in accordance with WHC-SD-WM-OMM-024.
- 6.7.3.6 Verify that the deployment device can be removed easily through the spool piece and that the rubber wiper is functioning satisfactorily. Verify that all surfaces of the deployment device are self-draining and that there are no "traps" or "pockets" of water.
- 6.7.3.7 After the deployment device has been removed from the spool piece, lower the deployment device back to the horizontal position per a 306E Building Certified Crane Operator's direction. Perform a thorough visual inspection of the cables to verify that no damage occurred. Indicate acceptance below.

ACCEPTANCE CRITERIA: deployment device self-draining
no damage to cables

Accept/Reject (circle one)

Responsible ME's signature

GL A. Att

Date

4/4/96

As the last step for the 306E Test Procedure, review the test and verify that all steps in Section 6.0 have been completed.

Test Engineer's signature

GL A. Att

Date

4/15/96

ref -
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

7.0 FMEF TEST PROCEDURE

7.1 PREREQUISITES

7.1.1 Prejob Meeting

Conduct a "prejob meeting" of operations including a review of all procedures, drawings, safety hazards, and other engineering documents required to complete the test. Personnel who have attended the prejob meeting shall sign the attendance form given in Appendix C.

Test Engineer's signature

Date 2/5/96

(FMEF FOR INSTALLING DEPLOYMENT DEVICE WAS PERFORMED ON 1/21/96)

7.1.2 Equipment Staging and Test Setup

Verify that the equipment listed in Section 4.3 is staged in the test area per the responsible ME's and FMEF representative's direction. Verify that no interconnections have been made. Note that only the deployment device and rigging accessories are required for starting testing. If not all of the equipment in Section 4.3 is available at the start of testing, record below when the rest of the equipment is delivered. The DAV will be delivered and setup at FMEF after testing has begun. The DAV will only be used for training Operations personnel.

The test area in room 351 must be prepared for the probe placement test (Section 7.3). The following steps can be performed before or after the deployment device is installed. Prepare and locate targets for the probe placement test as follows.

- 7.1.2.1 Prepare 29 targets by cutting out circular pieces of colored paper 15 cm (6 in.) in diameter.
- 7.1.2.2 Lower a plumb bob (or mock-up probe if deployment device is installed) through the center of the mock-up riser to the ground level in room 351 and mark the center of the riser (location for Target 1).
- 7.1.2.3 Place and secure (using tape) the targets on the floor of room 351 below the mock-up riser (in which the deployment device is installed) as shown in Figure 7-1. This figure represents the recommended sampling point grid for in-tank moisture measurements. Table 7-1 lists the locations for the targets.

NOTE: The specified positions for the targets are approximate. The required accuracy for placing the targets is ± 7.6 cm (3 in.). The furthest targets are exceptions, they cannot be located more than 1.8 m (6 ft) away or the arm will not reach it.

~~SEE COMMENT~~

APPROXIMATE PLACEMENT ACCURACY FOR TARGETS WAS:

$\pm 1/4"$, $\pm 2^\circ$

ref.
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 7.1.2.4 Sign below to indicate that the equipment has been staged and is ready to be installed.

Test Engineer's signature

GLA Pitt

Date 2/6/96

7.2 DEPLOYMENT DEVICE TEST

7.2.1 Install Deployment Device and Camera

- 7.2.1.1 Lift the deployment device from horizontal to vertical and install in the selected mock-up riser in room 500 per the critical lift procedure provided in the work package. Bolt the deployment device bearing plate to the mock-up riser using the bolts provided with the deployment device.
- 7.2.1.2 Install the camera system in the selected adjacent mock-up riser in room 500 per TO-020-141, *In-Tank Video Procedure* (disregard steps related to contamination control and HPT surveys). Set up two video monitors: one next to the camera controls, and one next to the deployment device winch enclosure.
- 7.2.1.3 Connect the cables between the camera, camera controls, and video monitors and supply power to the camera system.

NOTE: Power to all components will be disabled at the end of testing each day. The cables should be reinspected at the beginning of each day to verify that they are connected correctly before resupplying power to the components.

Test Engineer's signature

GLA Pitt

Date 1/5/96

7.2.2 Deployment Device Arm Operability and Reliability Test

PERFORMED BY: G.A. RITTER & A.C. DAVIS M.D. 2-8-96

This section will demonstrate that sustained, repeated execution of the deployment sequence (raising and lowering the arm) does not have adverse effects on the mechanical operability and reliability of the deployment device.

- 7.2.2.1 Repeat steps 7.2.2.2 through 7.2.2.6 a minimum of 50 times as directed by the responsible ME. Using the camera, zoom in on the deployment device as directed by the responsible ME and observe whether the following conditions are met.
1. The rotational motion is smooth.
 2. The arm winch mechanism does not jam.
 3. No binding or pinching of the cables occurs.
 4. The mechanical parts are not damaged or galled and the cables do not show excessive wear.
 5. The probe seats reliably in the arm's probe socket.
 6. The arm and probe cables seat reliably in the mast's channel shaped cut-out when the arm is returned to the vertical position.

WHC-SD-WM-ATR-153 Rev. 0

TEST CONTROL COPY

7. The arm and probe do not exhibit a significant amount of oscillation or "bouncing" during deployment.
8. The bell crank retracts reliably without interfering with or damaging the probe cable.

7.2.2.2 Lower the probe approximately 15 cm (6 in.) by rotating the probe winch counterclockwise. The probe needs to clear the arm's probe socket before the arm can be lifted.

7.2.2.3 Confirm that the clearance between the probe and the arm can be verified with the camera.

Accept/Reject (circle one)

Responsible ME's signature

Date 2/7/96

7.2.2.4 Raise the arm to the horizontal position by rotating the arm winch clockwise.

7.2.2.5 Lower the arm to the vertical position by rotating the arm winch counterclockwise.

7.2.2.6 Raise the probe by rotating the probe winch clockwise until it is secured in the arm's probe socket.

7.2.2.7 After the deployment device is removed from the mock-up riser (after section 7.3 is performed) and placed in the horizontal position, perform a thorough inspection of the deployment device. In particular, inspect the cables, connectors, and winches to verify that they are not damaged and do not show excessive wear. Indicate acceptance below.

ACCEPTANCE CRITERIA: items 1 through 8 of 7.2.2.1

Accept/Reject (circle one)

Responsible ME's signature

Date 3/11/96

7.2.3 Probe Cable Wear Test

PERFORMED BY: G.A. RITTER

M.C. DARR M.S.D 2-8-96

This section will demonstrate that raising and lowering the probe does not have adverse effects on the probe cable or cause excessive wear.

7.2.3.1 Using the dial calipers, measure the diameter of a new 3 m (10 ft) section of probe cable in 20 locations, approximately 15 cm (6 in.) apart. Record diameters in Table 7-2. Calculate the average diameter and the standard deviation below.

Average new cable diameter: 0.3999

Standard deviation of average new cable diameter: 0.0017

ref.
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 7.2.3.2 Lower the probe to the ground and mark off a 60 cm (2 ft) section of probe cable near the probe using tape or some other means of clearly identifying the section of cable.
- 7.2.3.3 Using the dial calipers, measure the diameter of a the marked section of probe cable in 20 locations, approximately 2.5 cm (1 in.) apart. Clearly identify the locations on the cable at which the measurements were made. Record diameters in Table 7-2. Calculate the average diameter and the standard deviation below.

Average pre-test cable diameter: 0.4008 inches

Standard deviation of pre-test cable diameter: 0.0016 inches

- 7.2.3.4 Raise the arm to the horizontal position by turning the arm winch handle clockwise.
- 7.2.3.5 Raise the probe by turning the arm winch clockwise until the lower tape mark is approximately lined up with the rounded surface on the end of the arm.
- 7.2.3.6 Raise and lower the probe 60 cm (2 ft) 50 times as directed by the responsible ME such that the probe cable section between the tape marks slides repeatedly over the rounded surface on the end of the arm.
- 7.2.3.7 Lower the probe to the ground. Using the dial calipers, measure the diameter of the marked section of probe cable in the same 20 locations as before. Record diameters in Table 7-2. Calculate the average diameter and the standard deviation below.

Average mid-test cable diameter: 0.3995 inches

Standard deviation of mid-test cable diameter: 0.0018 inches

- 7.2.3.8 Raise the probe again until the lower tape mark is lined up with the rounded surface on the end of the arm.
- 7.2.3.9 Raise and lower the probe 60 cm (2 ft) 50 more times (100 cycles total) as directed by the responsible ME such that the probe cable section between the tape marks slides repeatedly over the rounded surface on the end of the arm.
- 7.2.3.10 Lower the probe to the ground. Using the dial calipers, measure the diameter of a the marked section of probe cable in the same 20 locations as before. Record diameters in Table 7-2. Calculate the average diameter and the standard deviation below.

Average post-test cable diameter: 0.3983 inches

Standard deviation of post-test cable diameter: 0.0012 inches

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 7.2.3.11 Compare the post-test cable average diameter to the pre-test cable average diameter. Calculate the number of standard deviations that the post-test cable diameter differs from the pre-test cable diameter and record below. If the post-test cable diameter is more than six standard deviations (based on the pre-test average cable diameter) different than the pre-test cable, then the results are not acceptable.

Number of standard deviations difference: 1.6

ACCEPTANCE CRITERIA: less than 6 standard deviations difference

Accept/Reject (circle one)

Responsible ME's signature

GL H Mitt

Date 2/8/96

7.2.4 Stop Clamps Functional Test

With the deployment device installed in the mock-up riser, perform the following steps to verify that the stop clamps are functioning correctly.

- 7.2.4.1 Set the stop clamps such that the deployment device mast can only rotate approximately 45 degrees. Rotate the box until it reaches the stops. Apply approximately 450 N (100 lbf) by pushing on the box to verify that the stops prevent further rotation such that rotation is restricted to 45 degrees.

- 7.2.4.2 Repeat step 7.2.4.1 for angles of 90, 180, and 270 degrees. Also verify that not setting the stop clamps will allow full 360 degree rotation. Indicate acceptance below.

ACCEPTANCE CRITERIA: stop clamps limit the specified rotation

Accept/Reject (circle one)

Responsible ME's signature

SEE OBSERVATIONS/RESULT SHEET
GL H Mitt

Date 2/8/96

7.3 PROBE PLACEMENT TEST

The deployment device is equipped with an electronic compass, inclinometer, and encoders for positioning the probe on the waste surface. However, a relatively flat surface is required for positioning the probe to perform an accurate moisture measurement. For an in-tank deployment, it will not be known exactly where the preferred measurement positions are located. Therefore, given an approximate sampling position, the deployment device operator must be able to adjust the probe position using only the view from the camera, such that the probe is positioned on a good surface for moisture measurement. This section will test the ability of an operator to position the probe on selected targets using the deployment device and view from a camera located up to 9.1 m (30 ft) from the targets. The acceptance criteria will be based on the time it takes the operator to place the probe on 29 targets (one riser deployment).

ref.
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Two separate camera locations will be used for this test. The first camera location will be in an adjacent mock-up riser located near the deployment device. Because this riser is relatively close to the deployment device, a second test will be performed with the camera on the ground floor positioned 9.1 m (30 ft) from the deployment device (FMEF does not have a mock-up riser that is 9.1 m away from the riser in which the deployment device will be installed).

In addition, the following test must be performed at least once by a representative from Operations. Once the deployment device is installed in a waste tank, operators will control the deployment device for placing the probe on the waste surface. The operator will be wearing anti-contamination clothing and possibly a mask. The Operations representative will determine the acceptability of ease of operation for the deployment device.

7.3.1 Equipment Setup

- 7.3.1.1 Measure the center to center distance from the mock-up riser (in which the deployment device is installed) and the mock-up riser (in which the camera is installed) using a tape measurer with a minimum accuracy of ± 1.3 cm (0.5 in.). Record below.

Distance

21' - 1"

Test Engineer's signature

GLA [Signature]

Date

2/9/96

- 7.3.1.2 Verify that the deployment device arm and probe are aligned in the vertical position as it would be installed in the riser.

- 7.3.1.3 Verify that the cables are connected between the camera, camera controls, and video monitors and supply power to the camera system. Power up the camera lights.

- 7.3.1.4 Turn off the lights in room 351 such that the only light available in room 351 is from the camera lights.

Test Engineer's signature

GLA [Signature]

Date

2/9/96

7.3.2 Functional Test for Camera Located in Adjacent Riser

Steps 7.3.2.1 through 7.3.2.5 are intended to provide guidance for placing the probe on a target. These steps may be deviated from as needed if a better method for placing the probe is determined. Note that the probe placement operation must also be videotaped. Record comments on the Observation/Results sheets (Appendix A).

In addition, the locations of the targets are not to be given to the winch operator. This test is intended to show that the probe can be placed in a good sampling location using only the view from the camera.

PERFORMED BY: VICKI GOSSENOW
BRUCE WATKINS

[Signature]

2-13-96
213 96

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

7.3.2.1 Record the start time below.

Start time: 9:00 7/13/66

NOTE: When tracking the time it takes to place the probe on targets, be sure to note any breaks that were taken. Subtract the total time for breaks from the time interval below.

7.3.2.2 Lower the probe onto Target 1 by rotating the probe winch counterclockwise. Place the probe as close as possible to the center of the target. Follow the probe with the camera as it is lowered to the floor.

7.3.2.3 After the winch operator is satisfied with the probe placement, verify that the probe is on the target from the lower level (room 3S1). Also verify that the probe is flat on the target surface. Measure the minimum distance from the probe housing to the edge of the target and record in Table 7-3.

7.3.2.4 Measure the radial distance from the center of the riser to the center of the probe and the azimuthal angle and record in Table 7-3. Also record the radial distance and azimuthal angle indicated on the DAV's computer display (from the compass and inclinometer) ** see exception #4*

7.3.2.5 Rotate the deployment device so that the arm is in position for placing the probe on the next target.

7.3.2.6 Raise the arm a few degrees by rotating the arm winch clockwise.

7.3.2.7 Lower the probe by rotating the probe winch counterclockwise until it is near the target.

7.3.2.8 Rotate the deployment device, and raise or lower the arm and probe as required to position the probe on the center of the target.

7.3.2.9 Raise the probe as required and repeat steps 7.3.2.3 through 7.3.2.6 for the rest of the targets (29 total). Record comments and observations on the Observation/Results sheets (Appendix A). Record the stop time, calculate the time interval, and record below. Indicate acceptance for the probe placement accuracy.

7.3.2.10 For the "repeat" sample points/targets indicated in Table 7-3, return the probe to the previous position according to the compass and inclinometer readings. Measure the radial distance from the center of the riser to the center of the probe and the azimuthal angle and record in Table 7-3. Compare to the previous values. Record comments and observations on the Observation/Results sheets (Appendix A). ** see exception #4*

Stop time: 2:45

Time interval (with breaks subtracted): 1:53:06 (HOURS:MINUTES:SECONDS)

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

ACCEPTANCE CRITERIA: time interval of 8 hours (maximum)

Accept/Reject (circle one)

Responsible ME's signature

GLH [Signature]Date 2/15/96

7.3.3 Remove Camera and Setup in Room 351

- 7.3.3.1 Disable power to the camera system and disconnect the cables between the camera, camera controls, and video monitors.
- 7.3.3.2 Remove the camera system from the selected mock-up riser in room 500 per TO-020-141, *In-Tank Video Procedure* (disregard steps related to contamination control and HPT surveys).
- 7.3.3.3 Position the camera on the ground level 9.1 m (30 ft) $\pm$ 15 cm (6 in.) away from the center of the riser in which the deployment device is installed. Note that the camera may need to be located outside of room 351 and view the probe through one of the windows to obtain the specified distance.
- 7.3.3.4 Reconnect the cables between the camera, camera controls, and video monitors and supply power to the camera system. Turn on the camera lights.
- 7.3.3.5 Turn off the lights in room 351 such that the only light available in room 351 is from the camera lights.

Test Engineer's signature

GLH [Signature]Date 2/23/96

7.3.4 Functional Test for Camera Located in Room 351

Repeat the steps specified in Section 7.3.2 for the second camera location, placing the probe on each of the 29 targets. Record measurements in Table 7-4. Record comments on the Observation/Results sheets (Appendix A). Record the start time, stop time, calculate the time interval, and record below. Indicate acceptance for the probe placement accuracy at this camera location.

Start time: 2:15 2/23/96

NOTE: When tracking the time it takes to place the probe on targets, be sure to note any breaks that were taken. Subtract the total time for breaks from the time interval below.

Stop time: 2:50 2/23/96 * SEE EXCEPTION #3Time interval (with breaks subtracted): 18:01 (MINUTES: SECONDS)
(FOR 7 TARGETS)

ref -
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

ACCEPTANCE CRITERIA: time interval of 8 hours (maximum)

Accept/Reject (circle one)

Responsible ME's signature

Date 2/23/96

7.3.5 Probe Placement on Irregular Surfaces

The tank waste surface that the probe will be positioned on is not flat or smooth like the targets in the previous tests. For the tests in this section, position the probe on selected surfaces per the responsible ME's and/or Operations Representative's direction. For each surface, record a description of the surface in Table 7-5. Videotape the surface and probe placement operation. After the winch operator is satisfied with the probe placement, measure the probe offset from the surface (if any), the probe inclination, and any other parameters to describe the placement accuracy. Record the measurements and comments in Table 7-5. Indicate acceptance for the probe placement accuracy below.

Accept/Reject (circle one)

Responsible ME's signature

Date 3/5/96

Operations Representative signature

Date 3/5/96

7.3.6 Operations Representative Approval

A representative from Operations shall perform the tests in Section 7.3.2 and Section 7.3.4 at least once to determine the ease of operation of the deployment device. In addition, this representative will attach and remove the brackets that prevent azimuthal rotation to verify that this operation can be performed in the field. Using the following criteria (as a minimum), indicate acceptability of deployment device operation.

7.3.6.1 Verify that the probe can be easily placed on a target using the deployment device winches and only the view from the camera.

Accept/Reject (circle one)

Operations Representative signature

Date 3/5/96

7.3.6.2 Verify that the deployment device can be easily rotated around the azimuth such that the smallest operator can perform this task.

Accept/Reject (circle one)

Operations Representative signature

Date 3/5/96

7.3.6.3 Verify that the arm and probe cranks can be easily turned such that this operation is not exhausting to the smallest operator.

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Accept/Reject (circle one)Operations Representative signature Don P. M. M. Date 3/5/96

- 7.3.6.4 Verify that brackets that prevent azimuthal rotation of the deployment device during tank installation/removal can be attached/removed by an operator wearing clothing per the RWP.

Accept/Reject (circle one)Operations Representative signature Don P. M. M. Date 3/5/96

7.3.7 Remove Deployment Device

- 7.3.7.1 Disable power to the deployment device and disconnect cables.
- 7.3.7.2 Lift the deployment device from the mock-up riser and place in the horizontal position on pipe stands (or sawhorses) per the critical lift procedure.
- 7.3.7.3 With the deployment device in the horizontal position, perform a thorough inspection of the device as described in Step 7.2.2.7. Indicate acceptance at the end of Section 7.2.2.
- 7.3.7.4 Disassemble and secure equipment for transport.

As the last step for the FMEF Test Procedure, review the test and verify that all steps in Section 7.0 have been completed.

Test Engineer's signature GLA Mtt Date 3/11/96

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Figure 1-1. Surface Moisture Measurement System.

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Figure 6-1. Circuit Breaker Panel Layout.

WHC-SD-WM-ATR-153 Rev. 0

TEST CONTROL COPY

Figure 6-2. SMS and LOWESS Instrument Cable Connections.

*Kevlar is a trademark of E.I. du Pont de Nemours and Company, Wilmington, DE.

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Figure 6-3. SMMS Deployment Device Lift Points and Required Rigging.

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Figure 6-4. Winch Enclosure Box Leak Test Setup.

ref
MHC-SD-MM-ATR-153 Rev. 0

TEST CONTROL COPY

Figure 6-5: SMMS Decontamination System Block Diagram.

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Figure 7-1. Sampling Point/Target Layout.

ref -
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Table 7-2. Probe Cable Diameter Measurements (Section 7.2.3).

Measurement#	New Cable Measurements	Pre-test Measurements	Mid-Test Measurements (after 50 cycles)	Post-Test Measurements (after 100 cycles)
STARTING FROM TOP OF CABLE	.398	.399 inch	.397	.399
2	.401	.402	.397	.400
3	.399	.400	.398	.400
4	.401	.399	.400	.399
5	.400	.400	.397	.398
6	.397	.399	.400	.400
7	.402	.400	.400	.398
8	.402	.399	.399	.398
9	.401	.400	.400	.398
10	.402	.402	.400	.398
11	.398	.400	.397	.397
12	.397	.400	.397	.396
13	.399	.401	.399	.398
14	.398	.402	.401	.397
15	.400	.401	.399	.398
16	.399	.404	.400	.399
17	.401	.404	.400	.399
18	.400	.402	.404	.397
19	.400	.402	.403	.399
20	.402	.399	.397	.400

MHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Figure 1-1. Surface Moisture Measurement System.

WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Table 6-1. Probe Drop Test Measurements (Section 6.6.2).

Drop Test #	Calibration Fixture #1					Calibration Fixture #2				
	Det. #1	Det. #2	Det. #3	Temp #1	Temp #2	Det. #1	Det. #2	Det. #3	Temp #1	Temp #2
Pre-Test (6.6.2.1)	CR 3898 SD 36	CR 7651 SD 48	CR 2264 SD 27	23°C 29°C →		CR 3555 SD 34	CR 6691 SD 47	CR 2239 SD 27	23	29
1 (6.6.2.3)	CR 3868 SD 36	CR 7157 SD 49	CR 2522 SD 29	24 ←	30	CR 3578 SD 34	CR 6678 SD 47	CR 2208 SD 27	24	29
2 (6.6.2.4)	CR 4009 SD 37	CR 7380 SD 50	CR 2462 SD 29	24 →	30	CR 3592 SD 35	CR 6665 SD 47	CR 2160 SD 27	24	30
3 (6.6.2.5)	CR 3991 SD 36	CR 7300 SD 49	CR 2476 SD 29	24 ←	30	CR 3632 SD 35	CR 6765 SD 47	CR 2276 SD 28	24	30
4 (6.6.2.6)	CR 3943 SD 36	CR 7202 SD 49	CR 2507 SD 29	24 →	30	CR 3565 SD 34	CR 6596 SD 47	CR 2186 SD 27	24	30
5 (6.6.2.7)	CR 3936 SD 36	CR 6991 SD 48	CR 2254 SD 27	25 ←	31	CR 3562 SD 34	CR 6632 SD 47	CR 1965 SD 26	25	30

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Table 7-1. Sampling Point/Target Locations.

Sample Point#	Radius (m [ft])	Azimuthal Angle (degrees)
1	0	NA
2	0.3 [1]	0
3	0.3 [1]	180
4	0.6 [2]	90
5	0.6 [2]	270
6	0.9 [3]	135
7	0.9 [3]	225
8	0.9 [3]	315
9	0.9 [3]	45
10	1.2 [4]	90
11	1.2 [4]	180
12	1.2 [4]	270
13	1.2 [4]	0
14	1.5 [5]	22.5
15	1.5 [5]	67.5
16	1.5 [5]	112.5
17	1.5 [5]	157.5
18	1.5 [5]	202.5
19	1.5 [5]	247.5
20	1.5 [5]	292.5
21	1.5 [5]	337.5
22	1.8 [6]	0
23	1.8 [6]	45
24	1.8 [6]	90
25	1.8 [6]	135
26	1.8 [6]	180
27	1.8 [6]	225
28	1.8 [6]	270
29	1.8 [6]	315

WHC-SD-WM-ATR-153 Rev. 0

TEST CENTRAL COPY

3/5/96 PAGE 1 OF 2

Table 7-3. Probe Placement Measurements (Section 7.3.2).

(* SEE EXCEPTION #4 *)

Target #	Distance to Target Edge	Measured radius/angle	Computed radius/angle	Measured radius/angle (repeats*)
1*		0.0" / NA	0.0 / NA (3)	~0'-0" / NA
2*		1'-1" / 0°	0.5' / 357°	1'-0 1/2" / 354°
3		1'-0" / 270°	1.5' / 283°	1'-0" / 270°
4				
5*		2'-0" / 270°	1.5' / 283°	1'-11 3/4" / 270°
6				
7*		3'-0 3/4" / 225°	2.6' / 234°	3'-0 1/2" / 227°
8				
9				
10				
11				
12				
13*		3'-11 1/4" / 0°	3.9' / 6°	4'-0 1/4" / 2.5°
14				
15				
16				
17*		4'-11 3/4" / 157.5°	4.7' / 152°	5'-0" / 158°
18		5'-0" / 157.5°		
19		75/46		
20				
21				
22				
23				
24				
25				
26				
27				
28		5'-9 3/4" / 269°	5.8' / 281°	5'-9 1/4" / 268°
29*		(COULD NOT BE SEEN BY CAMERA - USED 28 INSTEAD)		

TEST PERFORMED BY: G.A. RITTER G.A. RITTER 3/5/96
J.B. GUNTER J.B. GUNTER 3/5/96

WHC-SD-WM-ATR-153 Rev. 0

TEST CONTROL COPY

3/5/96 PAGE 2 OF 2
 Table 7-3. Probe Placement Measurements (Section 7.3.4).
 * SEE EXCEPTION #4

Target #	Distance to Target Edge	Measured radius/angle	Computed radius/angle	Measured radius/angle (repeats*)
1*				< 1/4"
2*				1/8"
3				
4				
5*				7/8"
6				
7*				5/8"
8				
9				
10				
11				
12				
13*				1"
14				
15				
16				
17*				5/8"
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				1/4"
29*				

TEST CONTROL COPY *ref*

PERFORMED BY: VICKI GOODENOUGH 2-13-96 *[Signature]*

BRUCE WATKINS 2-13-96 *[Signature]*

Table 7-3. Probe Placement Measurements (Section 7.3.2).
(CAMERA LOCATED 56 1/2" FROM CELL FLOOR)

Target #	Distance to Target Edge	Measured radius/angle	Computed radius/angle	Measured radius/angle (repeats*)
1*	1"	—		
2*	1/2" OFF THE EDGE	1'-1 1/4"/2°		
3	1/4"	1"/178°		
4	1/4" OFF THE EDGE	2'-1"/86°		
5*	1/2"	2'-1"/271°		
6	5/8"	2'-11 3/4"/125°		
7*	7/8"	3'-0 3/4"/225°		
8	7/8"	3'-0 3/4"/316°		
9	5/8"	3'-0"/44°		
10	1/2"	3'-11 1/2"/90°		
11	1/2" OFF THE EDGE	3'-10 3/4"/180°		
12	1/2" OFF THE EDGE	3'-11 1/4"/272°		
13*	5/8"	4'-0 1/4"/1°		
14	5/8"	5'-0 1/4"/22°		
15	3/4"	4'-11 1/2"/67.5°		
16	7/8"	5'-0"/112°		
17*	1/4"	4'-11 3/4"/159°		
18	1 1/8"	5'-0"/202.5°		
19	5/8"	5'-0"/248°		
20	3/4"	4'-11 3/4"/293°		
21	7/8"	4'-11 1/4"/337.5°		
22	7/8"	6'-0"/1°		
23	1/8" OFF THE EDGE	6'-1"/44°		
24	1/4"	5'-11 1/4"/89°		
25	1/4" OFF THE EDGE	5'-10 3/4"/134°		
26	1 1/8"	180°/6'-0°		
27	0"	5'-10 3/4"/225°		
28	1/2"	5'-11 1/2"/269°		
29*	7/8"	6'-0"/316°		

SEE EXCEPTION #4

DISTANCE OFF-CENTER OF TARGET
(DETERMINED FROM MEASURED DISTANCE
TO TARGET EDGE):

R: TARGET RADIUS

C: TARGET CENTER

P: PROBE CENTER

d: MEASURED DISTANCE

r: PROBE RADIUS

X: DISTANCE OFF-CENTER = $R - r - d$

IF DISTANCE TO TARGET EDGE (FROM TABLE) IS $1\frac{1}{4}$ " (d),
THEN PROBE IS PERFECTLY CENTERED ON TARGET.

TEST CONTROL COPY *ref*
WHC-SD-WM-ATP-153 Rev. 0

* CAMERA LOCATED APPROXIMATELY 25 FEET ABOVE FLORA

Table 7-3. Probe Placement Measurements (Section 7.3.2).

(* SEE EXCEPTION #4)

Target #	Distance to Target Edge	Measured radius/angle	Computed radius/angle	Measured radius/angle (repeats*)	TIME
1*					
2*	1"				5:15
3	$\frac{3}{8}$ " $\frac{3}{8}$ "				6:57, 0:35
4	$\frac{3}{8}$ "				1:40
5*	$\frac{1}{4}$ "	$1'-11\frac{1}{2}" / 272^\circ$			~ 3:00
6					
7*					
8					
9					
10					
11					
12	$\frac{1}{2}$ "				
13*	$\frac{3}{4}$ "				0:34
14	$\frac{3}{4}$ " $\frac{1}{8}$ "				2:14, 0:43
15	$\frac{3}{4}$ "				0:21
16					
17*	$\frac{3}{8}$ " $\frac{1}{8}$ "	$4'-11\frac{1}{4}" / 158^\circ$			2:18, 0:51
18					
19					
20					
21					
22					
23	$\frac{9}{16}$ "	$5'-11\frac{3}{4}" / 46^\circ$			3:10
24					
25					
26					
27					
28					
29*					

PERFORMED BY: VERN MATTHEWS: VERN MATTHEWS 2-16-96
DON REDDOUT: DON REDDOUT 2-16-96

7251 Central Copy
 MHC-SD-WM-ATR-153 Rev. 0
 2-23-96
 125 performed by: V. B. Williams
 2-23-96
 Table 7-4. Probe Placement Measurements (Section 7.3.4).
 Don't report
 2-23-96

Target #	Distance to Target Edge	Measured radius/angle Time	Computed radius/angle	Measured radius/angle (repeats*)
1*				
2*				
3				
4	1/2" Off Hole	2:35		
5*				
6				
7*	1/2"	1:10		
8	3/4"	2:35		
9				
10				
11				
12	2 1/2" Off Hole	3:07		
13*				
14	1/4"	2:50		
15				
16				
17*				
18				
19	1 1/8"	3:39		
20	5/8"	5:05		
21				
22				
23				
24				
25				
26				
27				
28				
29*				

see exception #4

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Table 7-5. Probe Placement on Irregular Surfaces (Section 7.3.5).

2/28/76 p. 1/2

Surface Description	Probe Offset	Probe Incl. Angle	Comments
HARDHAT (DONES SLIPPERY SURFACE) CAMERA ①	—	87.2° 88.5°	ATTEMPTED TO PLACE PROBE VERTICAL - WANT 90°.
HARDHAT - CAMERA ②	—	86.3°	LOOKS LIKE THIS CAN BE DONE CONSISTENTLY WITHIN 5° OF VERTICAL
ITALIA SALTCAKE SIMULANT SWEETENED ON PIECE OF PLYWOOD, INCLINED 30° SIDE VIEW, CAMERA ①	1/4" ON ONE SIDE	54° 6" FROM ⊥	30° APPEARS TO BE BINDERLINE TOO STEEP.
SALTCAKE, 30° FACING CAMERA ①	1/2" ON ONE SIDE	62° 2" FROM ⊥	CANNOT BE DONE CONSISTENTLY W/OUT PROBE SLIPPING.
REPEAT ABOVE	NONE	59° 1" FROM ⊥	
SALTCAKE, 30° AWAY FROM CAMERA ①	—	—	COULD NOT BE DONE @ THIS ANGLE
SALTCAKE, 30° FACING CAMERA ②	< 1/4" ON ONE SIDE	53° 7" FROM ⊥	
SALTCAKE, 20° AWAY FROM CAMERA ①	< 1/4" ON ONE SIDE	71° 1" FROM ⊥	PLACED W/OUT TOO MUCH DIFFICULTY
SALTCAKE, 20° FACING CAMERA ①	< 1/4"	69° 1" FROM ⊥	

CAMERA POSITIONS ARE AS FOLLOWS:

- ① - 2'-1" AWAY FROM RISER CENTER
~ 30' ABOVE CELL FLOOR
- ② 30' AWAY FROM RISER CENTER (OUTSIDE CELL)
57" ABOVE CELL FLOOR

ref.
WMC-SD-WM-ATR-153 Rev. 0

TEST CONTROL COPY

Table 7-5. Probe Placement on Irregular Surfaces (Section 7.3.5).

2/28/96 CONT P. 2/2

Surface Description	Probe Offset	Probe Incl. Angle	Comments
SALT CREE, 20° SIDE VIEW CAMERA ①	1/4"	77° ~ 7° FROM ⊥	
SALT CREE, 20° FRONT CAMERA ②	NONE	71° 1° FROM ⊥	
SALT CREE, 20° SIDE VIEW, CAMERA ②	~ 1/2"	72° 2° FROM ⊥	
SALT CREE, 20° SIDE VIEW, CAMERA ①	~ 1/4"	72° 2° FROM ⊥	REPORT OF PREVIOUS CREE W/ BOTH CAMERA LIGHTS
SALT CREE, 20° FRONT CAMERA ②	NONE	72° 2° FROM ⊥	REPORT
SEPT WET SAND SURFACE CAMERA ① - 6" Ø MOUND	1" ON EACH SIDE, 1/2" OF PROBE IN CONTACT	—	TRIED TO PLACE PROBE W/OUT SINKING INTO SAND
SAND CAMERA ② - 6" Ø MOUND	1/8" - 1/4" GAP ON EACH SIDE	—	DID NOT SINK INTO SURFACE - SLIGHT OFFSET BE INDICATED
			LOWER CAMERA ANGLE IS OBVIOUSLY BETTER FOR VERIFYING PROBE
			PROBE NOT SINK INTO SURFACE.
PLACE PROBE DOWN PIPE IN SAND BOX	PIPE IS TOO LARGE TO TOP.		

TEST PERFORMED BY:

VICKI GOODENOW

BRUCE WATKINS

DON REDDOUT

DAN NIEBUHR

Vicki Goodenow 2-28-96

2-28-96

GAIL PMLA 2/28/96

WHC-SD-WM-ATR-153 Rev. 0

TEST CONTROL COPY

Table 7-5. Probe Placement on Irregular Surfaces (Section 7.3.5).

Surface Description	Probe Offset	Probe Incl. Angle	Comments
SALTCAKE, 21° FACING CAMERA	NONE	64.2°	
SALTCAKE, 20° FACING CAMERA ①	< 1/4"	67.6°	INCLINOMETER (FROM SOFTWARE) RADIUS: 3.1' COMPASS: 194°
SALTCAKE, 20° SIDE VIEW CAMERA ②	1/4" FIRST TRY 2/8" AFTER ADJUSTMENT	67.4°	RADIUS: 3.1' COMPASS: 202°
SALTCAKE, 20° AWAY FROM CAMERA ③	1/8 - 1/4" ON BACK SIDE	75.3° 5.3° FROM ⊥	RADIUS: 3.6' COMPASS: 186°
REPEAT ① TO RETURN TO SAME RADIUS + COMPASS	1 5/8"	—	CAMERA PAIRGE PLACEMENT REPEATABILITY ON INCLINED SURFACE.
REPEAT ② TO RETURN TO SAME RADIUS + COMPASS	2"	—	RECORD PROBE DISPLACEMENT FROM ORIGINAL LOCATION
REPEAT ③ TO RETURN TO SAME RADIUS + COMPASS	2"	—	→ PROBE OFFSET
REPEAT ① AGAIN TO SAME RADIUS + COMPASS	3/4"	—	

CAMERA
112'
ABOVE
FLOOR

TEST PERFORMED BY:

GLEN RITTER: G. L. A. Ritter 3/5/96

W. TOOP WATSON: W. Toop Watson 3/5/96

JASON B. GUNTER: Jason B. Gunter 3/5/96

- * ALL TESTS ON THIS SHEET ARE WITH THE CAMERA INSTALLED IN THE ADJACENT RISER THAT IS LOCATED 21'-1" AWAY. THE HEIGHT OF THE CAMERA ABOVE THE FLOOR WAS 64" - ABOUT 5 FEET - UNLESS NOTED OTHERWISE. ~~THE BEST VIEWING ANGLE MORE THAN ONE VIEWING ANGLE WAS USED FOR EACH TEST.~~

ref -
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

Table 7-5. Probe Placement on Irregular Surfaces (Section 7.3.5).

Surface Description	Probe Offset	Probe Incl. Angle	Comments
ITALIANT UNDER PLASTIC MATERIAL - 21' FOOT AWAY	—	86.4°	TRIED TO PLACE PROBE VERTICAL
HARDHAT - 34' AWAY FROM CAMERA		86.6°	"
BAG OF SAND INCLINED TO 13.5° (28' AWAY)	NONE	—	PROBE ORIENT PLUMB ON SURFACE
BAG OF SAND INCLINED TO 37°	NOT ABLE TO PLACE PROBE FLAT	—	PROBE SLIPS OFF OF BAG.
BAG OF SAND @ 37° WITH PLASTIC MATERIAL	NONE	—	PLACED PROBE WITH SOME DIFFICULTY
SOFT SAND - WANT PROBE TO JUST TOUCH THE SURFACE W/OUT SINKING	NONE	—	PROBE SANK ABOUT 1/4" INTO SAND

TEST PERFORMED BY:

VICKI GOODENOW : Vicki Goodenow 2-23-96

VERN MATTHEWS : Vern Matthews 2-23-96

DO NOT REPEAT:

ref
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

APPENDIX A

SURFACE MOISTURE MEASUREMENT SYSTEM
FUNCTIONAL TESTING
OBSERVATION/RESULTS SHEET

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

TEST STEP	OBSERVATION/RESULTS	INITIALS	DATE
6.5.2.13	THE PROBE WHICH CAUSED THE ALARM ABOUT 5-10" BEFORE THE TORQUE LIMITER SLIPS - THIS CAUSES NO DAMAGE TO THE ARM OR PROBE HEAD. IT IS VERY EASY TO TELL/FEEL WHEN THE PROBE	G.H.L.	2/9/96
	ACHIEVES THE ARM SACKET. A TORQUE LIMITER FOR THE PROBE WHICH DOES NOT APPEAR TO BE ESSENTIAL. THE LOWER RANGE OF 6 ft-lbf WOULD BEST.		
7.3.2.	BEGIN PROBE PLACEMENT TEST WITH TWO LEFT FROM OPERATIONS. 1 GANON ^{OR} HODGSON 1 VICKI GOODNOW 1 BRUCE WATKINS 1 WIND OPERATOR CAMERA LOCATED 56 1/2" FROM FLOOR	G.H.L.	2/13/96
	A STOP WATCH WAS USED TO RECORD THE ELAPSED TIME FOR THE PROBE PLACEMENT TEST. FIRST FIVE PLACEMENTS TOOK ABOUT 8-10 MINUTES TO COMPLETE. AFTER THE OPERATORS		
	HAD SOME PROBLEMS, IT GENERALLY TOOK ABOUT 3 MINUTES. NOTE THAT A DISTANCE OF 1/4" FROM THE EDGE OF THE TARGET TO THE PROBE IS PERFECTLY CENTERED ON THE TARGET		
7.3.2	PROBE PLACEMENT TEST/TRAINING OF ADDITIONAL OPERATORS. RAISED THE CAMERA TO APPROX. 25 FEET ABOVE THE FLOOR	G.H.L.	2/16/96
	OPERATIONS WHO PERFORMED THE TEST: * VICKI GOODNOW * BRUCE WATKINS * DON REDDOUT * JEFF MATTHEWS		
	DON NICHOLSON OBSERVED TESTING * PERFORMED TESTING ON 2/13/96 NEW CAMERA LOCATION/ANGLE COMPARED TO PREVIOUS LOCATION: SLIGHTLY EASIER THAN SHALLOW CAMERA ANGLE. FOR LOCATING TARGET BUT DEPTH PERCEPTION IS WORSE.		

ref-
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

TEST STEP	OBSERVATION/RESULTS	INITIALS	DATE
6.5.2.13	THE PROBE WHICH RAISED THE ARM ABOUT 5-10° BEFORE THE TORQUE LIMITER SLIPS - THIS CAUSES NO DAMAGE TO THE ARM OR PROBE HEAD. IT IS ONLY EASY TO TELL/FEEL WHEN THE PROBE	G.L.H.	2/9/96
	REMOVES THE ARM SOCKET. A TORQUE LIMITER FOR THE PROBE WHICH DOES NOT APPEAR TO BE ESSENTIAL. THE LOWER RANGE OF 6 ft-14ft WORKS BEST.		
7.3.2.	BEGIN PROBE PLACEMENT TEST WITH TWO LEFT FROM OPERATIONS 1 CAMERA OPERATOR VICKI GOODENOW 1 WIRE OPERATOR BRUCE WATKINS CAMERA LOCATED 56 1/2" FROM FLOOR	G.L.H.	2/16/96
	A STOP WATCH WAS USED TO RECORD THE ELAPSED TIME FOR THE PROBE PLACEMENT TEST. FIRST FIVE PLACEMENTS TOOK ABOUT 8-10 MINUTES TO COMPLETE. AFTER THE OPERATORS		
	HAD SOME PROBLEMS; IT GENERALLY TOOK ABOUT 3 MINUTES. NOTE THAT A DISTANCE OF 1/4" FROM THE EDGE OF THE TARGET TO THE PROBE IS PERFECTLY CENTERED ON THE TARGET		
7.3.2	PROBE PLACEMENT TEST/TRAINING OF ADDITIONAL OPERATORS. RAISED THE CAMERA TO APPROX. 25 FEET ABOVE THE FLOOR	G.L.H.	2/16/96
	OPERATIONS WHO PERFORMED THE TEST: * VICKI GOODENOW * BRUCE WATKINS DON REDDOUT VERN MATTHEWS		
	DAN NICHOLS OBSERVED TESTING * PERFORMED TESTING ON 2/13/96 NEW CAMERA LOCATION (ANGLE COMPARED TO PREVIOUS LOCATION) SLIGHTLY EASIER THAN SHALLOW CAMERA ANGLE. FOR LOCATING		

TARGET BUT DEPTH PERCEPTION IS WORSE.

WHE-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

TEST STEP	OBSERVATION/RESULTS	INITIALS	DATE
7.3.2	RAISED CAMERA SO IT JUST PASSED ABOUT 1 FOOT BELOW RISE - THIS IS 30-32' ABOVE THE FLOOR - BETTER ANGLE FOR POSITIONING THE PROBE ON TARGET	G.A.L	7/14/96
N/A	PRACTICE INSTALLING + REMOVING DEPLOYMENT DEVICE FROM THE MOUTH OF RISE - PLACES 2 DIFFERENT TYPES OF SWEETING ON THE DEVICE	G.A.L	7/16/96
	36" DIA CONTINUOUS AND 8" DIA ZIP LASH SWEETING.		
	* NOTED THAT A SHARP EDGE EXISTS NEAR THE BOLL CHAIN THAT SHOULD BE MATCHED OUT.		
	* NEED DUMMY - PROOF WAY OF POSITIONING SPACER BAR CORRECTLY MATCH MARKINGS		
	* NEED CHARTER ON MATH BETWEEN 8' AND 9' MARK		
	THE BIG SWEETING WORKED BETTER THAN THE 8" SWEETING - WAS MORE ADVANTAGEOUS.		
	BETTER CONTINUOUS.		
	→ PROBE HANGING 4 FEET DOWN BEFORE REMOVING FROM RISE		
	→ PLACE PROBE IN C/L FEATURES		
	IN AIR - NOT GLOVE BAG.		
	TRANSLATING SHIELD FOR PROBE WHILE PREPARING FOR CALIBRATION		
	* NOT MARKS FOR PLACING MIDPOINT LEFT CHAIN.		
	USE 36" DIAMETER SWEETING - HAVE 8" ZIP-TENSION AS A BACK UP		

ref.

WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

TEST STEP	OBSERVATION/RESULTS	INITIALS	DATE
7.3.4	BEGIN TEST WITH CAMERA LOCATED 20 FEET AWAY (PERPENDICULAR DISTANCE) AND 10 FT ABOVE THE FLOOR. CAMERA WAS PLACED	G.H.L.	2/23/96
	5' OUTSIDE OF THE WINDOW (MEASURED FROM THE WALL) ON THE SOUTH SIDE OF THE CELL. THE CAMERA AREA WAS COVERED WITH CARDBOARD		
	AND GREEN PLASTIC TO PREVENT LIGHT FROM ENTERING THE CELL.		
7.3.5	MORE TESTING WITH IRREGULAR SURFACES - DAN MIEBURN AND 3 OPERATORS (DAN REBERT, BRUCE	G.H.L.	2/28/96
	WATKINS, AND VICKI GOODENOW ASSISTED THE TESTING)		
7.3.2	PERFORMED PACE PLACEMENT REPEATABILITY TEST - (JB GUNTER + GA MITCHELL) SEE EXCEPTION #4	G.H.L.	3/5/96
	PERFORM ONLY STEPS 7.3.2.4 AND 7.3.2.10 FOR THE "REPEAT" POINTS		
7.3.5	MORE TESTING WITH IRREGULAR SURFACES - TEST PERFORMED BY JB GUNTER, WT WATSON, GA MITCHELL	G.H.L.	3/5/96

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

TEST STEP	OBSERVATION/RESULTS	INITIALS	DATE
6.6.1	BEGIN FRASE HOUSING LEAK TEST FIRST PLACED FRASE HOUSING (W/OUT ELECTRONICS) IN A 4" x 3' L	G.A.H.	3/14/96
	PVC PIPE, PLUGGED ON ONE END. NO SEALANT WAS USED FOR FIRST TEST. 1 FOOT WATER WAS ADDED UNTIL THERE WAS 1 FOOT ABOVE THE		
	TOP OF THE CABLE HEAD. RESULT: LEAKAGE ULTRA BLUE SILICONE RTV WAS THEN APPLIED AS FOLLOWS:

	ALLOWED RTV TO SET UP FOR 1 HOUR. ASSEMBLED THE FRASE AND RETESTED.		
	RESULT: LEAKED AGAIN THROUGH TOP THREADS - WHEN DISASSEMBLED, IT APPEARED THE RTV WAS SHEARED/SQUISHED - NOT IN GOOD COND.		
	* REPEATED TEST WITH RTV APPLIED ON OUTSIDE OF THE 2 THREADED JOINTS AS FOLLOWS:

	RESULT: NO LEAKAGE WHEN SEALED ON THE OUTSIDE IN THIS MANNER. THIS IS THE METHOD TO BE USED TO SEAL THE FRASE.		

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

TEST STEP	OBSERVATION/RESULTS	INITIALS	DATE
6.7.1+ 6.7.2.5	BEGIN BECON SYSTEM TEST. INSPECTED SYSTEM FOR LEAKS - 2 FITTINGS LEAKED AT THE SPRAY RING. THE FITTINGS WERE	G.A.L	3/14/90
	TIGHTENED AND SUBSEQUENTLY THERE WAS NO FURTHER LEAKAGE. SPRAY FROM THE UPPER NOZZLES WAS IMPACTING THE SIDES OF THE		
	PIPE AS SHOWN:
	NOZZLE SPRAY WIDTH APPEARS TO BE A LITTLE TOO WIDE, CAUSING A SLIGHTLY NONUNIFORM PATTERN, BUT		
	THIS WAS NOT SIGNIFICANT. OTHER THAN THIS, THE SPRAY PATTERN LOOKED GOOD - NONE OF THE NOZZLES APPEARED TO BE PLUGGED.		
6.4	SET UP PLASTIC SHROUD OVER FRONT OF VAN TO HEAT UP AIR IN FRONT OF VAN. A HEATER WAS NOT NEEDED.	G.A.L	3/27/90

	THE SHROUD BLOCKED OFF AIR FLOW TO THE RADIATOR AND ALLOWED THE AIR TEMP IN FRONT OF THE RADIATOR TO BE CONTROLLED. THE ENGINE RAN FOR 1 HOUR, 45 MIN BEFORE STOPPING OUT.		

ref.

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

TEST STEP	OBSERVATION/RESULTS	INITIALS	DATE
6.6.2	BEGIN PROBE SHOCK TEST - PROBE WAS POSITIONED BY HAND IN THE SPECIFIED ORIENTATIONS ON A 1/2" THICK SST PLATE. THAT	G.A.R.	4/1/96
	WAS Laid ON THE FLOOR OF ROOM 173 IN 306E.		
	NO DAMAGE TO THE PROBE HOUSING WAS OBSERVED.		
	SOME SLIGHT DAMAGE TO THE PROBE INTERNALS WAS IDENTIFIED → SEE SKETCH ON FOLLOWING PAGE. HOWEVER, THE PROBE		
	STILL FUNCTIONED SATISFACTORILY		
6.7.3	PERFORMED FULL SCALE DECON TEST AS PART OF OPERATIONS TRAINING. DAN NIEBUHR, BRUCE WATKINS, VERN MATTHEWS, AND	G.A.R.	4/4/96
	KEAT MORTENSON. AND CHAD ESVELT WERE PRESENT FOR THE TEST - ALSO VIDEO TAPED.		
	THERE WERE A FEW SPOTS ON THE DEPLOYMENT DEVICE THAT WERE NOT COMPLETELY SELF DRAINING - ELBOW, SLOT ON THE ARM - BUT IT IS ESTIMATED THAT LESS THAN		
	2-3 CM ³ OF WATER WAS ON THE MAST - THE RUBBER WIPER WORKED WELL.		

TEST CONTROL COPY

WHC-SD-WM-ATR-153 Rev. 0

TEST CONTROL COPY

TEST STEP	OBSERVATION/RESULTS	INITIALS	DATE
6.5.6	INSTALLED DEPLOYMENT DEVICE IN SHIPPING CONTAINER IN NORTH PARKING LOT OF 306E. IT WAS DONE USING A CRANE TO	G.A.R.	4/5/96
	SUPPORT THE MAST AND A FORKLIFT TO SUPPORT THE BOX. TWO PROBLEMS WERE OBSERVED:		
	1) ARM BRACE HAS SHARP EDGES THAT CAUGHT ON THE WELD BEAD INSIDE THE CONTAINER.		
	2) THE 4" BOLT PATTERN ON THE DEVICE DOES NOT MATE UP TO THE 6" FLANGE ON THE CONTAINER - AN ADAPTER MAY BE NEEDED.		
	THE SLEEVING GENERALLY LOOKED LIKE IT WAS IN GOOD SHAPE.		
	(AFTER THE DEVICE WAS REMOVED FROM THE CONTAINER, AN INSPECTION WAS PERFORMED) THE LARGEST TEARS WERE $\sim 1/2$ " IN DIA.		
	ALONG THE LENGTH OF THE MAST BETWEEN THE BRACE + MOUNTING FLANGE, THERE WERE ABOUT $1/2$ DOZEN SMALL HOLES (LESS		
	THAN $\phi 1/4$ ") ON THE SLEEVING. THESE HOLES ARE DOCUMENTED ON THE VIDEO.		

WMC-SD-WM-ATR-153 Rev. 0

TEST CONTROL COPY

TEST STEP	OBSERVATION/RESULTS	INITIALS	DATE
6.5.7.6	PULLED 5" VACUUM ON THE VINYL BOX - MEASURED APPROX. DEFLECTION ON WINDOW USING STRAIGHT EDGE + RULER	G.A.R.	4/8/96
	THE MAX DEFLECTION (AFTER WINDOW CONTACTED RUBBER BUMPER) WAS $\approx 5/16"$. THIS WAS MEASURED ACROSS THE BUMPER TO THE		
	TOP OF THE WINDOW ON THE PROBE WINDCH SIDE.		
6.6.3.3	SCREW HANDLING TOOL TEST - THE PROBE ROTATES AFTER REWINDING TOOL BUT GETS BOUND UP OCCASIONALLY. THIS IS BECAUSE THE PROBE TENDS	G.A.R.	4/9/96
	TO TILT DOWN WHEN THE CABLE RELAXES - CAUSING IT TO BIND FROM THE WEIGHT OF THE PROBE.		
	SOME SLIGHT DAMAGE OCCURED WHEN		
	THE TOOL WAS RELEASED AND THE PROBE DID NOT ROTATE ALL THE WAY. THE SPIKE SCREW HOLDER WAS SLIGHTLY CAUSTED AND THE THREADED ROD ON		
	THE TOOL WAS SLIGHTLY BENT. SEE COLLECTION # 11.		

ref.
WHC-SD-WM-ATR-153 Rev. 0

TEST CONTROL COPY

TEST STEP	OBSERVATION/RESULTS	INITIALS	DATE
6.5.5	REDUCED ARM LENGTH TEST - (PROBE CABLE GETS STUCK ON LIFT ARM AND DOES NOT ALLOW IT TO RETRACT):	G.A.R.	4/10/96

	BECAUSE OF THIS TIGHTER ANGLE MORE FORCE (UPWARD) IS PUT ON THE LIFT ARM FROM THE PROBE CABLE WITH A SHORTER ARM. THE SURFACES ON THE LIFT ARM NEED		
	TO BE ROUNDED AND POSSIBLY A STEARBOL SPRING IS NEEDED. SEE EXCEPTION # 13		
6.5.2.5 -6.5.2.15	RETESTS OF THE TONGUE LIMITER, LOAD TEST AND DEVICE OPERABILITY TEST WERE PERFORMED WITH THE NEW ELBOW, NEW ARM CABLE AND	G.A.R.	4/10/96
6.5.3 7.2.2	NEW ARM WHICH WORKS. EVERYTHING LOOKED/WORKED GOOD. THE ARM WINCH CRANK WAS SET TO ~ 4 ft-lbf.		
	THE ARM WAS RAISED + LOWERED 50 MORE CYCLES.		

WHC-SD-WM-ATR-153 Rev. 0

TEST CONTROL COPY

TEST STEP	OBSERVATION/RESULTS	INITIALS	DATE
N/A	ADDED DRAG BRACE ^T WITH BOX TO APPLY A BRAKING FORCE TO KEEP THE BOX FROM ROTATING TOO	G.H.L	4/15/96
	EASILY. BECAUSE THE BOX RESTS ON A HEAVY DUTY ROLLER BEARING, IT ALMOST TURNS TOO EASILY - A LIGHT WIND WOULD CAUSE IT TO		
	ROTATE. THE FORCE REQUIRED TO ROTATE THE BOX WAS MEASURED WITH THE BRACE ON BY ATTACHING A SPRING SCALE TO THE LONG SIDE		
	OF THE BOX AND NOTING THE FORCE AT WHICH THE BOX STARTED TO ROTATE. BREAKAWAY FORCE WAS ~25 lb		
	CORRESPONDING TO A TORQUE OF ~600 in-lb		
6.3.2.3	OR 50 ft-lb THE JAW INSTRUMENTATION WAS LEFT TURNED ON FOR A TOTAL OF 14 HOURS TO VERIFY THAT A MINIMUM OF 6 HOURS	G.H.L	4/15/96
	OF BATTERY POWER IS AVAILABLE. THE UPS NEVER SHOWED A "LOW BATTERY WARNING" SO THIS TEST WAS FOUND TO BE ACCEPTABLE.		

ref.

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

APPENDIX B

EXCEPTION TO SMMS ACCEPTANCE TEST

ref.
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

EXCEPTION TO SMMS ACCEPTANCE TEST

1

Title of Test: Surface Moisture Measurement System Test

EXCEPTIONS			CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	ORGANIZATION	INITIALS	DATE
6.5.2	2/9/96	TEST PERFORMED AT FMEP INSTEAD OF SOGE.	CEC (75250)	GFV	4-17-96
6.5.3	2/9/96	TEST PERFORMED AT FMEP INSTEAD OF SOGE.	CEC (75250)	GFV	4-17-96

<u>TEST APPROVED - NO EXCEPTIONS:</u> Responsible Engineer _____ Date _____ Quality Assurance _____ Date _____ Test Witness _____ Date _____		<u>TEST APPROVED - WITH EXCEPTIONS:</u> G.L.H. With 4/15/96 Responsible Engineer _____ Date _____ M.E. M'Elroy 4/29/96 Quality Assurance _____ Date _____ J.F. Bolan 4/15/96 Test Witness _____ Date _____	
---	--	--	--

ref-
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

EXCEPTION TO SMMS ACCEPTANCE TEST #2

Title of Test: Surface Moisture Measurement System Test

EXCEPTIONS			CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	ORGANIZATION	INITIALS	DATE
6.5.2.15	2/9/96	IT WAS DETERMINED THAT THE ELBOW FOR THE ARM WAS NOT STRONG ENOUGH TO WITHSTAND THE LOADS WITH THE ARM RAISED ALL THE WAY (180° HORIZONTAL). THIS TEST WAS THEREFORE NOT PERFORMED TO PREVENT DAMAGE TO THE ELBOW. THIS TEST WILL BE PERFORMED AFTER THE ELBOW IS REBUILT.	CEO (75250)	GFV	4-17-96
<p>* <u>TEST APPROVED - NO EXCEPTIONS: (RETEST PERFORMED)</u></p> <p><u>GL L With</u> 4/15/96 Responsible Engineer Date</p> <p><u>M. J. McEllen</u> 4/29/96 Quality Assurance Date</p> <p><u>FF Balsam</u> 4/15/96 Test Witness Date</p>			<p><u>TEST APPROVED - WITH EXCEPTIONS:</u></p> <p>Responsible Engineer Date</p> <p>Quality Assurance Date</p> <p>Test Witness Date</p>		

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 6.5.2.4 If the breakaway torque is not within the range of the acceptance criteria, adjust the nut per the responsible ME's direction and repeat steps 6.5.2.2 and 6.5.2.3 until the breakaway torque meets the acceptance criteria. NA below if no adjustment is required.

Breakaway torque (after adjustment): _____ N-m (ft-lbf)

ACCEPTANCE CRITERIA: 8.1 - 13.6 N-m (6 - 10 ft-lbf)

Accept/Reject (circle one)

(TEST EXCEPTION #2)

Responsible ME's signature ** RETEST **

Date _____

- 6.5.2.5 Secure the arm winch handle in a vise such that the handle is fixed but the extension (that connects the handle to the winch) is free to rotate.

- 6.5.2.6 Attach the calibrated torque wrench to the arm winch handle extension using an adapter.

- 6.5.2.7 Using the torque wrench, apply an increasing amount of torque to the probe winch handle extension and observe the torque at which the extension slips/rotates--the breakaway torque. Record the breakaway torque below.

Breakaway torque: (10 ft-lbf) N-m (ft-lbf)

- 6.5.2.8 If the breakaway torque is not within the range of the acceptance criteria, adjust the nut per the responsible ME's direction and repeat steps 6.5.2.6 and 6.5.2.7 until the breakaway torque meets the acceptance criteria. NA below if no adjustment is required.

Breakaway torque (after adjustment): N/A N-m (ft-lbf)

ACCEPTANCE CRITERIA: 12.2 - 19.0 N-m (9 - 14 ft-lbf)

Accept/Reject (circle one)

Responsible ME's signature *GLA with*

Date 4/11/96

- 6.5.2.9 Attach the winch handles to the winches and lift the deployment device from horizontal to vertical with the appropriate rigging and suspend the device from the crane in the 306E penthouse per a 306E Building Certified Crane Operator's direction. Uprighting the deployment device requires two cranes/hoists with a minimum 910 kg (1 ton) capacity. See Figure 6-3 for lift points and required rigging.

- 6.5.2.10 Secure the deployment device in place by strapping the mast to the stand next to the test pit to prevent movement when the arm is lifted per the Responsible ME's direction. Position the deployment device winches such that winch handles can be reached by test personnel on the lower catwalk in the penthouse.

WHC-SD-WM-ATR-153 Rev. 0

TEST CONTROL COPY

- 6.5.2.11 306E Certified Crane Operator and Responsible ME sign below to indicate that the deployment device has been safely secured.

Certified Crane Operator signature [Signature] Date 10 April 96

Responsible ME's signature [Signature] Date 4/10/96

- 6.5.2.12 With test personnel positioned on the lower catwalk of the penthouse, perform the following to verify the probe winch torque limiter is functioning satisfactorily. With the probe fully secured in the arm socket, turn the probe winch handle clockwise to try to raise the probe and verify that the probe winch handle turns but the probe winch does not rotate.

- 6.5.2.13 Verify that no damage to the deployment device occurred. In particular, visually inspect the probe cable and cable head to verify no damage occurred.

ACCEPTANCE CRITERIA: no damage to deployment device

Accept/Reject (circle one)

Responsible ME's signature

~~* RETEST *~~ (TEST EXCEPTION #2)

Date

- 6.5.2.14 The following will test the effect of raising the arm before the probe has been released from the arm socket (operating procedure violation). With the probe fully secured in the arm socket, perform the following to verify the arm winch torque limiter is functioning satisfactorily. Turn the arm winch handle clockwise to raise the arm. After the arm has been raised to the horizontal position, verify that the arm winch handle turns but the arm winch does not rotate.

- 6.5.2.15 Verify that no damage to the deployment device occurred. In particular, visually inspect the arm cable, bell crank, probe cable, and probe cable head to verify no damage occurred.

ACCEPTANCE CRITERIA: no damage to deployment device

Accept/Reject (circle one)

Responsible ME's signature

[Signature]

Date 4/10/96

- 6.5.2.16 Determine the following for the arm winch and probe winch. Note that too many turns of the winches indicates that the torque limiters are set too low and significant slippage is occurring.

(Acceptance Criteria are shown in bold)

arm winch--number of turns from vertical to horizontal:

(30 turns maximum)

ref.
WHC-SD-WM-ATR-153 Rev. 0

TEST CONTROL COPY

probe winch--number of turns per foot of deployment (average):

(15 turns maximum)

Accept/Reject (circle one)

Responsible ME's signature

Date

6.5.3 Load Tests * RETEST * (TEST EXCEPTION # 2)

The winches were designed to be self-locking to prevent unintentional spooling. This section will verify that the winches will hold a load of at least 2 times the weight of the probe. An electronic level may be used to determine the angle of the arm if the inclinometer is not available.

- 6.5.3.1 With the deployment device suspended from the crane in the 306E penthouse, lower the probe (or mock-up probe) to the floor level and attach a test weight such that the combined weight of the probe and test weight is at least 22.7 kg (50 lb). Record the applied load below.
- 6.5.3.2 Using the arm winch, raise and lower the arm and verify that it remains stationary after releasing the arm winch handle for the following angles of the arm: 10, 20, 30, 45, 60, and 90 degrees with respect to vertical (the arm winch handle should not rotate more than 1/20 of a revolution after releasing).
- 6.5.3.3 Using the probe winch, raise and lower the probe several feet and verify the probe remains stationary after releasing the probe winch handle (the probe winch handle should not rotate more than 1/20 of a revolution after releasing).

Applied Load: $25 \text{ lb (Probe)} + 32 \text{ lb}$ kg (lbs.)
 $= 57 \text{ lb TOTAL}$

ACCEPTANCE CRITERIA: no unintentional spooling of cable

Accept/Reject (circle one)

Responsible ME's signature

Date 4/16/96

6.5.4 Bell Crank Retraction Test

This test will verify that the bell crank on the arm retracts reliably without damaging the probe cable. The configuration for this test is intended to be the worst case scenario for which the probe cable has the highest probability of interfering with the bell crank.

- 6.5.4.1 With the deployment device suspended from the crane in the 306E penthouse, lower the deployment device such that it is approximately 30 cm (1 ft) from the floor level.

ref.
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

EXCEPTION TO SMMS ACCEPTANCE TEST (#3)

Title of Test: Surface Moisture Measurement System Test

EXCEPTIONS			CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	ORGANIZATION	INITIALS	DATE
7.3.4	2/29/96	CAMERA WAS LOCATED OUTSIDE THE CELL LOOKING THROUGH A CELL WINDOW - NOT ALL 29 TARGETS WERE IN VIEW AT THIS LOCATION - THEREFORE, ONLY SOME OF THE TARGETS WERE USED FOR THIS TEST - THOSE LOCATED FURTHEST AWAY TOTAL OF 7 INSTEAD OF 29.	LED (75250)	GFV	4-17-96
<u>TEST APPROVED - NO EXCEPTIONS:</u> Responsible Engineer _____ Date _____ Quality Assurance _____ Date _____ Test Witness _____ Date _____			<u>TEST APPROVED - WITH EXCEPTIONS:</u> G.L.H. With 4/15/96 Responsible Engineer Date M.L. McElroy 4/29/96 Quality Assurance Date Dennis G. Hane 4/15/96 Test Witness Date		

ref.
WMC-SD-WM-ATR-153 Rev. 0

TEST CONTROL COPY

EXCEPTION TO SMMS ACCEPTANCE TEST

Title of Test: Surface Moisture Measurement System Test

#4

EXCEPTIONS			CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	ORGANIZATION	INITIALS	DATE
7.3.2.4 + 7.3.2.10	2/21/96	<p>VAN WAS NOT AVAILABLE FOR THIS PART OF TESTING SO THE PROBE PLACEMENT REPEATABILITY PART WAS DEFERRED UNTIL LATER WHEN THE VAN WAS AVAILABLE + THE CURRESS + INCLINOMETER ARE FUNCTIONING.</p> <p>BASICALLY, THE TEST WAS BROKEN INTO 2 PARTS:</p> <p>1) PROBE PLACEMENT ON TARGETS</p> <p>2) PROBE PLACEMENT REPEATABILITY</p>	CEC (75250)	GFV	4-17-96
<p><u>TEST APPROVED - NO EXCEPTIONS:</u></p> <p>Responsible Engineer _____ Date _____</p> <p>Quality Assurance _____ Date _____</p> <p>Test Witness _____ Date _____</p>			<p><u>TEST APPROVED - WITH EXCEPTIONS:</u></p> <p>GLA <i>with</i> 4/15/96</p> <p>Responsible Engineer _____ Date _____</p> <p>M. E. McCalla 4/29/96</p> <p>Quality Assurance _____ Date _____</p> <p>Denise Brown 4/15/96</p> <p>Test Witness _____ Date _____</p>		

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

EXCEPTION TO SMMS ACCEPTANCE TEST

Title of Test: Surface Moisture Measurement System Test (#5)

EXCEPTIONS			CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	ORGANIZATION	INITIALS	DATE
C.3.9.4	3/15/96	OPEN CIRCUIT VOLTAGE READINGS DRIFTED ON THE INITIAL VALUE WAS RECORDED. THIS EXCEPTION WAS ACCEPTED AS-IS. SEE FOLLOWING WRITEUP FROM J. H. RUSSELL.	CED	G.FU	4/24/96
<p><u>TEST APPROVED - NO EXCEPTIONS:</u></p> <p>Responsible Engineer _____ Date _____</p> <p>Quality Assurance _____ Date _____</p> <p>Test Witness _____ Date _____</p>			<p><u>*TEST APPROVED - WITH EXCEPTIONS:</u></p> <p><u>M. Russell</u> 4/15/96 Responsible Engineer Date</p> <p><u>M. L. McEwen</u> 4/24/96 Quality Assurance Date</p> <p><u>GL A. Litt</u> 4/15/96 Test Witness Date</p>		

TEST CONTROL COPY

Exception for Floating Values on Intrinsic Safety Barrier for Inclinometer (#5)

The values measured for the voltage between connections points are acceptable.

D to E
E to F
A to B
B to C

The Elcon Instruments, Inc. model 1072 intrinsic safety barrier is a transformer isolated barrier and the connections on the intrinsically safe side of the barrier are not grounded. Barrier connection points A to C and D to F provide excitation voltage, approximately 0.1 V, to the potentiometer. Barrier connection points B and E measure the output voltage of the potentiometer wiper. This connection point is an input to the amplifier which has an high input impedance. The information provided by the vendor and the instruction manual, indicates there are zener clamping diodes between connection points A to B, B to C, D to E, and E to F. When measurements were made between the points listed in the above paragraph, the voltage slowly continued to increase. The values measured were from 9 mV to 88 mV. These values are well within the specified acceptance values of 13.1 V. The measuring instrument has a input impedance of 10^9 ohms. The reason for the increase in voltage can be traced to charging the parasitic capacitance of the zener clamping diodes, the amplifier input capacitance, and the measuring instrument capacitance from the potentiometer excitation voltage.

These barriers have been approved and listed by Factory Mutual, File LR 66259-7, for use in Class I, II, III, Division 1 Group A to G classified locations. This means that this intrinsic safety barrier has met the requirements of Factory Mutual. The testing that we have done above was designed to verify the safety parameters and to verify the connections are correct and not to test the barrier. It is for this reason and the explanation above that this exception is acceptable.

Jim H. Bussell
Jim H. Bussell
4/6/46

ref
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

EXCEPTION TO SMMS ACCEPTANCE TEST

Title of Test: Surface Moisture Measurement System Test #6

EXCEPTIONS			CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	ORGANIZATION	INITIALS	DATE
6.2	3/19/96	RESPONSIBLE EE RECORDED RESISTANCE NEXT TO EACH CONDUCTOR ON THE DWG INSTEAD OF INITIALING + DATING. THE RESP. EE INITIALED + DATED EACH SHEET AS IT WAS COMPLETED. DISCREPANCIES WERE NOTED (MAY WILL BE TRACKED) ON THE TEST CONTROL COPIES OF THE DWGS - NOTED BY REDLINING DWGS.	CEC (75280)	GRV	4/7/96
<u>TEST APPROVED - NO EXCEPTIONS:</u> Responsible Engineer _____ Date _____ Quality Assurance _____ Date _____ Test Witness _____ Date _____			<u>* TEST APPROVED - WITH EXCEPTIONS:</u> Responsible Engineer <u>AVBunnell</u> <u>4/15/96</u> Date Quality Assurance <u>M. E. McElroy</u> <u>4/24/96</u> Date Test Witness <u>GLH Pitt</u> <u>4/15/96</u> Date		

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

EXCEPTION TO SHMS ACCEPTANCE TEST

Title of Test: Surface Moisture Measurement System Test # 7

EXCEPTIONS			CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	ORGANIZATION	INITIALS	DATE
7.2.2.7	3/11/96	SEE ALSO EXCEPTION # 2. AFTER DEPLOYMENT DEVICE WAS REMOVED FROM RISER, INSPECTION OF THE ARM CABLE SHOWED THAT THE PLASTIC COATING HAD COMPLETELY WORN OFF. THEREFORE, CABLE WAS REPLACED WITH AN UNCOATED CABLE. THIS SECTION WILL BE RETESTED AFTER NEW ELBOW IS INSTALLED. (SECTION 7.2.2)	CEO (75250)	GFV	4-17-96
<u>TEST APPROVED - NO EXCEPTIONS: (RETEST PERFORMED)</u> <div style="display: flex; justify-content: space-between;"> <div> <u>GLH With</u> Responsible Engineer </div> <div> 4/15/96 Date </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div> <u>M. R. McElroy</u> Quality Assurance </div> <div> 4/29/96 Date </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div> <u>J. L. Bolson</u> Test Witness </div> <div> 4/5/96 Date </div> </div>			<u>TEST APPROVED - WITH EXCEPTIONS:</u> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div> Responsible Engineer </div> <div> Date </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div> Quality Assurance </div> <div> Date </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div> Test Witness </div> <div> Date </div> </div>		

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 7.1.2.4 Sign below to indicate that the equipment has been staged and is ready to be installed.

Test Engineer's signature _____

Date _____

7.2 DEPLOYMENT DEVICE TEST

7.2.1 Install Deployment Device and Camera

- 7.2.1.1 Lift the deployment device from horizontal to vertical and install in the selected mock-up riser in room 500 per the critical lift procedure provided in the work package. Bolt the deployment device bearing plate to the mock-up riser using the bolts provided with the deployment device.
- 7.2.1.2 Install the camera system in the selected adjacent mock-up riser in room 500 per JO-020-141, *In-Tank Video Procedure* (disregard steps related to contamination control and HPT surveys). Set up two video monitors: one next to the camera controls, and one next to the deployment device winch enclosure.
- 7.2.1.3 Connect the cables between the camera, camera controls, and video monitors and supply power to the camera system.

NOTE: Power to all components will be disabled at the end of testing each day. The cables should be reinspected at the beginning of each day to verify that they are connected correctly before resupplying power to the components.

Test Engineer's signature _____

Date _____

(TEST EXCEPTION #7)

7.2.2 Deployment Device Arm Operability and Reliability Test *RETEST*

This section will demonstrate that sustained, repeated execution of the deployment sequence (raising and lowering the arm) does not have adverse effects on the mechanical operability and reliability of the deployment device.

- 7.2.2.1 Repeat steps 7.2.2.2 through 7.2.2.6 a minimum of 50 times as directed by the responsible ME. Using the camera, zoom in on the deployment device as directed by the responsible ME and observe whether the following conditions are met.
1. The rotational motion is smooth.
 2. The arm winch mechanism does not jam.
 3. No binding or pinching of the cables occurs.
 4. The mechanical parts are not damaged or galled and the cables do not show excessive wear.
 5. The probe seats reliably in the arm's probe socket.
 6. The arm and probe cables seat reliably in the mast's channel shaped cut-out when the arm is returned to the vertical position.

WHC-SD-WM-ATP-153 Rev. 0

* RETEST *

TEST CONTROL COPY

7. The arm and probe do not exhibit a significant amount of oscillation or "bouncing" during deployment.
8. The bell crank retracts reliably without interfering with or damaging the probe cable.

7.2.2.2 Lower the probe approximately 15 cm (6 in.) by rotating the probe winch counterclockwise. The probe needs to clear the arm's probe socket before the arm can be lifted.

7.2.2.3 Confirm that the clearance between the probe and the arm can be verified with the camera.

Accept/Reject (circle one)

Responsible ME's signature N/A Date _____

7.2.2.4 Raise the arm to the horizontal position by rotating the arm winch clockwise.

7.2.2.5 Lower the arm to the vertical position by rotating the arm winch counterclockwise.

7.2.2.6 Raise the probe by rotating the probe winch clockwise until it is secured in the arm's probe socket.

7.2.2.7 After the deployment device is removed from the mock-up riser (after section 7.3 is performed) and placed in the horizontal position, perform a thorough inspection of the deployment device. In particular, inspect the cables, connectors, and winches to verify that they are not damaged and do not show excessive wear. Indicate acceptance below.

ACCEPTANCE CRITERIA: items 1 through 8 of 7.2.2.1 (EXCEPTION #7)

Accept/Reject (circle one)

Responsible ME's signature GLA Date 4/10/96

7.2.3 Probe Cable Wear Test

This section will demonstrate that raising and lowering the probe does not have adverse effects on the probe cable or cause excessive wear.

7.2.3.1 Using the dial calipers, measure the diameter of a new 3 m (10 ft) section of probe cable in 20 locations, approximately 15 cm (6 in.) apart. Record diameters in Table 7-2. Calculate the average diameter and the standard deviation below.

Average new cable diameter: _____

Standard deviation of average new cable diameter: _____

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

EXCEPTION TO SNMS ACCEPTANCE TEST

Title of Test: Surface Moisture Measurement System Test (#8)

EXCEPTIONS			CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	ORGANIZATION	INITIALS	DATE
6.3.5, 6.3.6, 6.3.7, 6.3.8, 6.2	3/27/96	DEVELOPMENT OF THE LOW SYSTEM WAS DELAYED INDEFINITELY. ALL TESTS RELATED TO LOW HARDWARE WERE THEREFORE CANCELLED.	CEO(75250)	GFV	4-17-96

<u>TEST APPROVED - NO EXCEPTIONS:</u> Responsible Engineer _____ Date _____ Quality Assurance _____ Date _____ Test Witness _____ Date _____		<u>*TEST APPROVED - WITH EXCEPTIONS:</u> GL L <i>lit</i> 4/15/96 Responsible Engineer _____ Date _____ M. L. McEgan 4/29/96 Quality Assurance _____ Date _____ <i>Henrich</i> 4/17/96 Test Witness _____ Date _____	
---	--	---	--

WHC-SD-WM-ATR-153 Rev. 0

TEST CONTROL COPY

EXCEPTION TO SMMS ACCEPTANCE TEST

Title of Test: Surface Moisture Measurement System Test

9

EXCEPTIONS			CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	ORGANIZATION	INITIALS	DATE
6.6.2	4/1/96	<p>PROBE SHOCK TEST. TO LIMIT EXPOSURE AND PREVENT WEARING IN HIGH RADIATION AREA - A SMALLER SOURCE WAS USED INSTEAD OF THE ACTUAL SOURCE. THE SMALLER SOURCE WAS PLACED IN THE BOTTOM OF EACH CAL. FIXTURE. THE COUNT RATE WAS ALSO INCREASED FROM 2 → 3 MINUTES.</p> <p>CONTINUED BELOW.</p>	CEO (75250)	GFV	4-17-96

<u>TEST APPROVED - NO EXCEPTIONS:</u>		<u>TEST APPROVED - WITH EXCEPTIONS:</u>	
Responsible Engineer	Date	Responsible Engineer	4/15/96 Date
Quality Assurance	Date	Quality Assurance	4/29/96 Date
Test Witness	Date	Test Witness	4/15/96 Date

→ AFTER PROBE INTERNALS WERE INSPECTED, SOME SLIGHT DAMAGE WAS IDENTIFIED. THE TUBE HOLDER FOR DETECTOR #3 WAS SLIGHTLY OUT OF PLUMB AND THE ANODE WIRE FOR DETECTOR #1 WAS BENT UPWARDS. THIS EXCEPTION WAS ACCEPTED ON THE CONTINGENCY THAT THE WELD ^{SIZE} FOR THE DETECTOR #3 TUBE HOLDER WILL BE INCREASED (PROTOTYPE HAS JUST A SMALL TACK WELD) AND A PROTECTIVE BLOCK WILL BE INSTALLED AROUND THE ANODE OF DETECTOR #1.

B-2

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

EXCEPTION TO SMMS ACCEPTANCE TEST

H 10

Title of Test: Surface Moisture Measurement System Test

EXCEPTIONS			CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	ORGANIZATION	INITIALS	DATE
6.5.6	4/5/96	<p>DEVICE DID NOT FIT INSIDE CONTAINER 4" BOLT PATTERN ON DEVICE MOUNTING FLANGE DID NOT MATE UP WITH 6" FLANGE ON CONTAINER. AN ADAPTER MAY BE REQUIRED.</p> <p>EXCEPTION ALLEGED BASED ON CONTINGENCY THAT FLANGES ARE MODIFIED TO MATE UP.</p>	CEO (75250)	BFV	4-17-96
<p><u>TEST APPROVED - NO EXCEPTIONS:</u></p> <p><u>GL. A. Pitt</u> 4/15/96 Responsible Engineer Date</p> <p><u>M. L. McElroy</u> 4/29/96 Quality Assurance Date</p> <p><u>Clayton Jones</u> 4/17/96 Test Witness Date</p>			<p><u>TEST APPROVED - WITH EXCEPTIONS:</u></p> <p>Responsible Engineer Date</p> <p>Quality Assurance Date</p> <p>Test Witness Date</p>		

ref.
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

EXCEPTION TO SMMS ACCEPTANCE TEST # 11

Title of Test: Surface Moisture Measurement System Test

EXCEPTIONS			CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	ORGANIZATION	INITIALS	DATE
6.6.3	4/1/96	SLIGHT DAMAGE TO THE SOURCE HOLDER (TURNING CAUSING) SLIGHTLY AND THREADED ROD ON HANDLING TOOL WAS SLIGHTLY BENT. A PRECAUTION / WARNING SHOULD BE ADDED TO THE PROCEDURE TO MAKE SURE THE TOOL AND SOURCE ARE HANDLED CAREFULLY.	CSO (75250)	GFV	9-17-96
<u>TEST APPROVED - NO EXCEPTIONS:</u> * Responsible Engineer 4/15/96 Date			<u>TEST APPROVED - WITH EXCEPTIONS:</u> Responsible Engineer Date
Quality Assurance 4/29/96 Date			Quality Assurance Date
Test Witness 4/17/96 Date			Test Witness Date		

* EXCEPTION ACCEPTED BASED ON THE CONTINGENCY THAT APPROPRIATE WARNINGS ARE ADDED TO THE OPERATING PROCEDURE TO HANDLE THE NEUTRON SOURCE WITH CARE TO PREVENT DAMAGE TO SOURCE HOLDER OR TOOL.

ref -
WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

EXCEPTION TO SMMS ACCEPTANCE TEST

#12

Title of Test: Surface Moisture Measurement System Test

EXCEPTIONS			CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	ORGANIZATION	INITIALS	DATE
6.5.1	4/10/96	PRABE WEIGHT IS 16 LBS BUT MUST BE INCREASED TO PREVENT THE CABLE ON THE PRABE WIPER FROM RAT-NESTING THEREFORE, WEIGHT WILL BE ADDED TO THE TOP OF THE PRABE TO BRING IT TO A 25 LBS ALSO, INITIAL LIMIT WEIGHT EXCEEDED CRITERIA OF 50 LBS. — CONTINUED	CEO (75250)	GFV	4-17-96
TEST APPROVED - NO EXCEPTIONS:			TEST APPROVED - WITH EXCEPTIONS:		
Responsible Engineer		Date	GLA <i>lit</i>		4/15/96
Quality Assurance		Date	M. L. McElroy		4/29/96
Test Witness		Date	Dennis <i>Shaw</i>		4/17/96

THE INTENT OF THE CRITERIA WAS THAT EACH PIECE WEIGHS LESS THAN 50 LB SO THAT THE CRACIA PIECE CAN BE LIFTED BY ONE PERSON. SINCE EACH PIECE OF THE TALL IMPACT LIMITER WEIGHED 35 LBS (70 LBS TOTAL), THIS WEIGHT IS ACCEPTABLE.

ref-
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

EXCEPTION TO SMMS ACCEPTANCE TEST #13

Title of Test: Surface Moisture Measurement System Test

EXCEPTIONS			CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	ORGANIZATION	INITIALS	DATE
G.S.S	4/10/96	THREE CABLE STICKS ON TOP OF LIFT ARM AND PREVENTS IT FROM RETRACTING INTO THE ARM - SEE OBSERVATION SHEET. THE LIFT ARM SURFACES WERE RADIOUSED TO ALLOW THE PARGE CABLE TO SLIP OFF. A STOP WAS ADDED TO HOLD THE LIFT ARM FROM RAISING PAST 60° A SUCCESSFUL RETEST WAS PERFORMED.	LESO (75250)	GFV	4-17-96
<p><u>TEST APPROVED - NO EXCEPTIONS: (RETEST PERFORMED)</u></p> <p><u>GL A With</u> 4/15/96 Responsible Engineer Date</p> <p><u>M. L. McElroy</u> 4/29/96 Quality Assurance Date</p> <p><u>J. J. Bolson</u> 4/15/96 Test Witness Date</p>			<p><u>TEST APPROVED - WITH EXCEPTIONS:</u></p> <p>Responsible Engineer _____ Date _____</p> <p>Quality Assurance _____ Date _____</p> <p>Test Witness _____ Date _____</p>		

WMC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

- 6.5.4.2 Verify that the arm is in the vertical position (aligned with the mast). Raise the bell crank out of the arm by turning the arm winch handle clockwise.
- 6.5.4.3 Lower the probe (or mock-up probe) to the floor by turning the probe winch handle counterclockwise. Continue to turn the probe winch handle counterclockwise to pay out several inches of slack cable. Note any interference between the probe cable and bell crank on Observation/Results sheets (Appendix A).
- 6.5.4.4 Retract the bell crank by turning the arm winch handle counterclockwise. Closely observe whether the bell crank retracts reliably without becoming tangled with or damaging the probe cable.
- 6.5.4.5 Raise the probe by turning the probe winch handle clockwise and verify that it seats reliably in the arm socket.
- 6.5.4.6 Repeat steps 6.5.4.2 through 6.5.4.5 a minimum of 20 times as directed by the responsible ME to verify that the bell crank retracts reliably each time. Indicate acceptance below.

ACCEPTANCE CRITERIA: no damage to probe cable
no interference between bell crank and probe cable

Accept/Reject (circle one)

Responsible ME's signature _____

Date _____

(EXCEPTION # 13)

6.5.5 Operational Test with Reduced Arm Length

* RETEST *

The arm on the deployment device has extensions that can be removed to shorten the arm length. A reduced arm length will allow the deployment device to be installed in tanks with limited headspace, because the overall length of the device is reduced. This test will verify that the deployment device functions satisfactorily with the extensions removed from the arm.

- 6.5.5.1 Remove the extensions from the arm by removing the screws at the extension joints and reattaching the end piece per the responsible ME's direction.
- 6.5.5.2 With the deployment device suspended from the crane in the 306E penthouse and personnel positioned on the lower catwalk of the penthouse, lower the probe approximately 6 inches to allow raising the arm.
- 6.5.5.3 Raise and lower the arm several times as directed by the responsible ME. Verify that the motion is smooth and that the shortened arm functions satisfactorily. Indicate acceptance below.

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

* RETEST *

ACCEPTANCE CRITERIA: rotational motion is smooth
no binding, pinching, or jamming
no damage or excessive wear

Accept/Reject (circle one)

Responsible ME's signature

GLA [Signature]

Date 4/12/96

6.5.6 Deployment Device Insertion into Shipping Container

The deployment device will be contaminated after the first in-tank deployment. It will therefore be shipped from tank farm to tank farm in an approved shipping container. This test will verify that the deployment device can be inserted into the shipping container when bagged with plastic sleeving as it would be after being removed from a waste tank.

- 6.5.6.1 Wrap the deployment device with the plastic sleeving material in accordance with the responsible ME's and Operations representative's direction.
- 6.5.6.2 Using two cranes, lift the deployment device in the horizontal position and carefully insert it into the shipping container in accordance with the responsible ME's direction.
- 6.5.6.3 Observe the plastic sleeving as the device is inserted to verify that the sleeving does not tear. Record comments on the Observation/Results sheets (Appendix A). Indicate acceptance below.

ACCEPTANCE CRITERIA: device fits inside container
no tearing of plastic sleeving

Accept/Reject (circle one)

Responsible ME's signature

Date

Ops representative's signature

Date

6.5.7 Winch Enclosure Box Leak Test

The SMMS deployment device winch enclosure box is open to the tank environment through the mast section. Therefore, this box must be leak tested to verify that it is sufficiently leak tight and will provide adequate containment. This leak test will also verify that the assembly is sufficiently weatherproof. Excessive leaks, as determined by the responsible ME, shall be repaired and the assembly shall be retested.

- 6.5.7.1 Isolate the winch box assembly by disconnecting the mast at the extension joint nearest the winch box. Place and seal a plug to the mast opening. The plug must have pass throughs for the cables.

WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

EXCEPTION TO SMMS ACCEPTANCE TEST #14

Title of Test: Surface Moisture Measurement System Test

EXCEPTIONS			CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	ORGANIZATION	INITIALS	DATE
6.3-10.3	4/12/96	RESISTANCE FOR NEUTRON PACE CASE (SEMI-CONDUCTIVE) A FULL LENGTH WAS A CML, WHICH EXCEEDED THE ACCEPTANCE CRITERIA OF 1 ML. THIS EXCEPTION WAS ACCEPTED AS-IS. SEE FOLLOWING WRITEUP FROM J. H. BUSSELL.	CEI (75250)	GFV	4/26/96

TEST APPROVED - NO EXCEPTIONS:		TEST APPROVED - WITH EXCEPTIONS:	
Responsible Engineer	Date	<u>J. H. Bussell</u>	4/15/96
Quality Assurance	Date	<u>M. L. McElroy</u>	4/24/96
<u>G. L. A. [Signature]</u> 4/15/96	<u>4/15/96</u>	<u>G. L. A. [Signature]</u>	4/15/96
Test Witness	Date	Test Witness	Date

TEST CONTROL COPY

Exception for higher than normal resistance of semiconductive cable jacket (#14)

The resistance value measured for the cable jacket to the enclosure is acceptable.

The measured value of 6 Megohms was measured with about 25 to 30 feet of cable extended beyond the cable shoe in the arm. The measurement was made by wrapping a stranded 10 AWG wire around the 0.4-inch diameter cable. This type of measurement crudely measures the surface resistance of the cable jacket. The surface resistance of the cable jacket is 10^5 to 10^6 ohms/square. The surface resistance can be calculated from the measured resistance by using the following formula found in standard ASTM D257:

$$\rho_v = \left(\frac{P}{g}\right) \cdot R$$

where P = perimeter of the electrode, circumference of cable (in inches)
 g = gap between electrodes (in inches)
 R = Resistance measured between electrodes

The surface resistance calculated is about 2×10^6 ohms/square. While this value is slightly higher than the factory value, 10^5 to 10^6 ohms/square, it is still acceptable in that resistance measures of this type are usually made with better designed electrodes and with applied voltages of 500 VDC instead of 1 to 2 V. The purpose of this measurement was to insure that the resistance is low enough to discharge static charge in a reasonable length of time (0.5 to 1 second for a change from 100% to 10% of initial value). The resistance value measured will satisfactorily discharge 16×10^{-9} farads of capacitance in 0.5 seconds. The estimated capacitance of the cable jacket to ground is in order of magnitude of 10^{-9} farads. This estimate is based on the 0.4-inch diameter cable in a 4-inch diameter riser using the standard formula for a coaxial capacitor. The capacitance of the cable is less than this value when it is suspended in the tank. NFPA 77 asserts that a value of 1 Megohm and possibly higher resistance is satisfactory to discharge static electricity. (See section 1-8.3 in NFPA 77 1993.)

Jim H. Bussell
 Jim H. Bussell

4/16/96

ref
WHC-SD-WM-ATP-153 Rev. 0

TEST CONTROL COPY

APPENDIX C

PREJOB SAFETY MEETING FORM
AND ATTENDANCE ROSTER

WHC-SD-WM-ATR-153 Rev. 0

TEST CONTROL COPY

PREJOB SAFETY MEETING FORM
AND ATTENDANCE ROSTER

PRE-JOB SAFETY MEETING FORM		Page 1 of 2
Job Description/Title Surface Moisture Measurement System Acceptance Test		Date 2/5/96
Work Package No.: WHC-SD-WM-ATR-153	Person in Charge (PIC): GLENN A. KITTER	
First Aid Qualified Person: GLENN A. KITTER, BUILDING 47045 (FIRE DEPARTMENT)		
Check Items Discussed		
☒ Procedures/Plans to be Used	No.	WHC-SD-WM-ATR-153
☐ Applicable OSHA's	No.	
☐ Radiation Work Permit	No.	
☒ Job Hazard Analysis	No.	
☐ Construction Permit (as needed)	No.	
☐ Additional Permits (i.e., confined space, excavation, etc.)	No.	
☒ Review All Applicable Safety Precautions and Prestart Conditions per Procedures/Plans to be used		
☐ Components Locked and Tagged		
☒ ALARA Considerations (applicable MSDS's)		
☐ Respiratory Protection (fresh air, PAPR's, chemical filters, etc.)		
☐ Radioactive Contamination Containment Device		
☒ Emergency Response and Actions		
☒ Summary of Job Sequence (or steps)		
☐ Work Area Conditions (high/low temperatures, lighting, etc.)		
☒ All Equipment Functionally Checked and at Work Site		
Special Circumstances or COMMENTS:		
Chairman Signature:		
Operations	SEE SIGN-OFF SHEET IN WORK PACKAGE	
Maintenance		
Other		

PREJOB SAFETY PLANNING/JOB HAZARD ANALYSIS SIGNOFF
TEST CONTROL COPY

Job Description WORK IN/UNDER 44-96 9/6 F061
 Job Location _____

Date	Name (Print)	Signature	Supervisor	Org. Code
1-30-96	Mike Yencopad	Mike Yencopad		
1-30-96	W.E. Boling	W.E. Boling		
1-30-96	M. O'Leary	M. O'Leary		
4/30/96	C. R. Rina	C. R. Rina		
1-30-96	GEO. DIXON	GEO. DIXON		
1-30-96	MARTIN FOSS	MARTIN FOSS		
1-30-96	Jim Gilman	Jim Gilman		
11/31/96	R.E. Schuller	R.E. Schuller		
2/5/96	D.B. GRAVES	D.B. GRAVES		
2/5/96	FZ BOLSON	FZ BOLSON		
2/5/96	G.W. Lankford	G.W. Lankford		
2/5/96	H.T. Vargo JR	H.T. Vargo JR		
2/5/96	JM BATES	JM BATES		D9T42
2/5/96	JH BRUSH	JH BRUSH		74430
2/5/96	M.E. Dahl	M.E. Dahl		
2/5/96	K.L. BENNETT	K.L. BENNETT		84800
2/5/96	Michael Gimera	Michael Gimera		
2/5/96	Ron Smith	Ron Smith		19200
2/6/96	Michael Gimera	Michael Gimera		
3/6/96	Michael McElroy	Michael McElroy		3E200
3/6/96	JASON B. GUNTER	JASON B. GUNTER		

54-3000-702 (03/93)

TEST CONTROL COPY

SMMS ACCEPTANCE TESTING PRE-JOB HANDOUT

CONDUCT OF OPERATIONS AT FMEF - Ron Smith (FMEF facility rep)

- Check out JCS work package at Work Control Center before beginning work each day
- Turn in JCS work package to Work Control Center at the end of testing each day

SAFETY PRECAUTIONS SPECIFIC TO TESTING AT FMEF

PERSON-IN-CHARGE: Glenn Ritter (376-4669, 85-3488) must be notified prior to performing testing

- Supply power off when connecting/disconnecting cables. Make sure camera system components are turned off before turning on power strip
- Hoisting & Rigging: only qualified personnel authorized to operate the FMEF overhead cranes--HARD HATS REQUIRED when crane is in use
- Keep area clean as possible--be aware of trip hazards
- Coordination with LDUA testing: no work shall be performed below an adjacent riser if LDUA personnel are installing/removing equipment--HARD HATS REQUIRED in exclusion area below risers in room 351.

FMEF TEST OUTLINE

- 1) Deployment device reliability test and cable wear test
- 2) Probe placement test
- 3) Software ATP
- 4) Operations training

FIRST AID: Fire Department, building 4704S, or HEHF
Report all first aid cases to FMEF Operations Management
(Dan Danko, 376-4080, or Jim Steffan, 376-0484)

EMERGENCY: US West telephone: dial 911
PAX phone: 197

TEST CONTROL COPY HANFORD JOB HAZARD ANALYSIS CHECKLIST

Page 1 of 1

Prepared By GUY A. RITER

Date 2/5/96

Area 400

Bldg. 427

a/Description:

TESTING OF SAMS AT FMEF

☒ New☐ Revised

Emergency Contact Person(s):

Primary: PAX 110 - WORK CONTROL CENTER (ANNE JOHNSON)

Secondary: PAX 102 - FMEF OPERATIONS MANAGEMENT (DAN HANCO, JIM STEPHAN)

Emergency Radio/Phone Number: US WEST TELEPHONE 911 PAX: 197

JHA Number (not required):

NA

Specific Work Location(s): Room 500, Room 351

KNOWN OR POTENTIAL HAZARDS

	Yes	No	/	•	Reference		Yes	No	/	•	Reference
1. Radiation Area Work		☒	☒	☒		10. Respiratory Hazards		☒	☒	☒	
2. Hazardous Waste Operations		☒	☒	☒		11. Electrical Hazards		☒	☒	☒	
3. Confined Space Entry		☒	☒	☒		12. Lock and Tag		☒	☒	☒	
4. Cutting/Welding		☒	☒	☒		13. Scaffolding		☒	☒	☒	
5. Roof Work		☒	☒	☒		14. Aerial Lifts		☒	☒	☒	
6. Fall Hazards (> = 10')		☒	☒	☒		15. Asbestos Removal		☒	☒	☒	
7. Excavation/Trenching		☒	☒	☒		16. Other (see JHA Sht. 2):		☒	☒	☒	
8. Asbestos Inspection Report		☒	☒	☒		/ = Formal training required.					
9. Hazardous Materials		☒	☒	☒		• = Items that require a permit/form/report.					

Other Hazards	Yes	No	Control Measures
1. Temperature Extremes		☒	
2. Noise		☒	
3. Poor Lighting		☒	
4. Animals/Insects		☒	
5. Process Chemicals/Steam		☒	
6. Dust		☒	
7. Flammable/Combustible Materials		☒	
8. Ladders	☒		Full Protection Required When Working Above 6 ft. See WHC-CM-110
9. Wet/Slippery Floors		☒	
10. Uneven Terrain		☒	
11. Open Excavations/Trenches		☒	
12. Adjacent Water Hazard		☒	
13. Vehicle Traffic		☒	
14. Heavy Equipment		☒	
15. Rigging Operation	☒		Any Time Crane is Operating - Hard Hats Required
16. Manual Lifting	☒		Use Proper Lifting Techniques
17. Power Tools		☒	
18. Pinch Points		☒	HHS
19. Falling Objects	☒		HHS Required Below in Room 351
20. Sharp Objects		☒	
21. Overhead Obstructions		☒	
22. Site Control (Signs/Barricades)	☒		Room 351 Lock off - Authorized Personnel Only
23. Remote Work Area		☒	
24. Other (see JHA Sht. 2):		☒	

MINIMUM DRESS REQUIREMENTS: ~~WHS~~ NONE

APPROVALS

uses further evaluation of the job steps, associated hazards, or safety measures need to be performed?

☐ Yes☒ No

If Yes, continue job hazard analysis on the following pages.

Supervisor, Person in Charge

(Signature)

Industrial Safety/Hygiene

(Signature)

Francis M. Amundson

2-5-96

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	G. A. Ritter	Date 5/8/96
Project Title/Work Order		EDT No. 604984
Surface Moisture Measurement System Hardware Acceptance Test Report		ECN No. NA

Name	MSIN	Text With All Attach.	Text Only	Attach./Appendix Only	EDT/ECN Only
J. M. Bates	K7-15	X			
J. H. Bussell	L6-38	X			
R. D. Crowe	H0-32	X			
G. T. Dukelow	S7-15	X			
M. Gimera	L6-37	X			
D. B. Graves	L6-37	X			
C. E. Hanson	H5-09	X			
L. S. Krogsrud	R3-08	X			
M. L. McElroy	S1-07	X			
D. P. Niebuhr	S7-03	X			
G. A. Ritter	H0-32	X			
J. S. Schofield	S7-12	X			
T. I. Stokes	L6-37	X			
G. F. Vargo Jr.	H5-09	X			
A. E. Waltar	H0-32	X			
W. T. Watson	H0-32	X			
Project Files	H5-09	X			
Central Files (orig + 2)	A3-88	X			