1996 Sta. 37 20

ENGINEERING DATA TRANSMITTAL

1. EDT 140824

2. To: (Receiving Organization) Distribution	3. From: (Originating Organization) Characterization Equip. Deve'l	4. Related EDT No.: 607410
5. Proj./Prog./Dept./Div.: N4H4A	6. Design Authority/ Design Agent/Cog. Engr.: GN Boechler	7. Purchase Order No.: 357153
8. Originator Remarks: ~~EDT~~ PP-94-0027 ETN For review and approval		9. Equip./Component No.: NA
		10. System/Bldg./Facility: NA
11. Receiver Remarks: 11A. Design Baseline Document? [] Yes [X] No		12. Major Assm. Dwg. No.: NA
		13. Permit/Permit Application No.: NA
		14. Required Response Date: 8-23-96

15. DATA TRANSMITTED

(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-ATR-151	ALL	0	Cone Penetrometer Acceptance Test Report	Q	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 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION
(See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name (K) Signature (L) Date (M) MSIN	(G) Reason	(H) Disp.	(J) Name (K) Signature (L) Date (M) MSIN
1	1	Design Authority: RJ Blanchard [signature] 9/4/96 S7-12	3		C Linschooten S7-12
1	1	Design Agent: GN Boechler [signature] 8/21/96 H5-09	3		Rosa Seda H5-09
1	1	Cog.Eng.: GN Boechler [signature] 8/21/96 H5-09	3		GA Barnes H5-09
1	1	Cog. Mgr. CE Hanson [signature] 8/21/96 H5-09			
1	1	QA: ML McElroy M. L. McElroy 9/11/96 S7-07	3		Central Files A3-88
		Safety			
		Env.			

18.	19.	20.	21. DOE APPROVAL (if required)
GN Boechler [signature] 8/21/96 Signature of EDT Originator Date	CE Hanson [signature] 8/21/96 Authorized Representative Date for Receiving Organization	CE Hanson [signature] 8/21/96 Design Authority/ Cognizant Manager Date	Ctrl. No. [] Approved [] Approved w/comments [] Disapproved w/comments

BD-7400-172R (05/96) GEF097 (Instructions)

Cone Penetrometer Acceptance Test Report

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

EDT/ECN: 140824 UC: 2070
Org Code: 75250 Charge Code: N4H4A
B&R Code: EW3120074 Total Pages: 102

Key Words: Cone Penetrometer, Acceptance Test Report (ATR)

Abstract: This Acceptance Test Report (ATR) documents the results of acceptance test procedure WHC-SD-WM-ATP-151. Included in this report is a summary of the tests, the results and issues, the signature and sign-off ATP pages, and a summarized table of the specification vs. ATP section that satisfied the specification.

SEP 19 1996
DATE:
STA: 37
HANFORD RELEASE
ID: 20

Janis D. Bishop 9-19-96
Release Approval Date

Release Stamp

Approved for Public Release

CONE PENETROMETER ACCEPTANCE TEST REPORT

AUGUST 1996

CONTENTS

CONE PENETROMETER ACCEPTANCE TEST REPORT

1.0 INTRODUCTION

The cone penetrometer platform (CPP) was designed by WHC and Applied Research Associates (ARA). The design was governed by WHC specification WHC-S-0241 Rev.2. The fabrication of the CPP was performed by ARA at their Vermont facility.

The CPP is designed to measure the physical and chemical properties In-Situ. The CPP is designed to be used both in and out of tank applications. In the Acceptance Testing, the CPP was operated to verify that it could satisfactorily accomplish these applications. More specifically the CPP was tested to verify that all the requirements of WHC-S-0241 Rev.2 were met. When the CPP arrives on site, further testing via a Operational Test Procedure (OTP) will be performed. This testing will verify the CPP is fully operational for field usage.

2.0 EQUIPMENT DESCRIPTION

The equipment tested was as follows:

Moisture Probe- Designed and built by Scientific Applications International Corporation (SAIC). The equipment includes a lab view[1] based software program, a deployment system, a neutron source and the neutron sensing probe. It will be used to measure the moisture at the surface as well as taking full moisture and temperature profiles of the tank waste. The original acceptance testing (WHC-SD-WM-ATP-145) of this equipment was performed at the SAIC facility and determined the equipment worked as specified in the Functional Design Criteria (WHC-SD-WM-FDC-047). The testing of this equipment for this ATP included the integration of the moisture probe software into the CPP computer, the integration of the hardware onto the CPP roof structure and the

[1] Lab View is a trademark of National Instruments Corporation.

verification that all the moisture probe operations were compatible with the CPP system.

RAMAN PROBE-The raman probe was designed and fabricated by Lawrence Livermore National Laboratory (LLNL). The equipment includes a computer, diode laser, monochromator, optical fiber bundle and the raman probe. It will be used to determine chemical compositions of the tank waste. The testing of this equipment included verifying the proper interfaces with the CPP were compatible. Further testing of this equipment will occur with it's own ATP when the systems software is more fully developed and installed.

CONE PENETROMETER SKID-The cone penetrometer skid was designed and fabricated by Applied Research Associates (ARA). The equipment included the skid structure, ballast weights, controls, support trailer, rods, guide tubes and the cone penetrometer probe. The skid will be used to store and operate both the moisture probe and the raman probe as well as it's own probe. The cone penetrometer's probe will be used for taking physical measurements of the tank waste.

3.0 TEST DESCRIPTION

The acceptance testing was conducted at ARA in their Vermont facility. The testing was structured as follows:

1) Pre-Operational Checkout.

In these tests the electronics, computer and instrumentation equipment were checked to verify the specified equipment was installed and that all the qualification of the equipment was adequate. All the sensors that required calibration were checked and verified.

2) Operational Tests

This series of tests checked everything from the ability to moving the CPP into place by a crane to running endurance tests on the equipment to verify the equipment would stand up to repeated use. All the functional requirements that will be needed to operate the CPP in a tank were tested individually in a step by step sequence similar to what will occur in the field. Examples of these tests would be skid leveling, XY table adjusting, clamp system operation and decontamination system operation, All the alarms were tested to function properly under accidents. The simulated accidents ranged from applying a heat gun on tip thermocouples and verifying the alarm and shut down modes operated to loading push rod sections to verify the proper software load curves alarmed and shut down the system.

3.0 SUMMARY AND CONCLUSIONS

The testing was conducted during the time period from 5/96 to 8/96. All tests specified in the ATP were performed and signed off. Some minor exceptions and observations were noted in the data sheets. However, none of the exceptions were critical deviations from the procurement specification and were dispositioned as accept-as-is. Thus the vendor fulfilled his obligations and the equipment tested adequate per WHC-SD-WM-ATP-151. Future testing will be conduced per a Operational Test Procedure with Hanford operators assisting when funds become available.

Reference: WHC-SD-WM-ATP-151
Revision 0

APPENDIX A

ref.

Cone Penetrometer Acceptance Test Procedure

R.Y. Seda
WHC, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

EDT/ECN: 607410 UC: 2070
Org Code: 75250 Charge Code: N4H4A
B&R Code: EW3120074 Total Pages: 84

Key Words: Acceptance Test Procedure, Cone Penetrometer

Abstract: This document outlines the tests which will performed on the cone penetrometer to verify it conforms to the functions outlined in WHC-S-0241.

MAR 26 1996
DATE:
STA: 21
HANFORD RELEASE
ID:

Janis Bishop 3-28-96

Release Approval Date

Release Stamp

Approved for Public Release

CONE PENETROMETER
ACCEPTANCE TEST PROCEDURE

March 1995

CONTENTS

Appendixes

1.0 INTRODUCTION

1.1 PURPOSE

This procedure shall be used for acceptance testing of the cone penetrometer instrument. The cone penetrometer system includes all the necessary hardware to operate the system. The hardware includes the skid, the probe, the hydraulic system, the data acquisition system, I/O interfaces and support trailer.

The acceptance test procedure (ATP) will demonstrate overall system function, including the software of the system. This ATP details the procedures used to verify that the cone penetrometer system adequately meets all the requirements in the performance specification, WHC-S-0241. Section 1.3 outlines the method in which the requirements, pertinent to the acceptance test procedure, in WHC-S-0241 are met.

1.2 SCOPE

Completion of this test will verify that the mechanical and electrical features of the CP instrument are operating as designed. The scope of the acceptance test is as follows:

* Basic equipment functions and mechanical interfaces will be verified.

* Performance of electronic components will be demonstrated.

* The deployment system will be demonstrated.

* The probe detectors will be demonstrated.

* The software will be demonstrated.

1.3 REQUIREMENTS

The following table details the cone penetrometer requirements specified in WHC-S-0241, the methodology used to meet these requirements and the ATP paragraph which details the test or visual inspection. The methods used were V (visual inspection), A (analysis) or T (testing).

2.0 APPLICABLE/REQUIRED DOCUMENTS

ARA document

- ARA/Vertex Drawing H053-1A "Platform Top ASM"
- ARA/Vertex Drawing H059-3A, "Schematic, Electrical"
- Design Package #001,"Guide Tube and Push Rod Calculations"
- Design Package #008,"Information for Seismic Design"
- Design Package #011,"CPT Data Acquisition Software Design Document"
- Design Package #012,"Ballast Design"
- Design Package #016,"Roof Design"
- Design Package #017,"Pick-up Cradle for Lifting the Skid"

WHC Document

- WHC-S-0241, "Specification for Enhanced Cone Penetrometer System"
- WHC-SD-WM-FDC-047, "Functional Design Criteria Cone Penetrometer Moisture Sensor"
- WHC-SD-WM-ATR-146 Rev 0, "Cone Penetrometer Moisture Probe Acceptance Test Report"
- WHC-SD-WM-DA-201, "National Standards and Code Compliance for Electrical Equipment and Instrument Installed in Hazardous Locations for the Cone Penetrometer"
- ETS-W-96-849,"Cone Penetrometer Skid Seismic Analysis"
- WHC-SD-WM-DA-212, "Structural Analysis of Hanford Waste Storage Tanks Under Loads Imposed by Cone Penetrometer Waste Characterization Device"

3.0 TEST CONTROLS

3.1 RESPONSIBILITIES

3.1.1 Project Engineer

Geoff Barnes
Nick Boechler
Rosa Seda
[Alternate: C.E. Hanson]

* Make redline changes to working ATP as required.

* Overall responsibilities for maintaining and controlling testing.

* Provide liaison with facility used for testing.

* Provide liaison with Quality Assurance (QA) for testing activities as required.

* Approve test procedure and final report.

* Overall testing responsibilities and assignment of responsibilities.

* Review test results and prepare/issue test report.

* Monitor testing for compliance with the test procedures and co-sign the appropriate steps. [Note: On certain steps, the project engineer may run these steps to gain a better understanding of the equipment.]

* Can authorize the test performer to perform Project Engineer responsibilities on a limited basis.

3.1.2 Applied Research Associates (ARA) Test Performer [as approved by the project engineer(s)]

* Perform test in accordance with approved test procedure.

* Maintain a file of documented information pertinent to the tests.

* Assure safe conduct of testing.

3.1.3 Science Application International Corporation (SAIC) Test Performer [as approved by the project engineer(s)]

* Perform test in accordance with approved test procedure.

* Maintain a file of documented information pertinent to the tests.

* Assure safe conduct of testing.

3.1.4 Quality Engineer: M. L. McElroy

* Review and approve the test procedure and test report.

* Ensure that quality requirements are defined and satisfied for the test.

* A vendor provided (ARA) Q.C. inspector shall witness and sign off on the appropriate inspection steps (as required).

3.1.5 Vendor Provided (ARA) Quality Control Inspectors

* Monitor test activities and provide signature verification, as required.

* The QA engineer or project engineer may request QC witness of testing not specifically required in the test procedure.

3.1.6 The ARA and SAIC test performers and project engineers for this test procedure shall be documented in the acceptance test report.

3.2 TEST DATA

3.2.1 All test data, pertinent observations, and off-normal events shall be recorded on the test procedure, section 6.0 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.

3.2.2 Data recorded on the observation/results data sheets shall be formally documented in the ATR.

3.2.3 The data recorded during the test shall be released in the ATR as raw or reduced data.

3.2.4 Calibration data shall be released in the ATR.

3.3 TEST CONFIGURATION

3.3.1 The drawings and engineering documents which establish the process equipment test configuration are listed in Section 2.0.

3.3.2 Additional documents required to perform, document, or validate a test (sketches, calibration sheets, etc.) will be referenced in the ATR.

3.3.3 All test will be performed with WHC provided gloves. Black ball point pens shall be used.

3.3.4 The following test equipment will be provided by WHC:

- Digital RMS multimeter
  - -Min/max voltage display
  - -Instantaneous peak recording
  - -Frequency display
- Flowmeter
- Dynamometer
- Noisemeter
- Riser Adaptor for 4 inch (10.2 cm) and 12 inch (30.5 cm) riser
- 4 inch (10.2 cm) and 12 inch (10.2 cm) simulated riser
- Spray Washer
- Gloves

3.4 PROCEDURE CONTROL

3.4.1 A controlled test procedure package shall be used for testing and shall include the following:

* A single copy of this test procedure.

* Other information directly applicable to testing which are required.

3.5 RETEST AND REDLINE PROCEDURE CONTROL

3.5.1 If retest is required, additional copies of applicable procedure sections or observation/results data sheets of this test procedure may be used or new procedures may be used.

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

3.5.3 Changes to the test procedure are permitted.

The project engineer shall red ink changes with the concurrence of the test performer. Approvals will be documented by the WHC project engineers and test performers initials on the redlined item and noted in the exceptions sheet location in Appendix B, giving the reasons for the change.

3.6 OPEN ITEMS

3.6.1 Items and actions identified during the conduct of testing which require future resolution/completion shall be noted on comment sheets. Identified open items shall subsequently be addressed in the Acceptance Test Report (ATR).

4.0 TEST FACILITY

The acceptance test will be conducted in the ARA's test facility in South Royalton, Vermont.

5.0 SAFETY

* Only the project engineers and test performers personnel shall operate the cone penetrometer during performance of this ATP.

* Test personnel shall be briefed, prior to test performance, on the hazards unique to the cone penetrometer equipment.

* Applied Research Associates (ARA) is responsible for safety during conduction of the acceptance test at their Vermont facility, and identifying the appropriate personnel protective equipment required for testing.

Concurrence: ______________________ 5/7/96
ARA Representative Date

6.0 TEST PROCEDURE

6.1 PREREQUISITES

Perform functional testing as follows. Record additional observations on functional testing observation/results sheets (Appendix A), as required. Successful completion of a given test is documented by project engineer signature on the observation/results data sheet.

6.2 VISUAL EXAMINATIONS AND MEASUREMENTS

6.2.1 Visually inspect that the cone penetrometer system to verify it contains a the cone penetrometer skid and cone penetrometer support trailer.

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5/7/96

6.2.2 Visually inspect the support trailer to verify that the following systems are located on the trailer:

* Decontamination unit
* Hydraulic fluid reservoir and pump. Verify that there is an indicator light for overheating and low fluid.

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5/7/96

6.2.3 Visually inspect the hydraulic ram to verify that the guide tubes/push rod can attain access to a riser. Visually inspect probe tip to verify a blunt faced tip with pore pressure sensor behind the tip design. Verify smooth surface of guide tube and push rod.

Push Rod: 41 @ 39 1/2"

Inner Diameter 1.0 (1.00 inch/2.5 cm)
Outer Diameter 1.75 (1.75 inch/4.4 cm)

Guide Tube: 43 @ 19 3/4

Inner Diameter 2.25 (2.25 inch/5.7 cm)
Outer Diameter 3.5 (3.5 inch/8.9 cm)
Outer Diameter N/A (6.0 inch/15.2 cm)

Cone Penetrometer Sensor Package:

Outer Diameter 2.0 (2.00 inch/5.1 cm)

Completed: ______________ / ______________
ARA Test Performer/Project Engineer

Date: 5/7/96

6.2.4 Visually inspect the data acquisition room is located in an enclosed compartment on the skid. Verify that all computers and electronics are located inside the room, including that the moisture probe electronics and raman spectrometer electronics. Verify a slide door exist and that the hydraulic ram is in full view from this room.

Completed: ______________ / ______________
ARA Test Performer/Project Engineer

Date: 6-17-96

6.2.5 Visually inspect the cone penetrometer computer system contains: operator station, I/O channels, laser printer with graphics package, modem and removable cartridge disk.

I/O Channels OK
Spare I/O Channels OK

Completed: ______________ / ______________
ARA Test Performer/Project Engineer

Date: 5/7/96

6.2.6 Visually inspect the data acquisition room to verify lighting and power receptacles are provided. A minimum of 5 interior receptacles are provided. Receptacles on the interior will be no more than 6 feet (182.9 cm) apart. Two 20 amp receptacles are located on the exterior. Verify that the generator exhaust cannot leak into the occupied space or the HVAC.

Completed: ______________ / ______________
ARA Test Performer/Project Engineer

Date: 5/7/96

6.2.7 Visually inspect the skid to verify the hydraulic and electrical controls are visibly labeled. These include manually operated valves to operate the push rod and guide tube. Verify all gages are in close proximity to the hydraulic controls.

Completed: [signature] / [signature]
ARA Test Performer/Project Engineer

Date: 5/7/96

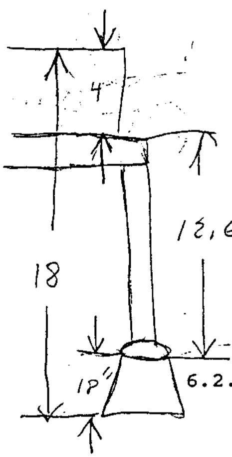
6.2.8 Visually inspect the side to verify hydraulic deployment unit is located outside the data acquisition room. Verify that the push rod and guide tube storage is located and secured on the side of the skid enclosure.

27,800

Completed: [signature] / [signature]
ARA Test Performer/Project Engineer

Date: 5/7/96

6.2.9 Visually inspect that the system meets DOT requirements.



	Skid	Support Trailer
Width	97" 8'1"	8'4"
Height	18' total 12'6" travel	10'
Length	275" 23ft	20'
Weight	33000 lb	≈ 4,000 lb

DOT Requirements:

Width < 108 inch (274.3 cm)
Length < 28 feet (853.4 cm)
Weight < 40 tons (355857.7 N) ← when ship

Completed: ~~ATA~~ [signature] [signature]
ARA Test Performer/Project Engineer

Date: 8/19/96

6.2.10 Visually inspect the skid and support trailer for signs which indicate potential industrial safety risks. Verify that the platform meet OSHA requirements.

Toe guard height 4 (min. 4 inch/10.2 cm)
Railing:

Width of railing 42.5 (42 inch/106.7 cm)
Midsection height 23 (21 inch/53.3 cm)
Diameter 1.0 (1.5 inch/3.8 cm)

29 CFR 1910.23 OK WB
200 lb rail pressure OK

Longitudinal Spacing 2ft (max. 8 feet/2.4 m)

Ladder:

Rung to rung 12 (max. 12 inch/30.5 cm)
Width 16x24 (min. 16 inch/40.6 cm)
Slip material No (Yes)
Rung diameter 1.0 (0.75 inch/1.9 cm)

Analysis for 200 lbs (889.6 N) live load acceptable for ladder and railings Yes (Yes)

Verify signs have been used to indicate potential industrial safety risks at Hanford.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5/7/96

6.2.11 Visually inspect skid and support trailer to verify it meets all applicable NFPA requirements.

Type of fire extinguisher: Yes (ABC)

Intrinsically safe equipment located within 36 inch (91.4 cm) from guide tube Yes (Yes)

Intrinsically safe equipment and wiring marked Yes (Yes)

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6-17-96

6.2.12 Visually inspect skid and support trailer to verify that none of the unacceptable fasteners are used (see Appendix C).

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5/7/96

6.2.13 Verify that non-intrinsically safe components are not within 36 inch (91.4 cm) from the guide tube and are marked.

Completed: Wm Bratton / [signature]
ARA Test Performer/Project Engineer

Date: 5/7/96

6.2.14 Verify decontamination water storage unit holds 100 gallons (378.5 L).

Diameter 31x48 56
Height 21

31 X 48 x 21
Height

Volume = 0.785 * Diameter * Diameter * Height

Volume = ≈ 146 cu ft (100 Gallons/378.5 L)

Completed: Wm Bratton / [signature]
ARA Test Performer/Project Engineer

Date: 5/7/96

6.2.15 Visually inspect inside and outside of skid for usage of exterior paint. Attain assurance from ARA test performer that vendor applied rust inhibiting primer. NASON Etch Primer 491-17

NASON
FUL-THANE
2 K Urethane
4749

Completed: Wm Bratton / [signature]
ARA Test Performer/Project Engineer

Date: 6-17-96

6.3 PRE-OPERATIONAL CHECKOUT

6.3.1 ELECTRONIC AND COMPUTER EQUIPMENT CHECKOUT

Review the following equipment and verify identification. Note any discrepancies in Appendix A.

6.3.1.1 Computer

Manufacturer: Intel 90MHz
Model No. I430FX
Serial No. SM 292205 INTEL

Completed: Wes Bratton
ARA Test Performer

[signature]
Project Engineer

Date: 6-17-96

6.3.1.2 GPIB Interface #1
Manufacturer: HP
Model No. HP E2073-66501
Serial No. 4QX055T

Completed: Wes Bratto
ARA Test Performer

Project Engineer

Date: 4/3/96

6.3.1.3 Signal Conditioner
Manufacturer: HP 75000 Series B
Model No. E1301-A
Serial No. 3B26-A-03684

Completed: Wes Bratto
ARA Test Performer

Project Engineer

Date: 4-3-96

• A/D S/N US3400024
• D/A converter S/N 2934A04429
• Quad 8-Bit input/output S/N 3221A06487

6.3.2 INSTRUMENTATION

6.3.2.1 Tip Thermistor

Potting Material Stycast 1266

Instrument (including all adhesive, bonding materials and other materials used to install instrument on cone penetrometer sensor package) can withstand the following conditions:

Temperature: 60 - 212 °F (15.6 to 100 °C)
Radiation: 0 - 900 Rad/hr
pH: 10 - 14
Flammable

Analysis Acceptable X (Y/N)

Calibration Method: Water Bath ≥ 100 points
NIST Calibration: Y (Y/N)
Calibration Date: 2/15/96

Completed: Wes Bratto
ARA Test Performer

Project Engineer
Date: 5-13-96

6.3.2.2 Side Thermistor

Instrument (including all adhesive, bonding materials and other materials used to install instrument on cone penetrometer sensor package) can withstand the following conditions:

Temperature: 60 - 212 °F (15.6 to 100 °C)
Radiation: 0 - 900 Rad/hr
pH: 10 - 14
Flammable

Potting Material
Stycast 1266

Analysis Acceptable X (Y/N)

Calibration Method: Water bath
NIST Calibration: Y (Y/N)
Calibration Date: 2-15-96

Completed: ____________
ARA Test Performer
____
Project Engineer

Date: 5/13/96

6.3.2.3 Tip Load Cell

Instrument (including all adhesive, bonding materials and other materials used to install instrument on cone penetrometer sensor package) can withstand the following conditions:

Temperature: 60 - 212 °F (15.6 to 100 °C)
Radiation: 0-900 Rad/hr
pH: 10-14
Flammable

Analysis Acceptable Y (Y/N)

Method Calibrated
Load Cell vs Voltage

Calibrated: Y (Y/N)
NIST Calibration: Y (Y/N)
Calibration Date: 4/2/96

Completed: ____________
ARA Test Performer
____
Project Engineer

Epoxy Lite Covering 813-9
M Bond 610 Glue

Date: 5/13/96

6.3.2.4 Side Load Cell

Instrument (including all adhesive, bonding materials and other materials used to install instrument on cone penetrometer sensor package) can withstand the following conditions:

Temperature: 60 - 212 °F (15.6 to 100 °C)
Radiation: 0-900 Rad/hr
pH: 10-14
Flammable

Analysis Acceptable X (Y/N)

Same as Tip. Calibrated Load cell vs Volts out

Calibrated: X (Y/N)
NIST Calibration: X (Y/N)
Calibration Date: 4/2/96

Completed: Wes Britton
ARA Test Performer

Project Engineer

Epoxy Lite-Covering 813-9
M Bond 610 -Glue

Date: 5/13/96

6.3.2.5 Pore Pressure

Instrument (including all adhesive, bonding materials and other materials used to install instrument on cone penetrometer sensor package) can withstand the following conditions:

Temperature: 60 - 212 °F (15.6 to 100 °C)
Radiation: 0-900 Rad/hr
pH: 10-14
Flammable

Analysis Acceptable X (Y/N)

Apply pressure by calibrated pressure gauge vs output voltage

Calibrated: X (Y/N)
NIST Calibration: X (Y/N)
Calibration Date: 3/27/96

Completed: Wes Britton
ARA Test Performer

Project Engineer

Polyethylene Pore Filter material

Date: 5/13/96

6.3.2.6 Inclinometer

Instrument (including all adhesive, bonding materials and other materials used to install instrument on cone penetrometer sensor package) can withstand the following conditions:

Temperature: 60 - 212 °F (15.6 to 100 °C)
Radiation: 0-900 Rad/hr
pH: 10-14
Flammable

Analysis Acceptable X (Y/N)

Physically measure angle vs output volts
0-2 volts
+ - 50 degrees
.2 volts/degree

Calibrated: Y (Y/N)
NIST Calibration: Y (Y/N)
Calibration Date: 5/7/96

Completed: [signature]
ARA Test Performer
[signature]
Project Engineer
Date: 5/13/96

6.3.2.7 Bottom Detector #1

Instrument (including all adhesive, bonding materials and other materials used to install instrument on cone penetrometer sensor package) can withstand the following conditions:

Temperature: 60 - 212 °F (15.6 to 100 °C)
Radiation: 0-900 Rad/hr
pH: 10-14
Flammable

Direct depth measurement vs output voltage
-100mv +300mV

Analysis Acceptable X (Y/N)

Calibrated: Y (Y/N)
NIST Calibration: Y (Y/N)
Calibration Date: 5/9/96

Potting Material
Stycast 1266

Completed: [signature]
ARA Test Performer
[signature]
Project Engineer

Date: 5-13-96

6.3.2.8 Bottom Detector #2

Instrument (including all adhesive, bonding materials and other materials used to install instrument on cone penetrometer sensor package) can withstand the following conditions:

Temperature: 60 - 212 °F (15.6 to 100 °C)
Radiation: 0-900 Rad/hr
pH: 10-14
Flammable

Analysis Acceptable X (Y/N)

Same As 6.3.2.7

Calibrated: Y (Y/N)
NIST Calibration: Y (Y/N)
Calibration Date: 5/9/96

Completed: ______________
ARA Test Performer

____
Project Engineer

Date: 5/13/96

6.3.2.9 Depth Transducer - Push Rod

Instrument (including all adhesive, bonding materials and other materials used to install instrument on cone penetrometer sensor package) can withstand the following conditions:

Operating temperature: 10 to 120 °F (-12.2 to 48.9 °C)
Storage temperature: -40 to 120 °F (-40 to 48.9 °C)
Humidity: 10-100 %
Elevation: 0 - 600 feet above sea level (0 to 183 m)
Exposed equipment to withstand sand and dust

Method
Take direct measurement of depth vs output voltage ≈ 0-10 volts

Analysis Acceptable X (Y/N)

Calibrated: Y (Y/N)
NIST Calibration: Y (Y/N)

Calibration Date: 5/3/96

Completed: Wm Pratt
ARA Test Performer

AIA
Project Engineer

Date: 5/13/96

6.3.2.10 Depth Transducer - Guide Tube

Instrument (including all adhesive, bonding materials and other materials used to install instrument on cone penetrometer sensor package) can withstand the following conditions:

Operating temperature: 10 to 120 °F (-12.2 to 48.9 °C)
Storage temperature: -40 to 120 °F (-40 to 48.9 °C)
Humidity: 10-100 %
Elevation: 0 - 600 feet above sea level (0 to 183 m)
Exposed equipment to withstand sand and dust

Analysis Acceptable: Y (Y/N) Take direct depth measurement vs Output Voltage 0-10

Calibrated: Y (Y/N)
NIST Calibration: Y (Y/N)
Calibration Date: ____

Completed: Wm Pratt
ARA Test Performer

AIA
Project Engineer

Date: 6-17-96

6.3.3 PROBE BODY

Can the seals/potting material used withstand the following environment (includes probe tip, guide tube and push rods):

Temperature: 60 - 212 °F (15.6 to 100 °C)
Radiation: 0-900 Rad/hr
pH: 10-14
Flammable

Analysis Acceptable (Y/N) Y

Viton Orings
Stycast 1265 Potting
Belzona 1391 Sealer
Tytanium Tip
SST 4340 Body, Sleeve etc

Manufacturer: ARA
Drawing No.: H043-5A

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5/13/96

6.4 ELECTRICAL SYSTEM PREOPERATIONAL CHECKOUT

6.4.1 Wiring Check

Verify the proper hook up of the electronics, detectors, data acquisition and the computer interface using the wiring diagram.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5/13/96

7.0 OPERATIONAL TESTS

7.1 Cone Penetrometer Installation

7.1.1 Verify shackle certifications are adequate for load to be lifted

Shackels 10 Tons
Choker Vertical 21200 lb
≈ 10 Ton
Polyester Core
Nylon Cover

Completed: ______ / ______
ARA Test Performer/Project Engineer

______ 5/9/96
QC Signature Date

Date: 5/9/96

7.1.2 Rig cone penetrometer skid with crane and lifting fixture.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5/9/96

7.1.3 Lift cone penetrometer 10 feet (304.8 cm) vertically and move a minimum of 10 feet (304.8 cm) horizontally.

Completed: ______________/______________
ARA Test Performer/Project Engineer

Date: 5/9/96

7.1.4 Place cone penetrometer skid over simulated riser. Check shackles and skid.

Any damage: N (Y/N)

Completed: ______________/______________
ARA Test Performer/Project Engineer

Date: 5-9-96

7.2 Riser Adaptor

7.2.1 Install riser adaptor and spray washer to simulated riser.

Completed: ______________/______________
ARA Test Performer/Project Engineer

Date: 5/9/96

7.2.2 Install riser adaptor bellows to skid. Verify bolt pattern matches.

Need Adaptor Made
SATC piece did not fit

Completed: ______________/______________
ARA Test Performer/Project Engineer

Date: N/A See Exceptions
WB Page A-63

7.3 Support Trailer

7.3.1 Wheel support trailer within 50 feet (127.0 cm) from skid.

7.3.2 The Test Performer, shall select an open area with no known buried objects (pipes, cables, or etc.) to test the generator and distribution equipment. Connect the metal frames of the cone penetrometer platform and support trailer to a driven 3 feet (20.3 cm) ground rod. Also, connect the generator and distribution panels to the driven ground rod.

7.3.3 OPEN the generator output breaker, with no loads connected, record the requested readings on the generator test data sheets (see Appendix A).

2 7.3.4 Start the generator. Record the requested readings on the generator test data sheets (see Appendix A). Take these readings quickly to minimize the time the generator runs unloaded.

3 7.3.5 CLOSE the generator output breaker, with all loads connected except, HVAC, hydraulic motor and water heater. Record the requested readings on the generator test data sheets (see Appendix A).

4 7.3.6 Connect HVAC load. Record the requested readings on the generator test data sheet (see Appendix A).

5 7.3.7 Sequentially turn on water heater and then turn on hydraulic motor. Record the requested readings on the generator test data sheets (see Appendix A).

6 7.3.8 Switch the hydraulic motor OFF, then switch it ON. Record the requested readings on the generator test data sheets (see Appendix A).

7 7.3.9 Switch the hydraulic motor OFF, then switch it ON. Record the requested readings on the generator test data sheets (see Appendix A).

8 7.3.10 Sequentially turn OFF each motor, start with the hydraulic motor. Then Turn OFF the water heater and HVAC, followed by the lighting loads. When all loads are disconnected, record the requested readings on the generator test data sheets (see Appendix A).

7.3.11 Turn the generator OFF.

7.3.12 Turn generator ON. A portable sound monitor will be used to verify that the noise produced by the generator is below 85 dBA at the entrance of the skid.

Completed: [signature] / [signature]
~~ARA~~ Test Performer/Project Engineer

Date: 6-17-96

7.3.13 Connect hydraulics lines, supply, return, instrumentation feedback and decontamination water lines to the cone penetrometer.

Completed: ________/________
ARA Test Performer/Project Engineer

Date: 5/13/96

7.4 Skid Leveling

7.4.1 Operate hydraulically driven outriggers. Lower and raise each leg cylinder 2 feet (60.9 cm) together. Perform five times.

Completed: ________/________
ARA Test Performer/Project Engineer

Date: 5/7/96

7.4.2 Level unit hydraulically. Verify that it is flat with leveling gage. Perform five times.

Completed: ________/________
ARA Test Performer/Project Engineer

Date: 5/7/96

7.4.3 Install safety leg blocks.

Completed: ________/________
ARA Test Performer/Project Engineer

Date: 6-12-96

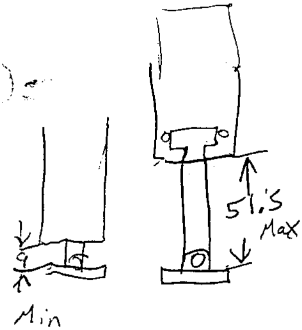
7.5 XY Table

7.5.1 Operate hydraulically driven X-Y table. Move table ± 6 inch (15.2 cm) in the X and Y direction. Perform five times. Verify that the X-Y movement is smooth and does not skew off axis.

Completed: ________/________
ARA Test Performer/Project Engineer

Date: 5/7/96

7.5.2 Center over simulated riser's dead center.



Verify that push rams can moved accurately within ± 0.25 inch (.6 cm) of the center of the riser. Perform five times.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5/7/96

7.5.3 Secure X-Y table in X direction.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5/7/96

7.5.4 Secure X-Y table in Y direction.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5/7/96

7.6 Ballasting

7.6.1 Load up skid with ~~25~~ 25 tons (222411 N) of ballast.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 4-30-96

7.6.2 ~~Verify unit is level with leveling gage and not affecting leveling jack pressure within 10% of each other.~~

Maximum Push Force 76,400
38 Tons

19.63 in²
outrigger hydraulic area
Top

Configuration #1:
Back ~~Front~~: 12 tons (106757 N)
Front ~~Back~~: 15 tons (133446 N)

Jack Pressures: RF ~~[illegible]~~ LF ~~[illegible]~~ R ~~[illegible]~~ R ~~[illegible]~~ ~~[illegible]~~

Total U.64
79500 lb
39.7 Tons

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 4/30/96 GB WLB

7.6.3 Repeat steps 7.6.1 to 7.6.2 with different ballast configurations to simulate all possible loading configurations. The ballasts consists of four 6,000 lbs (26689 N) for the rear of the skid and two 15,000 lbs (66723 N) for the front of the skid. ~~Verify the unit is level with leveling gage and not affecting leveling pressures within 10% of each other.~~

Max Push Force 21,000 lb (10 Tons)

Configuration #2: front: 0 back: 0
19.63 in² Jack Pressures: psi psi psi psi Total Weight

Configuration #3: front: 7.5 tons (66723 N)
back: 6 tons (53379 N)
Max Push Force 48000 lb (24 Tons)
Jack Pressures: ~~466~~ ~~760~~ ~~534~~ Total Weight

open Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6/24/96 WLB

7.7 Communications

7.7.1 Turn on power.

7.7.2 Turn on intercom headsets. Verify that 2 persons can communicate between stations.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6/17/96

7.8 HVAC

7.8.1 Adjust room temperature to 72 F (22 C).

7.8.2 Verify that temperature is reached within 10 minutes. 10:08 AM 10:12 AM

Temperature 56° start 72° Finish

Completed: ______ / ______
ARA Test Performer/Project/ Engineer

Date: 5/8/96

7.8.3 Measure number of room air changes per hour with no people in room.

Vol Body
76x90x90
= 403ft³

340 cfm/unit ref
2 units 680 cfm

Room changes/hour 50/One Unit

Completed: Wes Bratton / ________
ARA Test Performer/Project Engineer

Date: 5/7/96

7.9 Guide Tube and Push Rod Sequencing

7.9.1 Assemble three sections of 3 1/2 inch (8.8 cm) guide tube and crane it into push system. Clamp guide tube. Verify safety clamp is installed as a backup clamp during all steps following. The safety clamp does not need to be installed when both hydraulic clamps are engaged.

Completed: Wes Bratton / ________
ARA Test Performer/Project Engineer

Date: 5-8-96

7.9.2 Shutdown power and verify that safety clamps keep guide tube secured.

Completed: Wes Bratton / ________
ARA Test Performer/Project Engineer

Date: 5-8-96

7.9.3 Measure depth of guide tube. Verify that the data acquisition and guide tube depth correspond to each other.

Data acquisition 2 ft
Depth 2 ft

Completed: Wes Bratton / ________
ARA Test Performer/Project Engineer

Date: 5-18-96

7.9.4 Install 3 push rod sections into guide tube using manual installation procedures. During installation turn off power when only one of the clamps are engaged (repeat for both clamps). Verify clamps hold.

Completed: ______________ / ______________
ARA Test Performer/Project Engineer

Date: 5/8/96

7.9.5 Manually install 3 additional section of guide tube. Verify manual clamps is on at all times when double clamp is not engaged. Install crane attachment device to guide tube and push rod.

Completed: ______________ / ______________
ARA Test Performer/Project Engineer

Date: 5/8/96

7.9.6 Shutdown power and verify that guide tube and push rod do not fall.

Completed: ______________ / ______________
ARA Test Performer/Project Engineer

Date: 5-8-96

7.9.7 Remove guide tube and ~~push rod~~ with crane.

Completed: ______________ / ______________
ARA Test Performer/Project Engineer

Date: 5/9/96

7.9.8 Manually install 2 push rod sections and probe tip with rams. Add 3 sections of guide tube.

Completed: ______________ / ______________
ARA Test Performer/Project Engineer

Date: 5-8-96

7.9.9 Remove guide tube with rams and then push rods with rams. Safety clamps must be utilized to verify proper sequential function.

Completed: ______________ / ______________
ARA Test Performer/Project Engineer

Date: 5-8-96

7.10 Decontamination System

7.10.1 Install three guide tube sections and three push rod sections and probe tip into ram. Push guide tube and push rod in approximately 4 feet (121.9 cm) of sludge simulant to "contaminate"foot assembly outside surface.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5-8-96

7.10.2 Verify that 100 gallons (378.5 L) of water are in the decontamination tank.

Tank Level 20 inches

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5-8-96

7.10.3 Turn on heating unit on decontamination unit. Inspect the system to verify that all gauges and controls are visible and accessible to the operator while decontamination unit is in operation.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5-8-96

7.10.4 Heat to 130 F (54.4 C). Calculate heat rate. Verify it is 40 F/hr (4.4 C/hr) or faster.

Heat rate ≈20°F/hr 10:18 AM 63°F Lab Temp Sensor 54°F Skid Temp Sensor 1:18 PM 130°F 100°F

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5/8/96 GB See Exceptions Sheet WLB

7.10.5 Operate pump. Verify that discharge pressure is 400 ± 20 psig (2758 ± 137.8 kPa) when flow valve to spray washer (both positions) is open. Close flow valve and run for 20 minutes. Verify bypass is operating and pump does not overheat.

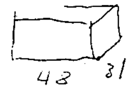
Discharge Pressure: 200 psi Top Nozels 400 PSI Lower Nozels

Completed: Wes Bratton / [signature]
ARA Test Performer/Project/Engineer

Date: 5-8-96

7.10.6 Install flowmeter. Run half a tank in 15 minutes. Read level gage. Verify that system pumps at minimum of 3.8 gpm (14.4 liters per minute).

Manual level (start) 14.25
Manual level (finish) 11.06
Level gage No Level Gage
Duration 6 min 15 sec
flowmeter N/A
Calculated flow rate 3.7



Completed: Wes Bratton / [signature]
ARA Test Performer/Project/ Engineer

Date: 5-8-96

7.10.7 Run decontamination unit until tank is empty. Verify that system low level ~~alarms~~. Light on controll pannel light

@ 8.25"
Light went on
≈ 55 gal left

Completed: Wes Bratton / [signature]
ARA Test Performer/Project Engineer

Date: 5-8-96 WB

7.10.8 Verify that tank decontamination temperature ~~alarm~~ light works.

Light comes on
at 100 °F when tank
is at 130 °F

Completed: Wes Bratton / [signature]
ARA Test Performer/Project Engineer

Date: 5-8-96 WB

7.10.9 Visually verify that no leaks exist between riser adaptor bellows and skid.

Need adaptor from
bellows to skid

Completed: Wes Bratton / [signature]
ARA Test Performer/Project/ Engineer

Date: 5-9-96

7.10.10 Simulate washing procedure at .8 inch/sec (2 cm/sec). Run 3 times. Measure material left in interface. Mark observations on observation/results data sheet (see Appendix A).

Completed: ________________/________________
ARA Test Performer/Project Engineer

Date: 5/9/96

7.11 Data Acquisition and Push System Operation

7.11.1 Turn on power to lights and electronics. Turn on computers and lights. Verify all systems are functional.

Completed: ________________/________________
ARA Test Performer/Project Engineer

Date: 5/10/96

7.11.2 Run recheck algorithm. Verify that calibration verification software works properly.

Completed: ________________/________________
ARA Test Performer/Project Engineer

Date: 5/10/96

7.11.3 Run cone penetrometer software. Verify that software can change gains and filter inputs. Input project specific test setup which includes waste tank, riser, waste level, date, operator, dome load limit, and run number. Ballast Config. WEB

Completed: ________________/________________
ARA Test Performer/Project Engineer

Date: 5/14/96

7.11.4 Remove simulated riser, spray washer, riser adaptor and riser adaptor bellows. Home cone penetrometer tip and guide tube with membrane to known levels.

Completed: ________________/________________
ARA Test Performer/Project Engineer

Date: 5/10/96

7.11.5 Place waste simulant (sugar urea) barrel with 40 inch (101.6 cm) minimum diameter under skid ram.

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5-11-96

7.11.6 Install guide tube into ram. Move guide tube to 12 inch (30.5 cm) above waste. Measure location of guide tube and verify it is the same as the data acquisition system. Verify that software can time record.

Barrel #1
Urea - full depth
start 7" above
waste surface
35" to barrel bottom

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5/11/96

7.11.7 Install instrumented push rod. Move push rod until it touches guide tube membrane. Measure force and distance in which the membrane is sensed by the tip load cell. Verify membrane punctures within 2 inch (5.1 cm) of push rod movement.

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5/13/96

7.11.8 Penetrate simulant at a rate of .8 inch/sec (2 cm/sec).

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5-11-96

7.11.9 Verify that numerical/graphical data can be obtained and software is menu driven. Data to be displayed includes ~~dual stage~~ tip load cell, sleeve friction, pore pressure, tip and sleeve temperature, inclination, depth, downward force and bottom detection.

GB
WLB

Completed: Wes Bratton / [signature]
ARA Test Performer/Project Engineer
CB/WLB

Date: 5-11-96

7.11.10 Take measurements up to ~~18~~ 7 inches inch (45.7 cm) above bottom of barrel.

Completed: Wes Bratton / [signature]
ARA Test Performer/Project Engineer

Date: 5-11-96

7.11.11 Activate tip load cell bottom detection system. Record force measurements from Excel.

Starting ~~force~~ distance -7 inches (above waste)
Set ~~limit force~~ depth 2.91 feet (6 inches above bottom of barrel)

Completed: Wes Bratton / [signature]
ARA Test Performer/Project Engineer
CB WLB

Date: 5-11-96

7.11.12 Continue push until system alarms and shutdown. Record force at alarm and shutdown.

~~Push force~~ Depth at alarm: 2.46 feet Alarm + Shutdown the same
~~Push force~~ Depth at shutdown: 2.46 feet for depth alarm

Completed: Wes Bratton / [signature]
ARA Test Performer/Project Engineer
CB WLB

Date: 5-11-96

7.11.13 Repeat steps 7.11.8 to 7.11.12 three times for the barrel.

Push #2:

Penetration Rate: ~~.8~~ (.8 inch/sec / 2 cm/sec)
Graphical/Numerical Display: Y (Y/N)
Measurements up to 18 inches (45.7 cm) above bottom: Y (Y/N)
~~Tip load cell bottom~~ Tank depth gauge detection:
Starting ~~force~~ depth -7in
Set limit ~~force~~ depth 2.91 feet
CB WLB

4B WLB

Depth ~~Push force~~ at alarm: 2.47 ft
~~Push force~~ Depth at shutdown: 2.47 feet

Push #3:

Penetration Rate: 2.8 (.8 inch/sec / 2 cm/sec)
Graphical/Numerical Display: Y (Y/N)
Measurements up to 18 inches (45.7 cm) above bottom: Y (Y/N)
Tip load cell bottom detection:

WLB Starting Depth ~~force~~ 2 in
Set limit ~~force~~ 2.91
Depth ~~Push force~~ at alarm: 2.468 ft
~~Push force~~ Depth at shutdown: 2.468 ft

Δ 6 in Between Set Limit Tank Bottom and Depth shutdown

Completed: ______________ / ______________
ARA Test Performer/Project Engineer

Date: 5-11-96

7.11.14 Post process data. Data to be collected includes compressive strength, yield stress, shear strength and stratigraphy. Verify that data corresponds to lab data. Three profile of the barrel will be taken and analyzed for shear strength, compressive strength and yield stress. Output should include tip and pore pressure, sleeve friction, downward force, and tip temperature shall be measured during penetration of the waste simulant. From these measurements, the friction ratio versus depth, differential pore pressure ratio versus depth, corrected total cone resistance versus depth, effective vertical stress versus cone resistance, cone resistance versus depth, frictional stress versus depth and pore pressure versus depth shall be tabulated and plotted.

Completed: ______________ / ______________
ARA Test Performer/Project Engineer

Date: 6/20/96

7.11.15 Verify that sensor data has been logged and saved under a unique file name. Down load data to ARA's computer via the modem. List data to be plotted.

Completed: ______________/______________
ARA Test Performer/Project Engineer

Date: 6/20/96

7.11.16 Disconnect cable from tip. Verify that connector does not jam inside push rod.

Completed: ______________/______________
ARA Test Performer/Project Engineer

Date: 6-20/96

7.11.17 During different stages in data runs, activate emergency shutdown palm button. Verify that system immediately alarms and shutdown.

Completed: ______________/______________
ARA Test Performer/Project Engineer

Date: 5/13/96

7.11.18 Remove guide tube and push rod from simulant. Repeat steps 7.11.8 to 7.11.12 with layered simulant consisting of water and clay. Verify that the system can differentiate between layers. (Water over clay)

Push #1:

On first run ran the wiper and membrane test.

Membrane took 3 in to break. Wiper Seal ripped out.

Penetration Rate: 2.0 (.8 inch/sec / 2 cm/sec)
Graphical/Numerical Display: Y (Y/N)
Measurements up to 18 inches (45.7 cm) above bottom: Y (Y/N)
Tip load cell bottom detection:

Starting force 0
Set limit force 500 psi shutdown 100 Alarm

Push force at alarm: 100
Push force at shutdown: did not reach max Force

Layer #1 0
Data Acquisition Layer #1 0"

Layers #2 +14 inches
Data Acquisition Layer #2 14 in

Raman on

Push #2:

Penetration Rate: ~.8 (.8 inch/sec / 2 cm/sec)
Graphical/Numerical Display: Y (Y/N)
Measurements up to 18 inches (45.7 cm) above bottom: Y (Y/N)
Tip load cell bottom detection:

Starting force 0
Set limit force 500 shutdown 100 Alarm

Push force at alarm: 100 Alarm
Push force at shutdown: 800 psi } same time ~
Started at -11 inches
Layer #1 +0 inches
Data Acquisition Layer #1 0

Layers #2 +14 inches
Data Acquisition Layer #2 14"

Push #3:

Penetration Rate: ~.8 (.8 inch/sec / 2 cm/sec)
Graphical/Numerical Display: Y (Y/N)
Measurements up to 18 inches (45.7 cm) above bottom: Y (Y/N)
Tip load cell bottom detection:

Starting force 0
Set limit force 500
Tip forces so low didn't stop to set higher. Just set at 500

Push force at alarm: 100
Push force at shutdown: 600 psi

Layer #1 0
Data Acquisition Layer #1 0

Layers #2 +14 inches
Data Acquisition Layer #2 14"

Completed: [signature] / [signature]
ARA Test Performer/Project Engineer

Date: 5-11-96

7.11.19 Post process data. Data to be collected includes compressive strength, yield stress, shear strength and stratigraphy. Verify that data corresponds to lab data. Three profile of the barrel will be taken and analyzed for shear strength, compressive strength and yield stress. Verify shear strength accuracy is within ± .02 psi (± 1500 dyne/cm^2) accuracy. Output should include tip and pore pressure, sleeve friction, downward force, and tip temperature shall be measured during penetration of the waste simulant. From these measurements, the friction ratio versus depth, differential pore pressure ratio versus depth, corrected total cone resistance versus depth, effective vertical stress versus cone resistance, cone resistance versus depth, frictional stress versus depth and pore pressure versus depth shall be tabulated and plotted.

Shear Strength Accuracy Good See ARA 5289 ATR

Completed: Wes Math / [signature]
ARA Test Performer/Project Engineer

Date: 6/20/94

7.11.20 Remove guide tube and push rod from simulant. Repeat steps 7.11.8 to 7.11.12 with layered simulant consisting of ~~hard sugar urea~~, clay over and sugar urea.

Push #1:

Penetration Rate: .83 (.8 inch/sec / 2 cm/sec)
Graphical/Numerical Display: Y (Y/N)
Measurements up to 18 inches (45.7 cm) above bottom: Y (Y/N)
Tip load cell bottom detection:

Starting force 0 lb/in²
Set limit force 500 lb/in² Tip stress 400 psi Alarm

Push force at alarm: 400 lb/in² Tip Stress
Push force at shutdown: 500 lb/in² Tip Stress

Layer #1 0
Data Acquisition Layer #1 0"

Layers #2 +/14"
Data Acquisition Layer #2 14"

CB WCB ~~Layers #3~~ ________
~~Data Acquisition Layer #3~~ ________

Push #2:

Penetration Rate: 2.8 (.8 inch/sec / 2 cm/sec)
Graphical/Numerical Display: Y (Y/N)
Measurements up to 18 inches (45.7 cm) above bottom: Y (Y/N)
Tip load cell bottom detection:

Starting force 0
Set limit force 500 lb/in² Alarm Set 400 psi

Push force at alarm: 400 lb/in²
Push force at shutdown: 900 lb/in² Final

Layer #1 -0 in Above waste start 0" Layer 1
Data Acquisition Layer #1 0

Layers #2 +14 in
Data Acquisition Layer #2 14

CB WCB ~~Layers #3~~ ________
~~Data Acquisition Layer #3~~ ________

Push #3:

Penetration Rate: 2.8 (.8 inch/sec / 2 cm/sec)
Graphical/Numerical Display: Y (Y/N)
Measurements up to 18 inches (45.7 cm) above bottom: Y (Y/N)
Tip load cell bottom detection:

Starting force 0 psi
Set limit force 500psi Alarm 125 psi

Push force at alarm: 125 psi
Push force at shutdown: 200 psi
Pressure spikes so fast Alarm + shutdown is at same time.

Layer #1 0 inch above waste start 0 Layer 1
Data Acquisition Layer #1 0

Layers #2 +14
~~Data Acquisition~~ Layer #2 14

CB WKB
~~Layers #3~~
~~Data Acquisition Layer #3~~

Completed: ______________ / ______________
ARA Test Performer/Project Engineer

Date: 5/11/96

7.11.21 Post process data. Data to be collected includes compressive strength, yield stress, shear strength and stratigraphy. Verify that data corresponds to lab data. Three profile of the barrel will be taken and analyzed for shear strength, compressive strength and yield stress. Verify shear strength accuracy is within ± .02 psi (± 1500 dyne/cm^2). Output should include tip and pore pressure, sleeve friction, downward force, and tip temperature shall be measured during penetration of the waste simulant. From these measurements, the friction ratio versus depth, differential pore pressure ratio versus depth, corrected total cone resistance versus depth, effective vertical stress versus cone resistance, cone resistance versus depth, frictional stress versus depth and pore pressure versus depth shall be tabulated and plotted.

Shear Strength Accuracy Good See ARA ATR 5289

Completed: ______________ / ______________
ARA Test Performer/Project Engineer

Date: 6/10/96

7.11.22 5-10-96 Remove guide tube and push rod from simulant. Repeat steps 7.11.8 to 7.11.12 with layered simulant consisting of 2 different types of clays.

Push #1:

Penetration Rate: 1.9 (.8 inch/sec / 2 cm/sec)
Graphical/Numerical Display: X (Y/N)
Measurements up to 18 inches (45.7 cm) above bottom: X (Y/N)
Tip load cell bottom detection:

Starting force 0 psi

Set limit force 100 psi

Push force at alarm: 100 psi
Push force at shutdown: 100 psi

Layer #1 0
Data Acquisition Layer #1 0

Layers #2 + 14"
Data Acquisition Layer #2 14

Push #2:

Penetration Rate: .8 (.8 inch/sec / 2 cm/sec)
Graphical/Numerical Display: Y (Y/N)
Measurements up to 18 inches (45.7 cm) above bottom: Y (Y/N)
Tip load cell bottom detection:

Starting force 0
Set limit force 100 psi

Push force at alarm: 100 psi
Push force at shutdown: 100 psi

Layer #1 0
Data Acquisition Layer #1 0

Layers #2 + 14"
Data Acquisition Layer #2 14

Push #3:

Penetration Rate: .8 (.8 inch/sec / 2 cm/sec)
Graphical/Numerical Display: Y (Y/N)
Measurements up to 18 inches (45.7 cm) above bottom: Y (Y/N)
Tip load cell bottom detection:

Starting force 0
Set limit force 100 psi

Push force at alarm: 100 psi
Push force at shutdown: 100 psi

Layer #1 0
Data Acquisition Layer #1 0

Layers #2 14"
Data Acquisition Layer #2 14

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5/11/97

7.11.23 Post process data. Data to be collected includes compressive strength, yield stress, shear strength and stratigraphy. Verify that data corresponds to lab data. Three profile of the barrel will be taken and analyzed for shear strength, compressive strength and yield stress. Verify shear strength accuracy is within ± 0.02 psi (± 1500 dyne/cm^2). Output should include tip and pore pressure, sleeve friction, downward force, and tip temperature shall be measured during penetration of the waste simulant. From these measurements, the friction ratio versus depth, differential pore pressure ratio versus depth, corrected total cone resistance versus depth, effective vertical stress versus cone resistance, cone resistance versus depth, frictional stress versus depth and pore pressure versus depth shall be tabulated and plotted. See ARA ATR 5289

Shear Strength Accuracy Good

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: ____________

7.12 Clamping system

7.12.1 Install 5 segments of push rod and guide tube.

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5/8/95

7.12.2 Turn off power. Verify that emergency lights turn on and clamping system firmly holds push rod and guide tube in place.

Completed: Wes Bratton / [signature]
ARA Test Performer/Project Engineer

Date: 5-13-96

7.12.3 Lower hydraulic reservoir. Verify that system holds guide tube and push rod firmly in place. Verify that low hydraulic fluid alarm functions.

Completed: Wes Bratton / [signature]
ARA Test Performer/Project Engineer

Date: 5-16-96

7.13 Alarms

WLB

7.13.1 Set guide tube depth gage to ~~5~~ 4 feet (152.4 cm). Set Alarm at 3.9' Shutdown at 4'

Completed: Wes Bratton / [signature]
ARA Test Performer/Project Engineer

Date: 5/13/96

7.13.2 Install 5 feet (152.4 cm) of guide tube. Verify alarm turns on within 1 inch (2.5 cm) of depth location and shutdown of the system at 5 feet ± 0.25 inches(152.4 ± 0.6 cm).

Depth at which alarm turns on 4 ft Set at 4
Depth at shutdown 5 ft Set at 5

Completed: Wes Bratton / [signature]
ARA Test Performer/Project Engineer

Date: 5/13/96

7.13.3 Set push rod depth gage to 5 feet (152.4 cm).

Completed: Wes Bratton / [signature]
ARA Test Performer/Project Engineer

Date: 5/8/96

At 4.5 the shutdown should occure. To get out you must turn on safety override back off then reset.

7.13.4 Install 5 feet of push rod. Verify ~~alarm~~ shutdown turns on with 1 ~~inch of depth location and shutdown of the system~~ at 5 feet ± 0.25 inches (152.4 ± 0.6 cm).

WLB

~~Depth at which alarm turns on~~
Depth at shutdown 4.56 ft

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5/13/96

7.13.5 Set tip temperature alarm at + ~~150~~ ~~F~~ 100 °C (+ 65.5 C).

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5-9-96

7.13.6 Apply heat gun to tip and verify that alarm turns on within 5 F (2.7C) of alarm setpoint and shutdown the system when it exceeds shutdown setpoint. Set Alarm 60 °C Shut down 100 °C

Temperature at which alarm turns on 60 °F
Temperature at shutdown 100 °F

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5/13/96

7.13.7 Set side temperature alarm at 150 F (65.5C).

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5/13/96

7.13.8 Apply heat gun to side and verify that alarm turns on within 5 F (2.7C) of alarm setpoint and shutdown the system when it exceeds shutdown setpoint. Set Alarm @ 60 °C shutdown @ 100 °C

Temperature at which alarm turns on 62 °C
Temperature at shutdown 99.9 °C

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5/13/96

7.13.9 Set inclinometer alarm setpoint to 5 degrees.

Completed: Wla Pratt / [signature]
ARA Test Performer/Project Engineer

Date: 5-9-96

7.13.10 Move probe to within 1 degree of shutdown setpoint and verify alarm turns on in calibration jig. Move probe to 5 degrees and verify it shuts system down when it exceeds shutdown setpoint.

Need absolute value in computer

	Y axis	X axis
Inclination at which alarm turns on	3.8 degrees	3.2 deg
Inclination at shutdown	5.1 degrees	4.9 deg

Completed: Wla Pratt / [signature]
ARA Test Performer/Project Engineer

Date: 5-9-96

7.13.11 Set downward force limit to 1000 lbs (4448 N), 10 tons (88965 N) and 20 tons (177930 N) and verify that system alarms within 10% of shutdown value. Continue pushing until shutdown. Verify shutdown occurs within 10% of shutdown value.

The variable reducing valve is adjusted by the computer and does not allow more pressure to the cylinders. No Alarm No Shut Down

This is a backup system to buckeling program.

Buckeling Program also operates the variable reducing valve. Valve looks for the lowest of the two + control down force

Configuration Menue

1000 lbs (4448 N) setpoint On Top set 318 psi

~~Force at which alarm turns on~~ Set 160 psi 565 lb
Force at shutdown 318 set 1372 lb

High Values Because of No time for response on steel plate

10 tons (88965 N) setpoint

Force at which alarm turns on 5 tons 5.1 tons
Force at shutdown 10 tons 9.4 tons

20 tons (177930 N) setpoint

Force at which alarm turns on 10 tons 9.9 tons
Force at shutdown 20 tons 19.9 tons

Completed: Wla Pratt / [signature]
ARA Test Performer/Project Engineer

Date: 9/20 96

7.13.12 Set ~~jack force~~ (dome loading) to ~~30~~ 40 tons (266895 N) and verify that it alarms and

130 WLB

shutdown once setpoints are exceeded.

A temporary spike occured because of the arrangment of a hard stop

Force at alarm 36 Tons
Force at shutdown 46 tons

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5/14/96

7.13.13 Heat hydraulic reservoir to 140F (60C). Verify that temperature with a thermometer placed in the fluid. Verify that the light goes on at 140F (60C).

Temperature at which light turns on 140

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5/13/96

7.14 Load Test

7.14.1 Load skid with 65 tons (578272.5 N) of ballast. Push as much as 53 tons (471514.5 N) of ram onto a plate. Record pushing force.

Pushing Force ~~90,000~~ 45tons Loaded To 60 Tons Earth anchors & Ballasted

58 tons Max Push with Ballast full

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 4-25-96 4-30-96

7.14.2 Verify that frame can take loads by checking welds and ram can exert force. Verify that push rod can take force.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 4-25-96

7.14.3 Take ballast off.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 4-25-96

7.14.4 Install pull assembly jig in which 30 tons (266895 N) are lifted with push rod.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 4/25/96 20,000 lb 35 Tons

7.14.5 Verify that frame can take loads by checking welds and ram can exert force. Verify that push rod can take force.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6/17/96 Need Weld Reports

7.15 Bottom Detection System

7.15.1 Shutoff depth gage alarm and tip gage alarm.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5/13/96

7.15.2 Place 1/4 inch (.6 cm) steel plate under push rod. Set bottom detection magnetometer alarm at 8 inches (20.3 cm). Move push rod at .8 inch/sec (2 cm/sec) until bottom detection system alarm. Alarm @ 15 shutdown @ 8

Inches away from plate - alarm 15
Inches away from plate - shutdown 8
Any visible damage to plate N (Y/N)

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 5/13/96

7.15.3 Set bottom detection magnetometer alarm at 6 inches (15.2 cm). Move push rod at .8 inch/sec (2 cm/sec) until bottom detection system alarm. Alarm @ 10 shutdown @ 6

Inches away from plate - alarm 9.25"
Inches away from plate - shutdown 6"
Any visible damage to plate N (Y/N)

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5/13/96

7.15.4 Set bottom detection magnetometer alarm at 4 inches (10.2 cm). Move push rod at .8 inch/sec (2 cm/sec) until bottom detection system alarm.
Set Alarm 8 Shut Down 4

2 12
6 10
4 8
Alarm 10 4"
9"

Inches away from plate - alarm 9"
Inches away from plate - shutdown 4"
Any visible damage to plate N (Y/N)

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5/13/96

7.15.5 Shutdown magnetometer and tip alarm. Home push rod. Set depth alarm to 12 inches (30.5 cm). Move push rod at .8 inch/sec (2 cm/sec). Verify that system alarms and shutdown system.
Set Alarm 8" Shut down @ 12"

Distance at alarm 11.5
Distance at shutdown 7.5
Any visible damage to plate (Y/N) N

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5/13/96

7.15.6 Shutdown magnetometer and depth alarm. Home push rod. Turn tip alarm on. Push the push rod until system alarms and shutdown.
1000 lb/in² shutdown 60 lb/in²

Tip alarm delta force setting 940 lb/in²
Tip force at alarm 65 lb/in²
Tip force at shutdown 988 lb/in²
Any visible damage to plate N (Y/N)

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 5/13/96

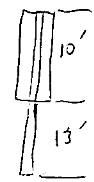
7.16 Buckling

7.16.1 This test will be conducted at a 12 inch (30.5

cm) OD dry well at Vermont.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6/20/96



GT 10'
Offset 4
Instal Rod
-10.75

7.16.2 Install ~~15~~ feet (4.6 m) of 3.5 inch (8.9 cm) OD guide tube and push rod. at 23 feet.

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6/20/96

7.16.3 Push on plate with push rod at ~~65000~~ lbs (289116 N).

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6/20/96 Max Force At Stall 3600 lb
4000 Tip

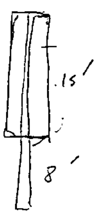
7.16.4 Measure inclination. Verify that no buckling occurs.

Inclination: None

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6/20/96

Same
Run
Setup
Continued



7.16.5 Install ~~25~~ 15 feet (7.6 m) of 3.5 inch (8.9 cm) OD guide tube and push rod. at 23 feet

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6/20/96

7.16.6 Push on plate with push rod at ~~36000~~ lbs (160126 N).

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6/20/96 Max Force At Stall 11,500 lb
13,000 Tip

7.16.7 Measure inclination. Verify that no buckling occurs.

Inclination: None

Completed: ____________/____________
ARA Test Performer/Project Engineer

Date: 6/20/96

7.16.8 Install ~~15~~ 3 feet (4.6 m) of 3.5 inch (8.9 cm) OD guide tube.

Completed: ____________/____________
ARA Test Performer/Project Engineer

Date: 6/20/96

To D clamp (in adapter)
2'
4' Riser offset
19' in well

7.16.9 Push on plate at ~~36000~~ lbs (160126 N).

Completed: ____________/____________
ARA Test Performer/Project Engineer

Date: 6/20/96 Max Force At Stall 33,000lb From Tip Stress

7.16.10 Measure inclination. Verify that no buckling occurs. 22,000 From Rams

Inclination: None

Completed: ____________/____________
ARA Test Performer/Project Engineer

Date: 6/20/96

2
4
44

7.16.11 Install ~~25~~ 50 feet (7.6 m) of 3.5 inch (8.9 cm) OD guide tube.

Completed: ____________/____________
ARA Test Performer/Project Engineer

Date: 6/20/96

7.16.12 Push on plate at ~~22500~~ lbs (100079 N).

Completed: ____________/____________
ARA Test Performer/Project Engineer

Date: 6/20/96 Max Force At Stall 8000 lb From Tip Stress

7.16.13 Measure inclination. Verify that no buckling
4000 lb From Rams

occurs.

Inclination: NA

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6/20/96

7.16.14 Install push rod until ~~15~~ 10 WCB feet (4.6 m) of push rod are inserted.

GT Length 0
Rod Length 10'
Offset 5'

10'

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6/20/96

7.16.15 Push on plate at ~~6750~~ lbs (30024 N).

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6/20/96 Max Force 9,000 lb Stall
~13,000 on tip

7.16.16 Measure inclination. Verify that no buckling occurs.

Inclination: None

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6 20 96

7.16.17 Install push rod until ~~25~~ 27 WCB feet (7.6 m) of push rod are inserted.

27'

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6/20/96

7.16.18 Push on plate at ~~2250~~ WCB lbs (10008 N).

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6/20/96 Max Force at Stall, 3000 lb
≈ 5000 on Tip

7.16.19 Measure inclination. Verify that no buckling occurs.

Inclination: Done in 12" Well. Rod leaned against side at the 2° inclination

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 6/20/96

7.17 Threaded Connections and Seals

7.17.1 Thread 5 sections of push rod with ~~Raman~~ CPT probe.

Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 6-17-96

7.17.2 Test with 510 psi (3516.5 kPa) of water for 10 minutes. Verify no unacceptable leaks occur.

Leaks: N (Y/N)
Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 6-17-96

7.17.3 Hydrotest guide tube and push rod interface (1.75 inch (4.4 cm) push rod) at 37 psi (255.1 kPa) for 10 minutes. Verify no leaks.

Leaks: N (Y/N)
Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 6/17/96 See 7.17.3 Data Sheet

7.17.4 Pneumatically or hydraulically test guide tube membrane to 10 inches of water (2490 Pa) for 15 minutes. Verify no pressure drops.

Pressure Drop: N (Y/N)
Completed: ____________ / ____________
ARA Test Performer/Project Engineer

Date: 6-17-96

7.18 Interfaces

7.18.1 Connect probe tip, adaptor and push rod. Pull cable connectors apart. Measure with dynamometer the force required to pull apart. Repeat 5 times.

With 2 raps of Black Elec. Tape 14 - 15 lb

force #1 8.5 lb
force #2 9.0
force #3 8.5
force #4 9.5
force #5 9.0

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: 6 17 96

7.18.2 Connect probe tip, Raman spectroscopy sensor, adaptor and push rod. Pull cable connectors apart. Measure with dynamometer the force required to pull apart. Repeat 5 times.

	Cable	Raman Both
force #1	13.5	1.75
force #2	13.0	1.75
force #3	12.5	1.50
force #4	12.5	1.50
force #5	13.0	2.0

Completed: ______ / ______
ARA Test Performer/Project Engineer

Date: ~~[illegible]~~ 7/10/96

7.18.3 Activate moisture sensor system tracking device with detectors installed. Run 3 times.

Completed: ______ / ______
~~ARA~~ SAIC Test Performer/Project Engineer

Date: 6/15/96

7.18.4 Verify no noticeable noise.

When in calibrate
< .1 volts
When not in calibrate
≈ 20 volts

Completed: ______ / ______
SAIC Test Performer/Project Engineer

Date: 6/15/96

7.18.5 Connect the outputs of two function generators directly into inputs of TC-512 counter timer.

Completed: Tad Simmons / Wes Bratton
SAIC Test Performer/Project Engineer

Date: 6/15/96

7.18.6 Adjust the function generator to a frequency of 10.46 Kilohertz.

≈ 10 KHZ

95.6 ms

Completed: Tad Simmons / Wes Bratton
SAIC Test Performer/Project Engineer

Date: 6/15/96

7.18.7 Verify the function generator frequency using a calibrated oscilloscope.

Completed: Tad Simmons / Wes Bratton
SAIC Test Performer/Project Engineer

Date: 6/15/96

Wavetech - far - ch 2
Health - Near - ch 1
Dead time correction

7.18.8 Perform a MANUAL scan with the moisture probe. (30 seconds) When the manual scan is complete, verify that the NEAR DETECTOR and FAR DETECTOR count reading are 313,800 ± 2000. Verify that there is no noticeable noise in the electronics while performing the manual scan.

	Comp	Nim	
NEAR DETECTOR COUNT:	328,461	313,365	
FAR DETECTOR COUNT:	384841	364,280	OK
Noticeable Noise:	N (Y/N)		

NOTE - Computer numbers are different than NIM-BIN Numbers because of Dead-Time correction. TMS 6/15/96

Completed: Tad Simmons / Wes Bratton
SAIC Test Performer/Project Engineer

Date: 6/15/96

7.18.9 Perform an automatic scan with the moisture probe. When the automatic scan is complete, verify that the NEAR DETECTOR and FAR DETECTOR count readings are 313,800 ± 2000. Verify that there is no noticeable noise in the electronics while performing the automatic scan.

6-15-96
C:\Batfiles\ #Z12399Z.01

		Nim	
NEAR DETECTOR COUNT:	314101	349980	1st Scan bottom
FAR DETECTOR COUNT:	392907	385369	2nd Scan

Final Scan	Nim	Comp
Near	314101	329270
Far	392907	416933

Noticeable Noise: N (Y/N)

Completed: Tad M. Symons / Wes Bratton
SAIC Test Performer/Project Engineer

Date: 6/15/96

7.18.10 Perform a surface scan with the moisture probe. When the surface scan is complete, verify that the NEAR DETECTOR count readings are 313,800 ± 2000. Verify that there is no noticeable noise in the electronics while performing the surface scan.

same as previous .21 NM-BW NEAR DETECTOR COUNT: 314851, 314,851, 314,988
Noticeable Noise: N (Y/N)

Completed: Tad Symons / Wes Bratton
SAIC Test Performer/Project Engineer

Date: 6/15/96

7.18.11 Place moisture probe into calibration block. Verify that the calibration software operates adequate. Verify that the bend radius is adequate and the storage and calibration can be easily be operated.

Completed: Tad M. Symons / Wes Bratton
SAIC Test Performer/Project Engineer

Date: 6/15/96

7.19 Endurance Testing

7.19.1 This test will be conducted at a 12 inch (30.5 cm) OD dry well at Vermont.

Completed: Wes Bratton /
ARA Test Performer/Project Engineer

Date: 6/20/96

7.19.2 Install 20 feet (7.6 m) of 3.5 inch (8.9 cm) OD guide tube and push rod. Remove 20 feet of guide tube and push rod. Repeat installation and removal of push rod and guide tube four times for a period of 2 hours. Verify that hydraulic oil temperature is maintained below 140 F (60 C).

Hydraulic Oil Temperature 81°F

Completed: [signature] / [signature]
ARA Test Performer/Project Engineer

Date: 6/20/96

7.19.3 Install 10 feet (7.6 m) of 3.5 inch (8.9 cm) OD guide tube and push rod. Hold push rod and guide tube with clamps for 4 hours. Verify that hydraulic oil temperature is maintained below 140 F (60 C).

Hydraulic Oil Temperature 81°F

Completed: [signature] / [signature]
ARA Test Performer/Project Engineer

Date: 6/20/96

APPENDIX A

FUNCTIONAL TESTING
OBSERVATION/RESULTS DATA SHEET
COMMENT SHEET
GENERATOR TEST DATA SHEET

FUNCTIONAL TESTING
OBSERVATION/RESULTS DATA SHEET

TEST STEP	OBSERVATION/RESULTS	INITIALS	DATE
7.6.2, 7.6.3	Jack Pressures were eliminated, Testing measured max. push force diff. configs.	[illegible]	4/30/96
7.10.7	A light rather than a alarm indicates low Deion H_2O	[illegible]	5/8/96
7.10.8	Temp light not same as tank temp. Needs mixing to equlize tank temps.	[illegible]	5/8/96
7.11.9	Tip has only a single stage load cell	[illegible]	5/11/96
7.11.11 7.11.13	Used depth to shut down system rather than force	[illegible]	5/11/96
7.13.3 & 7.13.4	Guide tube depth has shutdown only, not a pre alarm.	[illegible]	5/13/96
7.13.11	When pushing on steel plate down force spikes before shutdown (110 times to respond)	[illegible]	6/20/96
7.14.1	Earth anchors were used rather than extra ballast.	[illegible]	4/25/96
7.10.9	No leaks were observed from spray washer seal which is where bellows would be. No Bellows Installed because of bad Fitup	[illegible] See 7.10.4	5/9/96
7.10.10	Spray washer cleaned pushrod of all visable contaminants	[illegible]	5/9/96
7.11.18 & 7.11.20	Tip force alarm and shutdown happened too fast because of tip hitting bottom of tank. Not a gradual force increase	[illegible]	5/11/96
7.11.20	Clay over area no third layer	[illegible]	5/11/96
7.13.5	Set alarm at 100 °C rather than 150 °F	[illegible]	5/9/96
7.13.11	High force a result in force spike from hitting steel plate	[illegible]	6/20/96
7.11.3	Add Ballast Configuration to Software Setup.	[illegible]	5/14/96
7.11.10	Took measurements up to 7 inches from barrel bottom	[illegible]	5/11/96

FUNCTIONAL TESTING
COMMENT SHEET

ITEM	DESCRIPTION	RESOLUTION	INITIALS	DATE
7.11.20	Used Clay over sugar urea rather than Urea, Clay, Urea layering	Two layers gave better results than three because of depth	[illegible]	6/20/96
7.16.19	Rod leaned against side ≈ 2°	Will retest in OTP	[illegible]	6/20/96

GENERATOR TEST DATA SHEET

RATED KW 19.0 dBA (MAX.) 85 RPMs 1800

RATED AMPS 79 HERTZ 60

	STEP	VOLTAGE	PEAK VOLTAGE	CURRENT (AMP)	~~WATTS~~ HERTZ	FREQ HERTZ	SPEED (RPM)	TEMP (°F)	OIL (PSI)	
No load	1	235 / 235	235	0 / 0	61	61 / ( )	1800 / 900	0F / 0F	55 / 50	High Idel / Low Idel
	2	235	↓	0 / 0	61	61	1800	20	55	Time @ 45 min
HVAC	3	235		20 / 25	61	61	1800	116	55	
HVAC Water Heaters	4	235		45 / 50	58-65	61	1800	140	55	
HVAC, Hyd Pump Water Heaters	5	235		45 / 50	61-61	61	1800	150	55	
HVAC, HP, WH Water Pump	6	235		46 / 52	62-63	61	1800	175	55	
No Load	7	235	↓	0 / 0	61	61	1800	175	55	
	8									

Leg 1 Leg 2

NOTE: The rated wattage, speed (RPMs), rated amps and number of poles will be recorded on the data sheet from the identification tags prior to the start of the testing.

TEST WITNESSES:

[signature] Project Engineer Date 5/7/96

[signature] Vendor Provided QC Representative Date 5/7/96

APPENDIX B

Exception to Acceptance Test

EXCEPTION TO ACCEPTANCE TEST

EXCEPTIONS				CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	RESOLUTION/DISPOSITION	ORGANIZATION	INITIALS	DATE
7.2.2	5/9/96	Bellows Adapotor did not fitup	Built by SAIC needs redesign befor Operational Tests Accept-As-Is	WHC	AR	5/30/96
7.10.4	5/8/96	Decon H_2O heat rate 20 rather than 40 °F/hr	Lower heat rate acceptable for operations Accept-As-Is	WHC	AR	6/10/96
6.2.10	5/7/96	Rung diameter 1" sq rather than 1.5" dia.	29 CFR 1910.23 allows smaller rung if calcs show good for 200 lb OK Accept As Is	WHC	AR	6/10/96

TEST APPROVED - NO EXCEPTIONS:

PROJECT ENGINEER [signature] DATE 8/15/96

QUALITY ASSURANCE [signature] DATE 8/15/96

TEST PERFORMER [signature] DATE 8/15/96

TEST APPROVED - WITH EXCEPTIONS:

PROJECT ENGINEER [signature] DATE 8/19/96

QUALITY ASSURANCE [signature] DATE 8/15/96

TEST PERFORMER [signature] DATE 8/15/96

EXCEPTION TO ACCEPTANCE TEST

EXCEPTIONS				CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	RESOLUTION/DISPOSITION	ORGANIZATION	INITIALS	DATE
6.2.14	5/7/96	Water Storage 140 gal rather than 100 gal	Better condition than with the 100 capacity Except-as-Is	WHC	AH	5/7/96
7.6.2,3	4/30/96	Jack pressures were eliminated	Since ballast load configuration was added to software jack pressures were not needed Except-As Is	WHC	AH	4/30/96
7.10.7,8	5/8/96	lights rather than alarms used to indicate conditions	Low H_2O level and H_2O temp need only lights to signal condition Except-As-Is	WHC	AH	5/8/96
7.11.11,13	5/11/96	Used depth to shutdown system rather than force	Either system force or depth was exceptable Except As Is	WHC	AH	5/11/96
7.13.1	5/13/96	Set Guide Tube depth @ 4 rather than 5 ft	Except-As-Is	WHC	AH	5/13/96
7.13.4	5/11/96	Guide tube has only a shut down no alarm	Shutdown mode is sufficient Except-As-Is	WHC	AH	5/11/96
7.13.5	5/9/96	Set Tip alarm at 100°C rather than 150°F	≈ Same Temp Except-As-Is For Test Purpose	WHC	AH	5/9/96
7.13.12	5/14/96	Used Dome load @ 40 tons rather than Jack Force 30 tons	Dome load more accurate Except As-Is	WHC	AH	5/14/96
7.16.2,18	6/20/96	Installed Different lengths of Guide Tubes and Push rods than Procedure	To better test different configurations the new assemblys were chosen Except-As-Is	WHC	AH	6/20/96
7.16.19	6/30/96	Rod leaned on 12" well ≈ 2° Inclination	Retest in OTP	WHC	AH	6/30/96

APPENDIX C

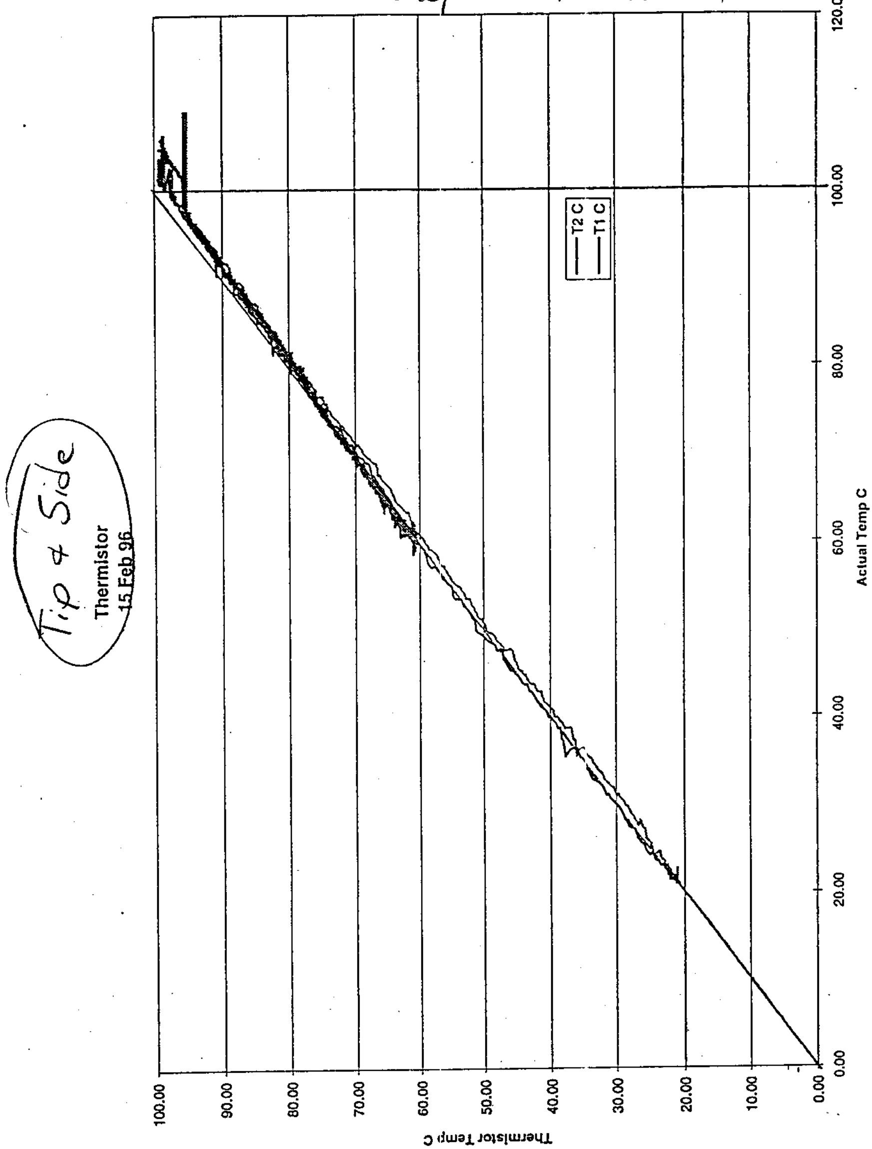
Figures

VERTEK WELDING INSPECTION REPORT
AS PER AWS D1.1 / SNT-TC1A (AWS D1.1 6.7.8)

WELD ID	PASS	FAIL	METHOD
H0342A	✓		MT Dry Visual
W3	✓		MT Dry Visual
H086-2A	✓		MT Dry Visual
H096-4A	✓		MT Dry Visual
H052-2A	✓		MT Dry Visual
W2	✓		MT Dry Visual
W3	✓		MT Dry Visual
H0872A	✓		MT Dry Visual

DATE 5/16/96	NAME Michael Davenport
LEVEL II	SIGNATURE Michael Davenport

Step C.3.21 + C.3.22



Step 6.3.2.3

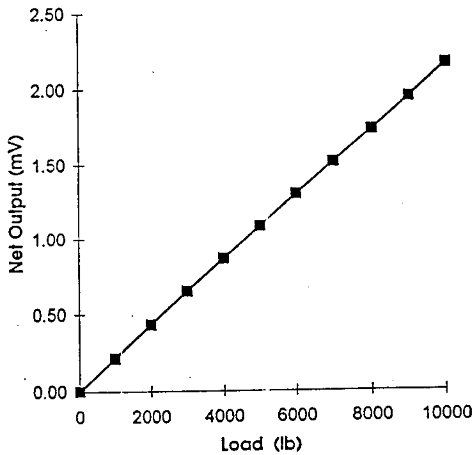
VERTEK
RR 1, Box 120A, Waterman Road
South Royalton, Vermont 05068
phone: (800) 639-6315 fax: (802) 763-8283

Cone Penetrometer Calibration
Tip Load

Cone Serial No. HAN-1 Rev 0
Rated Range 50000 lb
Calibrated with:
Excitation 5.00148 Volt DC
Amplification 1.0000
Load Reference: Interface S/N72693a

Date: 2-Apr-96
Calibrated by: [signature]
Approved by: [signature]

Load (lb)	Net Output (mV)
0	0.0000
1000	0.2160
2000	0.4320
3000	0.6486
4000	0.8656
5000	1.0823
6000	1.2988
7000	1.5155
8000	1.7319
9000	1.9481
10000	2.1641
9000	1.9482
8000	1.7322
7000	1.5160
6000	1.2999
5000	1.0833
4000	0.8663
3000	0.6495
2000	0.4324
1000	0.2160
0	-0.0004



Sensitivity 4.329E-05 mV / V / lb
r^2 0.999999
Nonlinearity 0.05% calibrated range
Zero Load Output 0.0023 mV/V

VERTEK

RR 1, Box 120A, Waterman Road
South Royalton, Vermont 05068
phone: (800) 639-6315 fax: (802) 763-8283

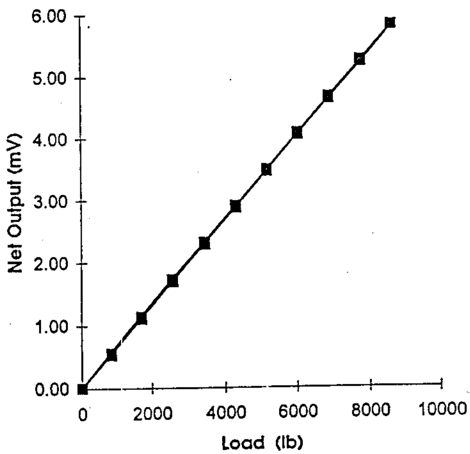
Step 6.3.2.4

Cone Penetrometer Calibration
Sleeve Load

Cone Serial No. HAN-1 Rev 0
Rated Range 8600 lb
Calibrated with:
Excitation 5.00180 Volt DC
Amplification 1.0000
Load Reference: Interface S/N72693a

Date: 2-Apr-96
Calibrated by: [signature]
Approved by: [signature]

Load (lb)	Net Output (mV)
0	0.0000
860	0.5257
1720	1.1047
2580	1.6935
3440	2.2841
4300	2.8737
5160	3.4625
6020	4.0513
6880	4.6409
7740	5.2303
8600	5.8180
7740	5.2631
6880	4.6755
6020	4.0845
5160	3.4982
4300	2.9084
3440	2.3183
2580	1.7276
1720	1.1388
860	0.5546
0	-0.0005



Sensitivity 1.362E-04 mV / V / lb
r^2 0.999867
Nonlinearity 0.96% fso
Zero Load Output -0.0587 mV/V

Item 1

VERTEK

RR 1, Box 120A, Waterman Road
South Royalton, Vermont 05068
phone: ~~(800) 639-6315~~ ~~fax: (802) 763-8283~~

Step 6.3.2.5

Pressure Transducer Calibration

Pore Pressure

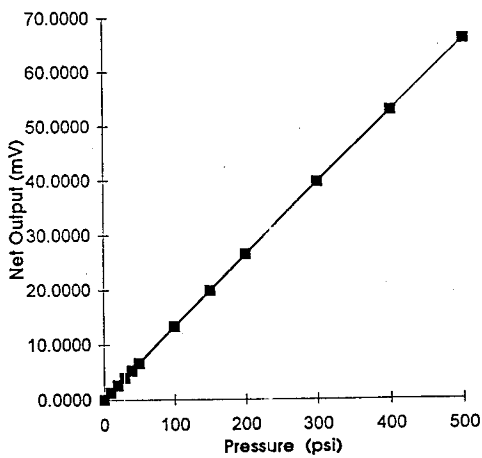
Date: 27-Mar-96

Calibrated by: TSM

Approved by: WEB

Rated Range 500 psi
Pressure Transducer Data Inst. S/N 5280-4-218
Calibrated with:
Excitation 4.00010 Volt DC
Amplification 1.0000
Load Reference: Data Inst. S/N 95082-413

Pressure (psi)	Net Output (mV)
0	0.0000
10	1.3310
20	2.6550
30	3.9780
40	5.3050
50	6.6290
100	13.2550
150	19.8700
200	26.4800
300	39.6940
400	52.8950
500	66.0940



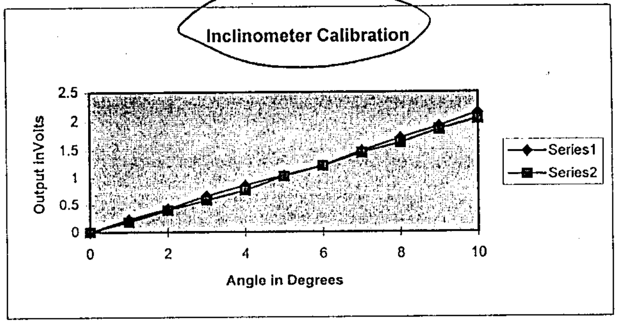
Sensitivity 3.306E-02 mV/V/psi
r^2 0.999998
Nonlinearity 0.05% calibrated range

nem 1

5/7/96

Step 6.3.2.6

degrees	x	y
0	0	0
1	0.231	0.182
2	0.429	0.396
3	0.664	0.587
4	0.859	0.769
5	1.047	1.026
6	1.224	1.217
7	1.491	1.456
8	1.711	1.63
9	1.914	1.858
10	2.144	2.04



cone s/n

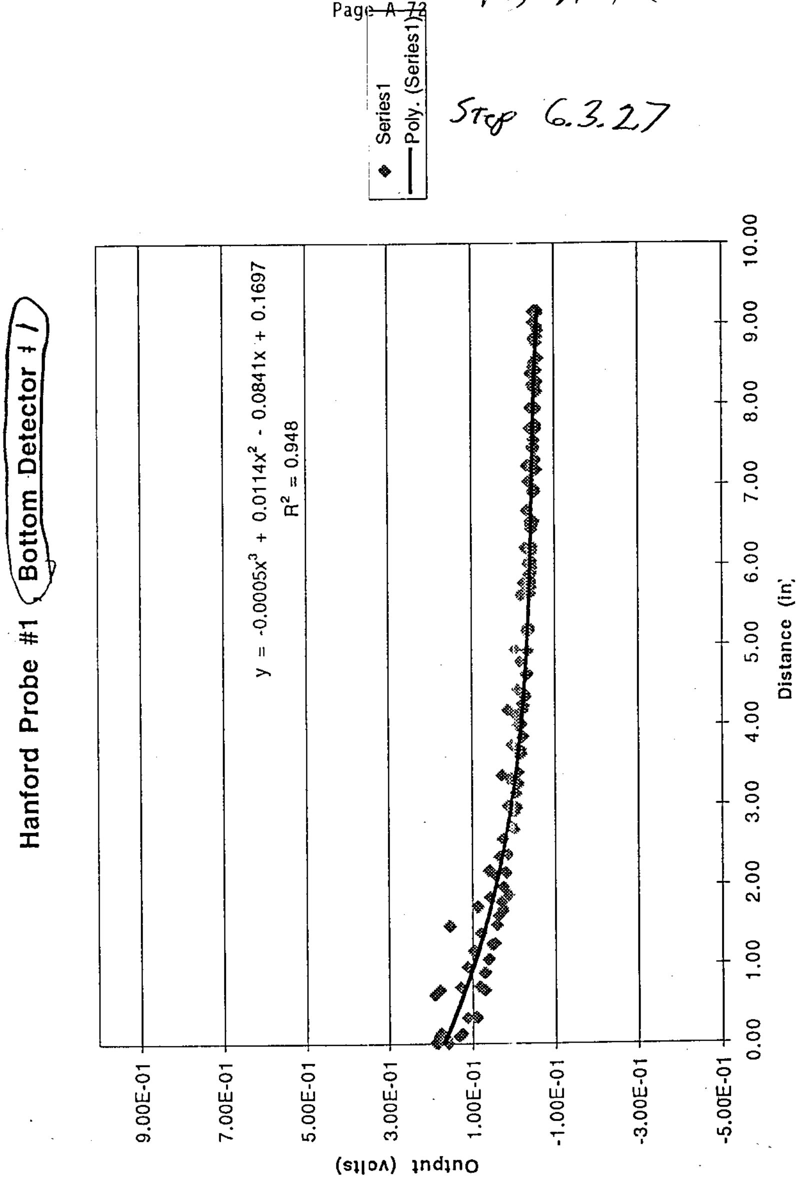
Slope of X-Axis	**0.211973**	volts/degree
R squared=	0.999114	
Slope of Y-Axis	**0.2072**	volts/degree
R squared=	0.999286	

Pg. A-72

Step 6.3.27

Aug 9th, 1991

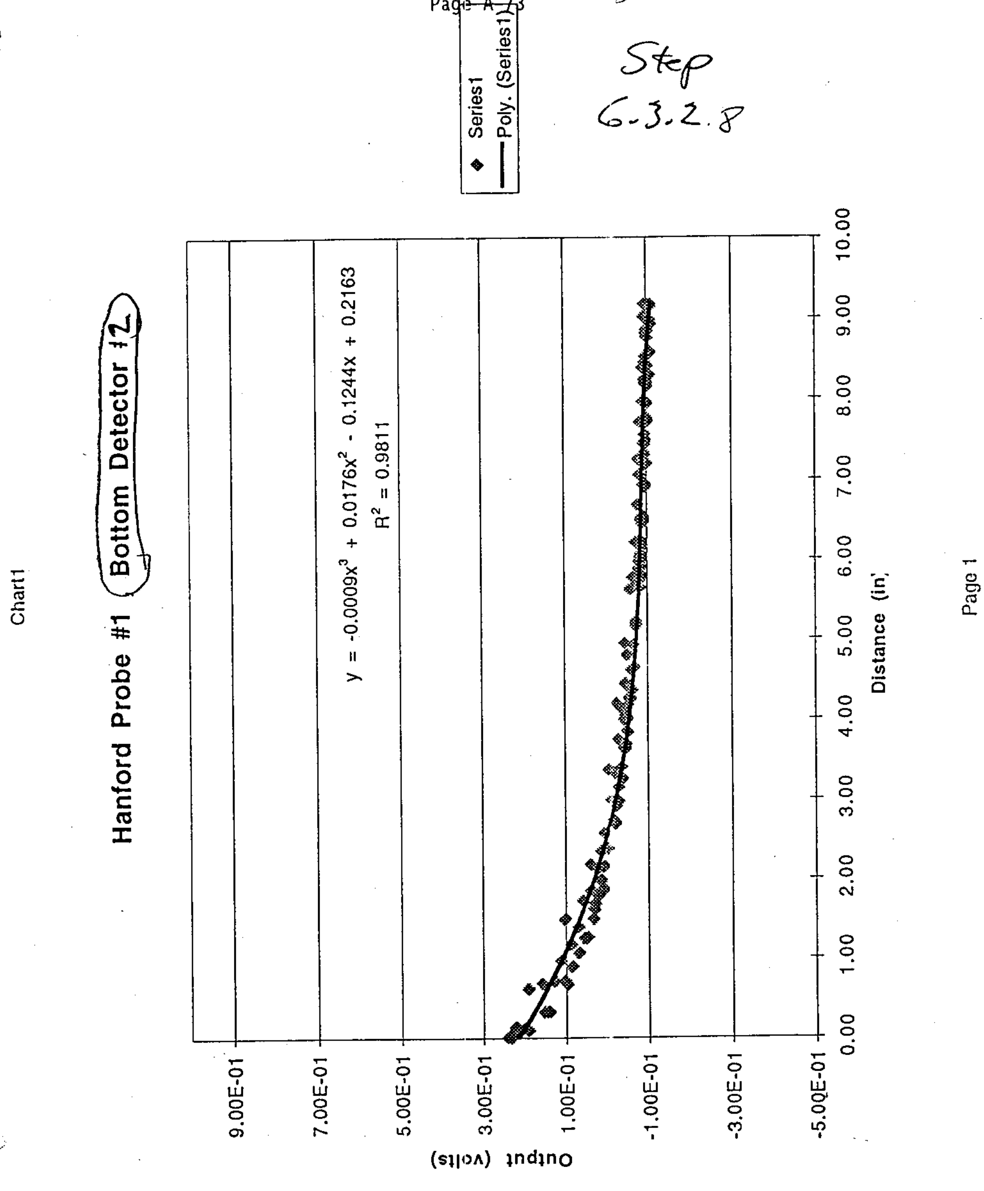
Chart1



Pg. A-73

Step
6.3.2.8

Nov 9th, 1996



UniMeasure
501 SW 2nd St., Corvallis, Oregon 97333, U.S.A.
Tel: (503) 757-3158 Fax: (503) 757-0856

pg. A-74

CUSTOMER: APPLIED RESEARCH ASSOC.
DATE: April 6, 1995
P.O NUMBER: 2302
TYPE: Analog Position
MODEL NO.: P-50A
RANGE: 50"
SERIAL NO.: 25044004
CIRCUIT DIAGRAM: A
DIMENSION DIAGRAM: T
OPTIONS:

CALIBRATION DATA

Rods

Step 6.3.2.9

TEST VOLTAGE 9.9988 VDC

DISPLACEMENT (inch)	MEASURED OUTPUT (volt)	CALCULATED OUTPUT (volt)	ERROR (VOLT)
0.00	0.056	0.056	0.000
10.00	2.009	2.007	0.001
20.00	3.959	3.958	0.000
30.00	5.910	5.909	0.000
40.00	7.862	7.860	0.001
50.00	9.812	9.812	-0.000

AVERAGE SENSITIVITY: 19.51 mV/V/inch
LINEARITY: ± 0.01% FULL SCALE

Document4

UniMeasure

501 SW 2nd St., Corvallis, Oregon 97333, U.S.A.
Tel: (503) 757-3158 Fax: (503) 757-0856

Pg. A-75

CUSTOMER: APPLIED RESEARCH ASSOC. **DATE:** April 6, 1995

P.O NUMBER: 2302

TYPE: Analog Position **MODEL NO.:** P-50A **RANGE:** 50"

SERIAL NO.: 25044006 **CIRCUIT DIAGRAM:** A **DIMENSION DIAGRAM:** T

OPTIONS:

CALIBRATION DATA

Gaid Tube

6-3.2.10

TEST VOLTAGE 9.9988 VDC

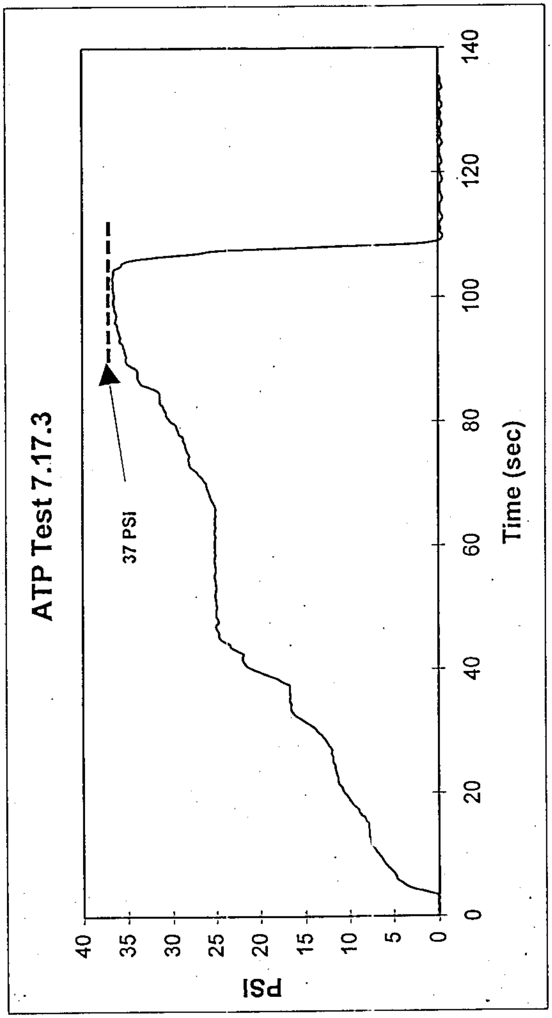
DISPLACEMENT (inch)	MEASURED OUTPUT (volt)	CALCULATED OUTPUT (volt)	ERROR (VOLT)
0.00	0.033	0.033	0.000
10.00	1.985	1.984	0.001
20.00	3.938	3.934	0.003
30.00	5.886	5.885	0.001
40.00	7.840	7.836	0.004
50.00	9.786	9.786	0.000

AVERAGE SENSITIVITY: 19.51 mV/V/inch

LINEARITY: ± 0.04% FULL SCALE

Document4

Chart1


ATP Test 7.17.3
37 PSI
PSI
0
5
10
15
20
25
30
35
40
Time (sec)
0
20
40
60
80
100
120
140

APPENDIX B

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
1	1.0	The system consists of a cone penetrometer skid and a cone penetrometer support trailer.	V	6.2.1
2	3.1.1	The hydraulically driven cone penetrometer shall be designed to penetrate layers of soft salt cake, sludge and liquid while gathering and storing information from the cone penetrometer sensor package. The cone penetrometer shall measure several physical properties as it penetrates through the underground storage tanks waste.	T	7.11
		The cone penetrometer system shall interface with a Raman spectroscopy sensor for chemical speciation measurement.	T	7.18
		Moisture measurements will be taken after the cone penetrometer push rod has reached the bottom of the Underground Storage Tanks. The cone penetrometer system shall be designed to integrate with the moisture measuring system.	T/A	7.18
		The system shall remove the cone penetrometer push rod and guide tube from the Underground Storage Tanks after in-tank measurements are complete.	T	7.9
		A decontamination unit shall be mounted on the support trailer to decontaminate the cone penetrometer push rod and guide tube during its removal from the Underground Storage Tanks.	V	6.2.2
		Sequencing of rod and guide tube removal shall be such that guide tube interior requires minimum decontamination. The decontamination of the cone penetrometer push rod and guide tube shall be such that decontamination waste streams are returned to the tank during the decontamination process.	T	7.9
		The maximum volume of water to be added to a Underground Storage Tanks is 100 gallons (378.5 liters).	V	6.2.14
3	3.2.1.1	The cone penetrometer shall have an approximate vertical net 35 ton (311375.5 N) pushing capability.	T	7.14
4	3.2.1.2	The cone penetrometer shall be designed to penetrate Underground Storage Tanks waste starting approximately from 15 feet (4.6 m) up to 55 feet (16.8 m) below grade to approximately 35 feet (10.7 m) up to 55 feet (16.8 m) below grade.	T	7.16

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
5	3.2.1.3	The cone penetrometer push rod and guide tube shall attain access to the Underground Storage Tanks through the riser via WHC provided riser adaptor.	V	6.2.3
6	3.2.2	The cone penetrometer system shall be able to maneuver over the riser and locate within ± 0.25 inches (.64 cm) of the riser's dead center. Positioning shall be assisted by a hydraulically operated system that accurately shifts the cone penetrometer approximately ± 6 inches (15 cm) in either x or y horizontal directions.	T	7.5
7	3.2.3	The cone penetrometer system shall exert no greater than 1000 lbs (4448.2 N) vertical loads on the risers and as low as achievable on the horizontal load on the riser.	A	See attachment 1
8	3.2.4	The cone penetrometer shall utilize 4 to 24 inch (10 to 61 cm) schedule 40 risers.	V	6.2.3
9	3.2.5	A clamping system shall exist on the skid such that the push rod and guide tube cannot at any time drop onto the Underground Storage Tank bottom. The clamping system shall be compatible with the push rod and guide tube.	T	7.12
		The push rod and guide tube shall not leak gas or liquid while inside the Underground Storage Tank.	T	7.17
		Safety mechanical clamps shall be provided for the push rod and guide tube such that at all times two clamps will be activated on push rod and guide tube during operation. Clamps include normal push clamps and safety clamps.	A	Design Package #19
		During removal, the push rod and guide tube shall be decontaminated. The supplier shall supply the decontamination unit which shall be compatible with the WHC riser/decontamination adaptor.	T	7.10

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
10	3.2.6	The cone penetrometer push rod and guide tube will be decontaminated during removal from the Underground Storage Tank. The decontamination unit shall interface with a WHC provided riser/decontamination adaptor. The decontamination unit shall be located on the support trailer. The decontamination unit shall have a self contained heating system which will heat a 100 gallon (378.5 L) container of water from 50 °F to 130 °F (10 to 54.4 °C) in 2 hours and maintain that 130 °F (54.4 °C) in ambient temperatures ranging from 10 °F to 100 °F (-12.2 to 37.8 °C). The unit shall contain a pumping system that can supply 3.8 gpm (14.4 liters per minute) (minimum) of water at 400 psig (2758 kPa) (minimum). The generator power supply, mounted on the skid, shall power the decontamination unit. The decontamination fluid shall be "potable" or "pure" water.	T	7.10
		All necessary gauges and operational controls for the unit shall be visible and accessible to the operator while the decontamination unit is in operation. All gauges and operational controls shall be in close proximity such that the operator can read the gauges and operate the unit simultaneously.	T	7.10
11	3.2.7.1	Cone penetrometer basic sensor package shall include tip pressure with a dual stage load cell, sleeve friction sensor, pore pressure sensor, tip and sleeve temperature sensors, inclination sensor, depth and a bottom detection system.	T	7.11
12	3.2.7.1.1	Tip pressure shall measure pressures between 0 and 15,000 psi (0 and 103421 kPa). A ± 5 % accuracy shall be required for these sensors.	T/A	7.11 Attachment 2
13	3.2.7.1.2	Pore pressure shall measure pressures between 0 and 200 psi (0 and 1379 kPa). A ± 5 % accuracy shall be required for these sensors.	T/A	7.11 Attachment 2
14	3.2.7.1.3	Sleeve friction shall measure pressure between 0 and 300 psi (0 and 2068 kPa). A ± 5 % accuracy shall be required for these sensors.	T/A	7.11 Attachment 2
15	3.2.7.1.5	The tip temperature shall measure temperatures between 60 to 320 °F (15.6 to 160 °C). A ± 5% accuracy shall be required for these sensors.	T/A	7.11 Attachment 2

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
16	3.2.7.1.6	All sensors listed above shall accurately perform measurements and survive the environmental conditions listed in paragraph 3.5. If the results from the waste simulant initial testing (paragraph 4.0) demonstrate deficiencies in the specified ranges in sections 3.2.7.1.1 through 3.2.7.1.5, the sensor ranges shall be changed to incorporate the results from the testing. The sensor package shall be able to withstand the Underground Storage Tank environment for a period of 2 weeks without any functional degradation.	T/A	7.11 Attachment 2
17	3.2.7.1.7	Measurements for tip pressure, pore pressure, and sleeve friction shall be calibrated for accurate results for salt cake, sludge and liquid layers.	T	7.11
18	3.2.7.1.8	Instructions shall be provided by the supplier on how to calibrate the instruments. The calibration procedures shall be identified by the supplier and approved by WHC. All instruments shall be delivered with a certified calibration (traceable to National Institute of Standards and Technology standards). All software and equipment required for the calibration of sensor shall be provided. The software required shall be provided as described in paragraph 3.2.10.	V	6.3.2
19	3.2.7.1.9	The cone penetrometer sensor package cables within the inner diameter of the push rod shall be designed to be remotely removed after the push rod has reached the Underground Storage Tank bottom. The removal of the cables shall provide an unobstructed path within the inner diameter of the cone penetrometer push rod for other sensors (not included in this specification) to be lowered into the Underground Storage Tank.	T	7.18
20	3.2.7.2	The data acquisition system shall be located in an enclosed compartment on the skid.	V	6.2.4
21	3.2.7.3	The cone penetrometer system shall have a redundant bottom detection sensor system. The sensors shall detect the bottom of the tank, alarm and stop the push rod prior to any damage to the Underground Storage Tank bottom. This means that two sensors or methods for bottom detection shall be working independently at the same time to assure the Underground Storage Tank bottom is not damaged.	T	7.15

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
22	3.2.8	The cone penetrometer system shall be equipped with adjustable alarms indicating loss of power, bottom detection system, tip and side temperature, excessive cone penetrometer inclination and limits on the down force. Limits shall be adjustable. All alarms shall be audible within the skid. The alarms shall sound as the alarm limits are approached. The down force limiter, bottom detection system, tip temperature and cone penetrometer inclination limits shall alarm and initiate automatic shutdown of the hydraulically driven push rod, if any one limit is reached.	T	7.10, 7.11, 7.12, 7.13, 7.15
23	3.2.9.1	The cone penetrometer system shall be equipped with data storage and retrieval capabilities. The data acquisition system shall be compatible with all supplied probes and capable of acquiring and logging dual stage load cells for tip pressure and sleeve friction, pore pressure, redundant tip temperatures, depth, downward force and redundant bottom detection data.	T	7.11
24	3.2.9.1	Cabinet space shall be provided for the moisture and Raman sensor computer equipment and associated hardware.	V	6.2.4
25	3.2.9.2	The data acquisition system shall contain the following hardware: * One operator station. * I/O channels to accommodate supplier's sensors plus 10 spare I/O channels. * A removable cartridge disk drive (90 MB minimum). * A laser printer with graphics package compatible with all input devices in 3.2.9.1. * The data acquisition system shall survive the conditions listed in section 3.5. The computer equipment shall be protected against dust. A NEMA 12 enclosure shall be acceptable to protect the equipment.	V	6.2.5
26	3.2.9.3	The data acquisition system shall incorporate software selectable gains and filter settings.	T	7.11
27	3.2.9.4	The data acquisition system shall provide real time graphical and numerical displays of data, available during penetration. The graphical display shall have scaling capabilities.	T	7.11
28	3.2.9.5	The data acquisition system shall be capable of recording time-stamped comments or notes in the form of a daily ASCII file. Each data point shall have a time stamp. The data acquisition system shall allow the operator to pause and resume data collection and record such events in the data file.	T	7.11

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
29	3.2.9.6	The acquisition system shall provide on-line access to a DOS prompt. The data acquisition system shall support both ASCII and binary file formats. The data acquisition system shall generate individually unique data file names.	T	7.11
30	3.2.9.7	The system shall contain a menu driven user interface.	T	7.11
31	3.2.9.8	The acquisition system shall store project specific test setup parameters to be used as defaults.	T	7.11
32	3.2.9.9	Data logged from the sensors listed in section 3.2.9.1 shall be used to output physical and mechanical properties developed from the initial tests in section 4.0. WHC engineering shall evaluate the results of the initial tests and determine which properties to output. Properties of interest are compressive strength, yield stress, and shear strength.	T	7.11
33	3.2.9.10	The data acquisition system shall have the capability of sending the collected data output to another system via a modem (CCITT standard or equivalent industry standard).	V	7.11
34	3.2.10.1	Instrument calibration software for all cone penetrometer tip sensors shall be provided. These sensors include dual stage load cells for tip pressure, sleeve friction, pore pressure, tip temperature (redundant), depth, downward force, and bottom detection (redundant). The software shall be compatible with the sensors and shall interface with the data acquisition software.	V	7.11
35	3.2.10.2	The sensor calibration system shall be capable of generating report-quality instrumentation calibration plots. Real time graphical and numerical display of instrumentation and calibration values shall be provided. Time-stamped comments or notes in the form of a daily ASCII file to be used as a daily operator's log shall be recorded. Calibration data shall automatically store data into a unique data file.	T	7.11
36	3.2.10.3	Calibration data for the tip and side temperature shall be provided prior to installation on the tip. The temperature calibration shall be verified by three different temperature points.	T/V	6.3.2.1, 6.3.2.2, 7.11

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
37	3.2.11.1	Two components (calibration and data acquisition) shall be developed for the cone penetrometer system. The data acquisition software acquires, stores and retrieves data acquired during system operation. Details on the system are described in section 3.2.9. The calibration software calibrates cone penetrometer sensors specified in section 3.2.10. Section 3.2.11 contains information on software functions, assumptions and interfaces.	T	7.11
38	3.2.11.2	This product is independent and totally self-contained. The major components of the system are the data acquisition system and the calibration system.	T	7.11
39	3.2.11.3	The system shall perform the following functions: sensor data acquisition and logging, sensor calibration and tank/system safety checks. The sensors include a dual stage load cells for tip pressure, sleeve friction load cell, pore pressure pressure transducer, tip and side temperature thermocouple or thermistors, depth, downward force and redundant bottom detection. From tip pressure, sleeve friction, and pore pressure, the following measurements shall be calculated after penetration is complete: compressive strength, yield stress, shear strength and tank stratigraphy. The system shall also perform safety checks for tank protection and protection from possible tank hazards. The down force limiter, bottom detection system, tip and side temperature and cone penetrometer inclination limits shall alarm and initiate automatic shutdown of the hydraulically driven push rod, if any one limit is exceeded. WHC shall provide the supplier with down force and side and tip limits. The sensors to be calibrated include the dual stage load cells for tip pressure, sleeve friction, pore pressure, tip and side temperature and bottom detector.	T	7.11, 6.3.2

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
40	3.2.11.6	The data acquisition software shall: * Be user friendly * Compatible with all supplied sensors and capable of acquiring and logging data from supplied sensors * Be capable of data storage and retrieval * Provide real time graphical and numerical displays of data, available during penetration. The graphical display shall have dual scaling capabilities. * Time-stamped comments or notes in the form of a daily ASCII file. Each data point shall have a time stamp. The data acquisition system shall allow the operator to pause and resume data collection and record such events in the data file. * The acquisition system shall provide on-line access to a DOS prompt. The data acquisition system shall support both ASCII and binary file formats. The data acquisition system shall generate individually unique data file names. * The system shall contain a menu driven user interface. * The acquisition system shall store project specific test setup parameters to be used as defaults. The calibration system shall be capable of: * Calibrating sensors listed in section 3.2.10.1. * Generating report-quality instrumentation calibration plots. Real time graphical and numerical displays of instrumentation and calibration values shall be provided. Time stamped comments or notes in the form of a daily ASCII file to be used as a daily operator's log shall be recorded. Calibration data shall automatically store data into a unique data file.	T	7.11

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
41	3.2.11.7.1	The system shall contain a menu driven user interface. The content of this interface shall contain information pertinent to the operation of the system as well as project specific test setup parameters. The user shall input project specific parameters such as operator's name, date, tank and riser location/number, and operational mode (calibration/data acquisition). Output shall include sensor output as a function of depth, moisture and temperature profiles and derived quantities such as compressive strength, yield strength, shear strength and tank stratigraphy as a function of depth. Hardcopy page layouts shall contain all the output information listed above as well as the user input.	T	7.11, 7.18
42	3.2.11.7.2	The data acquisition and calibration system will contain a personal computer system which interfaces with an analog to digital converter and an amplifier board. Hardware interfaces with the moisture probe are addressed in WHC-SD-WM-FDC-047.	V	6.3.1, 6.4.1
43	3.2.11.7.3	The cone penetrometer software shall interface with the moisture probe software which is written using National Instrument LabView software.	T	7.18
44	3.2.11.8	Sampling rate shall be software adjustable.	T	7.11
45	3.2.11.9.3	At each tank, the operator, tank and riser location must be entered. Each data file shall have a unique name.	T	7.11
46	3.2.11.9.4	The system shall be available upon demand, which may include weekends, annual and off-hour availability.	A	Design Package #011
47	3.3.2	The skid mounted system shall have the capability to exert a reaction load force of no less than 35 tons (311375.5 N) onto cone penetrometer push rod. The total loaded skid system shall be no more than 45 tons (400340 N). The skid system shall be designed to have the capacity of easily reducing the reaction load by 25 tons (222411 N) from its fully loaded 45 tons (400340 N) during rod removal. Twenty five tons (222411 N) of the 45 tons (400340 N) total shall be in the form of removable ballast.	T	7.6

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
48	3.3.3	The data acquisition system and control shall be contained in the environmentally controlled compartment. The data acquisition and control shall be protected with a NEMA 4 enclosure. A slide door shall exist in between the data acquisition and control room and the hydraulic room. The hydraulic ram will be viewed from the data acquisition console.	V/T	6.2.4, 7.8
49	3.3.4	The skid shall be compatible with riser and riser equipment.	V/T	6.2.3, 7.2
50	3.3.5	A four point outrigger leveling system shall provide a minimum of 2 feet (0.6 m) of leveling travel. In addition, four mechanical outriggers shall be provided as backup support, if hydraulic outrigger system fails.	T	7.4
51	3.3.6	Electrical power shall be provided to the cone penetrometer skid by a separate diesel powered generator. The generator shall be self contained and permanently mounted on the support trailer. The generator shall be capable of handling a maximum load when all units are operating simultaneously for at least two days. All wiring shall meet the NFPA 70 (National Electric Code). Power distribution equipment shall be included on the trailer. which maybe as far as 50 feet (15 m) from the cone penetrometer skid.	T	7.3
		Power shall feed into a surface mounted distribution panelboard which in turn will supplies the lighting, HVAC unit, and power receptacles. AC power receptacles shall be placed on interior and exterior wall. Receptacles on the interior shall be no more than six feet (1.8 m) apart. Two 20 amp exterior receptacles, on ground fault interruptible circuits (GFIC), shall be located on the exterior walls. Exterior receptacles shall be shock proof. At least, five receptacle shall be placed on the interior side wall and shall provide "clean" AC power to the computer and data acquisition equipment through the use of a power inverter or an uninterruptable power supply. The vent exhaust and radiator fan shall be located away from the ground to avoid dust from the ground. The location of the power generator exhaust shall be such that the exhaust does not leak into occupied space or the HVAC.	V	6.2.6
		The power generator noise generation shall be damped such that the levels of noise are no more than 85 dBA such that operators can hear the alarms.	T	7.3

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
52	3.3.7	The skid and all auxiliary equipment shall be bonded (metal to metal connection) to the tank during operation of the cone penetrometer. Grounding shall be per NFPA 70. WHC-SD-WM-TI-568 Rev 1 outlines grounding and bonding requirements for electrical and non-electrical installation at Hanford tank farms.	T	7.3
53	3.3.8	Light fixtures shall be located within the compartment for instrument read out as well as general use. Lighting levels shall adhere to the 50-30-10 foot-candles (538-322-108 lux) illumination standard for workstation, work areas and non-working areas (see section 2.2 for applicable standards). Fixtures shall be a standard, energy efficient, industrial grade and approved for indoor/outdoor locations. Lighting shall be operated by a switch on the inside wall.	T/A	7.11 Design Package #14
54	3.3.10	Install an electric air conditioner/heater with a minimum capacity to regulate to 75 °F (23.9 °C) with 120 °F (48.9 °C) outside temperature, and three people inside the skid enclosure and 70 °F (21.1 °C) with a -30 °F (-34.4 °C) outside temperature, 50 MPH (80.5 km/h) wind with no people in the skid. The volumetric airflow rate shall provide between four and eight air changes per hour. A 0.1 inch water (24.9 Pa) positive pressure shall exist when the doors are closed. The supply filter shall be 80% efficient or greater for particles greater than 5 microns.	T/A	7.8 Design Package # 2
55	3.3.11.1	The minimum cone penetrometer push rod inner diameter shall be 1 inches (2.5 cm). The cone penetrometer push rod and guide tube shall fit into a 4 inch (10.2 cm) schedule 40 riser with a minimum of 0.25 inch (0.6 cm) clearance all the way around to accommodate for some riser deformity. A 6 inch (15.2 cm) OD guide tube shall mate with the 1.75 inch (4.4 cm) OD rod for situations requiring greater push capabilities. This 6 inch (15 cm) OD guide tube and 1.75 inch (4.4 cm) OD rod shall be used in 12 inch (30.5 cm) risers.	V	6.2.3
56	3.3.11.2	A hydraulically driven guide tube shall provide buckling support for cone penetrometer push rod. The guide tube and cone penetrometer push rod shall be independent of each other. The guide tube installation system shall be designed to lower the guide tube into the tank both when the push rod is in place and prior to push rod deployment. The guide tube and push rod shall be supported from the skid at all times.	T	7.16, 7.9

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
57	3.3.11.3	A hydraulic fluid reservoir and pump shall be provided on the support trailer. The fluid shall be cooled and temperature controlled. An indicator light shall warn the operator of overheating and low fluid indicator.	V/T	6.2.2, 7.13
58	3.3.11.4	All hydraulic and electrical controls shall be visibly labeled and mounted in the skid enclosure. These controls shall include all manually operated valves to operate the push rod and guide. All gages shall be mounted in close proximity to the hydraulic controls.	V	6.2.7
59	3.3.11.5	The cone penetrometer push rod shall be leak tight at the couplings (see section 7.2 sixth bullet). No liquid or gas shall leak into the inner annulus space. The gap between the cone penetrometer push rod outer wall and guide tube inner wall shall be sealed to eliminate the possibility of vapor traveling into the skid (see Detail 1 from Figure 3).	T	7.17
60	3.3.11.6	None of the cone penetrometer components shall spark. The Underground Storage Tank environment is potentially flammable. All electrical equipment in the push rod tip sensor package, cone penetrometer push rod, and 36 inches from the top of the hydraulically deployed guide tube shall comply with Underwriters Laboratory (UL), Factory Mutual (FM), or Institute of Electrical and Electronic Engineers (IEEE) requirements for a Class 1 Division 1, Group B environment of the NEC Article 500. The cone penetrometer system shall comply with the design requirements outlined in WHC-SD-WM-DA-201.	V/A	6.2.13, WHC-SD-WM-DA-201
61	3.3.11.7	A 1.75 inch (4.4 cm) OD blunt faced cone penetrometer tip shall be used in order to reduce shock to the bottom of the Underground Storage Tank. The pore pressure inlet filter shall be located behind the tip.	V	6.2.3
62	3.3.11.8	The cone penetrometer push rod and guide tube shall be locked in place upon loss of power.	T	7.9
63	3.3.11.9	The cone penetrometer hydraulic deployment unit shall be outside of the skid enclosure.	V	6.2.8
64	3.3.11.10	The cone penetrometer push rod and guide tube storage shall be located and secured on the side of the skid enclosure.	V	6.2.8

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
65	3.4	The supplier shall identify maintenance requirements including the frequency of maintenance. A recommended spare parts and supplier list and troubleshooting procedures shall be provided by the cone penetrometer supplier. The unit shall be designed for easy accessibility to perform routine required maintenance and calibrations. The skid equipment which may come into contact with tank waste shall contain a minimum of crevices, have a smooth surface or finish to promote decontamination and/or easily replaced with a minimum of radiation exposure to personnel.	V	6.2.3
66	3.5	The cone penetrometer system shall meet the requirements of this performance specification under the following environmental conditions: <u>External Conditions:</u> Operating temperature: 10 to 120 °F (-12.2 to 48.9 °C) Storage temperature: -40 to 120 °F (-40 to 48.9 °C) Humidity: 10-100 % Elevation: 0 - 600 feet above sea level (0 to 183 m) Exposed equipment to withstand sand and dust The sensors within the cone penetrometer push rod shall operate under the following conditions for a period of no less than 2 weeks without degradation. <u>Underground Storage Tank Waste Environment:</u> Waste Temperature: 60 - 212 °F (15.6 to 100 °C) Radiation: 0 - 900 Rad/hr pH: 10 - 14 Flammable The system shall withstand any normal shock and vibration generated during the operation of the cone penetrometer.	T/A	6.3.2 Attachment 2
67	3.6	The cone penetrometer skid shall meet all applicable non-radioactive DOT requirements.	V	6.2.9
68	3.7	All equipment shall be built to OSHA requirements.	V	6.2.10

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
69	3.8	The skid shall meet all requirements in the applicable National Fire Protection Association.	V	6.2.11
70	5.1	All parts which are exposed to environmental conditions listed in this performance specification shall be non-corrosive. Dissimilar metals shall be insulated against galvanic corrosion. No aluminum or other reactive metals shall be utilized in the fabricated components which may potentially be exposed to tank waste.	A	Attachment 3
71	5.2	The cone penetrometer skid shall be painted inside and outside with rust inhibiting primer and an exterior coat of the manufacturer's standard color paint. Penned aluminum decking in high traffic areas is required. Carbon steel for the rod and guide tubes is acceptable.	V	6.2.15
72	5.3	Warning tape, signs or placards shall be used where necessary to indicate potential industrial safety risks. Such items shall be designed and located where operating and/or maintenance personnel cannot fail to notice them before any part of the equipment is operated or opened for maintenance. The labeling of radiological conditions per the Hanford Site Radiological Control Manual (HRSRCM-1) shall be left to WHC personnel, due to the complexity of the requirements.	V	6.2.10
73	5.4	The supplier shall ensure that any fastener with head marks matching those on the attached U. S. Custom Fasteners Headmarks list (Figure 4) are not utilized on this contract. These fasteners are not acceptable and will cause rejection of the cone penetrometer system/components or spare parts which use these fasteners. Bolts showing minor deviations from the examples in Figure 4, such as head stamp placement deviation or grade identification marks/headstamp orientation can still be considered suspect. The grade identification marks do have to be equally spaced radially as shown in Figure 4.	V	6.2.12

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
74	5.5	The cone penetrometer shall be designed per ASCE 7-88 (or ANSI A58.1) standard, AISC S326 standard and AISC Manual of Steel Construction. Conservative structural safety factor shall be approved by WHC prior to design. The system shall survive the following conditions: Wind Loads: Fastest Mile Wind Speed: 70 mi/h (112.7 km/h) Importance Factor: 1.07 Exposure category: C	A	Attachment 4
		Roof Load Live Loads: Per ANSI A58.1 Snow Loads: 20 psf (1 kPa) minimum roof load	A	Design Package #016
		Load Combination D+L+W D+L+S where D= Dead Load W = Wind Load L = Live or Operational Load S = Snow Load	A	7/14
		Transportation: 3G Longitudinal 2G Lateral 1G Vertical (not including gravity)	A	TBD

Item	WHC-S-0241 Paragraph	WHC-S-0241 Requirement	Method Used	ATP Paragraph
		Outriggers Requirements: Seismic analysis shall be performed on the push skid with the outriggers fully extended. The purpose of the analysis is to determine if the outriggers can withstand the seismic load case and will not tip-over. The seismic load case shall include seismic loads in three directions (two horizontal and one vertical). The total seismic load shall be determined by combining the effects of the horizontal and vertical loads using the square root sum of the squares methods. The total seismic load shall be added to the gravity load for the structural evaluation. Seismic 0.38 G Horizontal Wind load analysis shall be performed on the push skid with the outriggers fully extended. The purpose of the analysis is to determine if the outriggers can withstand the wind load and will not tip-over. The wind load shall be applied in the worst direction and added to the gravity load for the structural evaluation. Wind Load 80 mi/h (129 km/h) Importance Factor 1.00 Exposure Category C	A	Design Package #008 ETS-W-96-849
75	5.7	Primary load bearing loads (>200 lbs (889.6 N)) of lifting devices and their attachment to structural members shall be magnetic particle (MT) tested or penetration tested (PT) and visually tested per AWS D1.1 on final pass. Primary welds shall be identified by WHC prior to fabrication. Critical welds shall be examined prior to and after loading the cone penetrometer to 1.5 times the maximum operating load. Critical welds shall be identified by WHC prior to fabrication. Examination shall consist of VT and MT or PT per AWS D1.1 on the final weld pass.	T	7.1

Attachment 1:

The allowable loads on the riser are 1000 lbs vertically and 565 lb horizontally (see WHC-SD-WM-DA-212).The riser assembly (riser, riser adaptor & decontamination unit) and the cone penetrometer are connected by flexible bellows. No forces are transmitted from the bellows to the riser. The cone penetrometer only method of transmitting force to the riser would be if the cone penetrometer would go off at an angle. The safety system monitors the inclination of the cone penetrometer and shuts the system down, if exceeded. The safety system setpoint is 3°. The setpoint is sufficient so that the cone penetrometer system does not exert force on the riser. The allowable loads will be addressed in the operational procedures (riser straightness/integrity).

Attachment 2:

The following table includes the sensors and material limits and accuracy.

Sensor	Material	Storage Temperature (°C)	Operating Temperature (°C)	Radiation Limit (Rad)	Instrument Accuracy
Tip Pressure	Micro Measurement Load Cell (source)	Room	-50 to 150	$1.5x10^4$	± 5% FS
Pore Pressure: Filter	Polyethylene	Room	20 to 116	3.8×10^5	N/A
Sensor	Kulite XT-140 (source)	Room	-70 to 125	$1.5x10^4$	± 5% FS
Sleeve Friction	4340 Steel Micro Measurement Load Cell (source)	Room	-50 to 150	$1.5x10^5$	± 5% FS
Tip Temperature	Keystone Glass Encased glued to Mandrel Digi-Key (source)	10 to 100	-50 to 204	$4x10^5$	± 5% FS
Side Temperature	Hydlar (Kevlar) 415 Stainless Steel Digi-Key (source)	10 to 100	-50 to 204	$4x10^5$	± 5% FS
Inclinometer	Spectron SP5000 (source)	Room	-54 to 125	$4x10^5$	± 0.5% FS between ±15°
Bottom Detector	ARA (source) IC chip, PCB, resistors, Teflon Cable, diodes	Room	-55 to 150	$1.5x10^4$	± 10% @ 6 inch (15.2 cm)
Wiring	Teflon coated 28 AWL	Room	-120 to 260	$3.8x10^5$	N/A

Sensor	Material	Storage Temperature (°C)	Operating Temperature (°C)	Radiation Limit (Rad)	Instrument Accuracy
Potting:					
Belzona 1391	Epoxy	20 to 40	10 to 130	$5x10^5$	N/A
Stycast	Epoxy	20 to 65	10 to 130	$5x10^5$	N/A
Cables	Belden 8345 (source)	0 to 40	10 to 150	$1.5x10^4$	N/A
O-Rings	Viton	Room	-35 to 204	10^6	N/A
Tip	Titanium (TI-6A14V)	Room	N/A	N/A	N/A
Mandrel	4340 Steel	Room	N/A	N/A	N/A
Adaptor	4340 Steel	Room	N/A	N/A	N/A
Push Rods	4340 Steel	Room	N/A	N/A	N/A
Yo-yos	Uni-measure P-50A (source)	-30 to 50	-10 to 50	N/A	$\pm$.05% FS
Guide Tube	4340 Steel Neoprene Viton	Room	N/A 55 to 140 -35 to 204	N/A 10^7 10^6	N/A

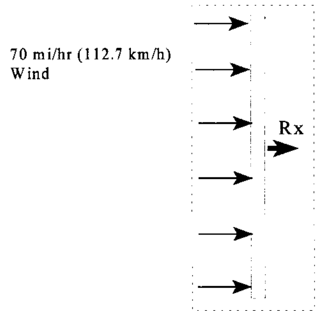
Attachment 3:

The cone penetrometer aluminum components aluminum are the elephant feet, the water tank, centering bushing, and stairs. These are not exposed to tank waste. Other components are made out of carbon steel.

Attachment 4:

The assumptions made on this analysis are that:

a) The vanbody is the largest area which will be subjected to wind loads.
b) The largest part of the vanbody encompasses the maximum load subjected to the platform.
c) Steady flow.
d) All forces and velocities are in the horizontal direction.



$A = 96 \text{ in} \times 84 \text{ in} = 8064 \text{ in}^2 \ (5.2 \text{ m}^2)$
$= 56 \text{ ft}^2 \ (5.2 \text{ m}^2)$

$\rho_{air} = .075 \text{ lbm/ft}^3 = .0023 \text{ slug/ft}^3$ at STP

$u = 70 \text{ mi/hr } (112.7 \text{ km/h}) = 103 \text{ ft/sec } (112.7 \text{ km/h})$

$Rx = u^2 \rho_{air} A$

$= (103 \text{ ft/s})^2 (.0023 \text{ slug/ft}^3)(56 \text{ ft}^2)$

$= 1366 \text{ lbf}$

The total weight of the cone penetrometer platform is 40,000 lbf. The number of G's associated with the wind load is then:

$G = 1366 \text{ lbf}/(40{,}000 \text{ lb/g}) = .03$

This load is less than the seismic loads. Therefore, the platform will survive a 70 mi/h (112.7 km/h) wind since it can survive a 0.38 G horizontal seismic load.