DISTRIBUTION SHEET

To Distribution	From TWRS Safety Programs Engineering Support	Page 1 of 1 Date 9/15/94
Project Title/Work Order Void Fraction Instrument Acceptance Test Procedure WHC-SD-WM-ATP-103/N2BG1		EDT No. 600138 ECN No. N/A

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D. B. Graves	L6-38	X			
C. E. Hanson	H5-09	X			
J. W. Lentsch	S7-15	X			
J. D. Martin	L7-04	X			
M. L. McElroy	S1-57	X			
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R. B. Post	T4-08	X			
R. W. Reed	R1-51	X			
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1	1	Cog.Eng. DB Graves	<i>[Signature]</i>	9/14/94	6-38	Project Eng. TI Stokes	<i>[Signature]</i>	9-12-94	H5-09	1	1
1	1	Cog. Mgr. RE Bauer	<i>[Signature]</i>	9/13/94	6-37	PNL Scientist JM Alzheimer	<i>[Signature]</i>	9-7-94	K5-22	1	1
1	1	QA ML McElroy	<i>[Signature]</i>	9-1-94	S1-57						
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18. KL Pearce <i>[Signature]</i> 9/14/94 Signature of EDT Originator Date	19. <i>[Signature]</i> Authorized Representative Date for Receiving Organization	20. RE Bauer <i>[Signature]</i> 9/13/94 Cognizant Manager Date	21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments

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RELEASE AUTHORIZATION

Document Number: WHC-SD-WM-ATP-103, Revision 0

Document Title: Void Fraction Instrument Acceptance Test Procedure

Release Date: September 15, 1994

* * * * *

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

APPROVED FOR PUBLIC RELEASE

* * * * *

WHC Information Release Administration Specialist:

M. Boston

(Signature)

M. N. Boston

9/15/94

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SUPPORTING DOCUMENT

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2. Title Void Fraction Instrument Acceptance Test Procedure	3. Number WHC-SD-WM-ATP-103	4. Rev No. 0
5. Key Words Void Fraction ATP Operation SY-101 In Situ	6. Author Name: K. L. Pearce <i>K. L. Pearce</i> Signature Organization/Charge Code 8A200/N2BG1	
7. Abstract This acceptance test procedure (ATP) was written to test the void fraction instrument (VFI) and verify that the unit is ready for field service. The procedure verifies that the mechanical and electrical features (not specifically addressed in the software ATP) and software alarms are operating as designed.		
APPROVED FOR PUBLIC RELEASE <i>M-Boston 9/15/94</i> Information Release Administration		
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WHC-SD-WM-ATP-103

Rev. 0

Page 1

**VOID FRACTION INSTRUMENT
ACCEPTANCE TEST PROCEDURE**

September 1994

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

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VOID FRACTION INSTRUMENT ACCEPTANCE TEST PROCEDURE

1.0 INTRODUCTION

1.1 PURPOSE

This procedure shall be used in conjunction with the software acceptance test procedure (ATP) (WHC-SD-WM-ATP-081) for acceptance testing of the in situ void fraction instrument (H-2-821719). The accepted in situ void fraction instrument will be used in support of the Hydrogen Mitigation project for double-shell Waste Tank SY-101 and other related projects.

1.2 SCOPE

Completion of this test will verify that the mechanical and electrical features (not specifically addressed by the software ATP) of the void fraction instrument (VFI) are operating as designed and that the unit is ready for field service. The control console is common to the void fraction instrument and to the in situ viscometer. Some of the functions/characteristics of the console are to be verified during the viscometer ATP and accordingly are not addressed in this document.

The scope of the acceptance test is as follows:

- Basic equipment functions and mechanical interfaces will be verified.
- Performance of hardwired electrical command signals (not tested by the software ATP) will be demonstrated.
- Performance of the heating and cooling fan systems which are not under control of the control console.
- Performance of decontamination spray system.
- Demonstrate that sustained, repeated execution of the automated sequences do have adverse effects on the mechanical operability of the system.

- Characterize the system:
  - Measure volumes (of chamber and lines) which are necessary to calculate the void fraction.
  - Determine the times required for a measurement sequence.
  - Determine the nitrogen consumption and leakage rates.

2.0 REFERENCES

- WHC-SD-WM-ATP-081, "Software Acceptance Test Procedure for Tank 101-SY Void Fraction Instrument."
- WHC-SD-WM-ATP-089, "In Situ Viscometer Acceptance Test Procedure."
- WHC-SD-WM-WP-259, "SY-101 In Situ Void Fraction Instrument Engineering Work Plan."
- H-2-821719, "Void Fraction Instrument Assembly."
- H-2-821314, "Viscometer/Void Fraction Power Distribution Skid Assembly."

3.0 TEST CONTROLS

3.1 RESPONSIBILITIES

3.1.1 WHC Special Projects

T. I. Stokes

- Approve the test procedure and final report.

3.1.2 Cognizant Engineers

Mechanical: D. B. Graves
Electrical: J. D. Martin and/or M. Gimera

Note: *The cognizant engineer may perform test performer activities.*

- Act as the Person In Charge (PIC) for test preparation and performance.
- Overall responsibilities for maintaining and controlling testing.

- Provide liaison with Quality Assurance Engineer (QE) for testing activities, as required.
- Overall testing responsibilities and assignment of responsibilities.
- Review test results.
- Monitor testing for compliance with the test procedures.
- Ensure Hanford Job Hazards Analysis checklist is complete.
- Conduct prejob briefing/readiness review prior to initiating test.

3.1.3 Test Performer [As Approved by the Cognizant Engineer(s)]

- Perform test in accordance with approved test procedure.
- Prepare/issue test report.

3.1.4 Quality Assurance Engineer (QE)

M. L. McElroy

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

3.1.5 Quality Control Inspectors (QC)

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

3.1.6 The names of the test performers and cognizant engineers for this test procedure shall be recorded in the acceptance test report.

3.2 TEST DATA

- #### 3.2.1
- All test data, pertinent observations, and off-normal events shall be recorded in the procedures 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 An acceptance test report shall be generated to publish all data gathered during testing activities.
- 3.2.3 Changes to the test procedure are permitted. The test performer shall red-ink changes with the concurrence of the cognizant engineer. Approvals will be documented by the cognizant engineer's initials on the redlined item. Lack of immediate redline approval does not constitute a test hold. Continued test progress is at the discretion of Special Projects.

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 or attached to the ATR.

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.
  - A single copy of H-2-821719, "Void Fraction Instrument Assembly."
  - A single copy of H-2-821314, "Viscometer/Void Fraction Power Distribution Skid Assembly."
  - Software ATP, WHC-SD-WM-WP-081.
  - Other information that is directly applicable to testing.

3.5 RETEST PROCEDURE CONTROL

- 3.5.1 If retest is required, additional copies of applicable procedure sections or 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 QE representative, and formally released in the ATR.

- 3.5.3 Minor procedure changes such as editorial changes to a step, clarification of a step or steps, elimination or addition of a step or limited sequential changes of steps, and changes which do not fall in the categories of Section 6.0 shall be noted in the procedure by redline entries and noted in the test procedure package giving the reason for the change. Redlined changes shall be documented in the ATR.

3.6 EXCEPTIONS TO ACCEPTANCE TEST SECTION

- 3.6.1 Exceptions to the test are dispositioned and agreed to by all witnesses. Actions taken regarding disposition are noted on the "Exception to Acceptance Test" (Appendix B) sheet. Typical dispositions are:
- Test approved with exception (i.e., rerun of the acceptance test unnecessary).
  - Entire acceptance test to be repeated after the discrepancy has been corrected.
  - ATP step(s) affected to be repeated after the discrepancy has been corrected.

4.0 TEST FACILITY

Acceptance testing of the void fraction instrument, control console, and decontamination spray assembly will be conducted in the 306E building high bay or area adjacent to the facility.

5.0 SAFETY

- Only the cognizant engineers and/or their approved personnel shall operate the void fraction instrument during performance of this ATP.
- Test personnel shall be briefed, prior to the test performance, on the hazards unique to the void fraction instrument equipment.

6.0 TEST PROCEDURE

6.1 PREREQUISITES

6.1.1 Prejob Briefing

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

6.1.2 Stage Equipment

Verify that the void fraction instrument has been installed horizontally in the test area and the power distribution skids, interconnecting cable and hose assemblies, control console, and decontamination spray system are staged in the test area. Verify no interconnections have been made.

Test Engineer's signature _____ Date _____

6.2 ELECTRICAL SYSTEMS PREOPERATIONAL CHECKOUT

A local disconnect will be used in the SY tank farm to lower a 480 VAC, 3-phase, 60 amp service to 35 amp service. A distribution panel is used to convert one input line of 480 VAC, 3-phase, 35 amp service into several other components. The control console, feed pump, and hot water high-pressure pump are all electrically connected to the distribution skid during field service.

6.2.1 Switches and Disconnects

6.2.1.1 Verify the switch labeled VISC INST and located on the inside right wall of the console (access from the rear) is in the OFF position.

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

1. Service disconnect switch.
2. Power distribution skids: CB1, CB2, DS1, DS2, and MS1 (see Figure 1).
3. Control console: CB2, CB6, and CB8 (see Figure 2).

Test Engineer's signature _____ Date _____

POWER DISTRIBUTION SKID
H-2-821314-010

DISCONNECT SKID
H-2-821314-020

Figure 1. Power Distribution and Disconnect Skids

Figure 2. Circuit Breaker Panel (1A8) Layout

6.2.2 Interconnections

Two cables connect the void fraction instrument (VFI) to the control console. One cable supplies power from the control console to the VFI. The other cable provides the communication link between the VFI and the control console. Each cable is made of two lengths with a connector in the middle.

Note: *Electrical cabling interconnections are shown in Figures 3 and 4.
Decontamination water hose interconnections are detailed in SK-2-61342.*

6.2.2.1 Electrical Connections

Connect the electrical cables to the equipment as follows:

- W6 to W8P1. In the field, the cable support grips on W6 and W8 are connected together using a threaded chain coupler. This is not necessary for lab testing.
- W7 to W9P1. In the field, the cable support grips on W7 and W9 are connected together using a threaded chain coupler. This is not necessary for lab testing.
- W8 to Void Fraction Instrument J1. Connect the cable support grip to the nearby eye bolt using a threaded chain coupler.
- W9 to Void Fraction Instrument J2. Connect the cable support grip to the nearby eye bolt using a threaded chain coupler.
- W7 to Control Console J7.
- W6 to Control Console J6.
- W1 to Control Console J1.
- W1 to Power Distribution Skid J4.
- Hot water high-pressure washer to Power Distribution Skid J2.
- Feed pump to Power Distribution Skid J3.
- W10 to Power Distribution Skid J1.
- W10 to Disconnect Skid J5.

Figure 3. VFI Cable Connections

- Disconnect Skid P6 to a service receptacle. Disconnect skid is currently wired to use a 480 VAC, 3-phase, 60 amp, 4-wire receptacle.

Test Engineer's signature _____ Date _____

6.2.3 Applying Instrument Power

Lights on the annunciator panel shown in Figure 5 provide status indications for power.

- 6.2.3.1 With circuit breakers and switches identified in Section 6.2.1.2 still in the OFF position, move the service disconnect switch to the ON position. Verify that all lights on the annunciator panel remain off.

Test Engineer's signature _____ Date _____

Power for the computer and other instrumentation within the control console is controlled by Circuit Breaker CB2. Power for instrumentation within the void fraction enclosures is controlled by Circuit Breaker CB8.

- 6.2.3.2 Move CB2 on the circuit breaker panel (Figure 2) from the OFF to the ON position.

- 6.2.3.3 Verify that the following lamps are illuminated and that all other lamps remain off:

CONSOLE
INSTRUMENT

Test Engineer's signature _____ Date _____

- 6.2.3.4 Move CB8 on the circuit breaker panel (Figure 2) from the OFF to the ON position. Verify that the VOID FRACTION lamp is illuminated.

Test Engineer's signature _____ Date _____

6.2.4 Enclosure Temperature Control

The pneumatic system enclosure contains a stand-alone heater and temperature controller. The I&C enclosure has a temperature-controlled fan for cooling only.

Note: For testing purposes, it is not necessary to lower or raise the temperature of the entire enclosure. It is sufficient to cool or heat the temperature sensor by blowing temperature-controlled air over it.

VISCOMETER/VOID-FRACTION CONTROL CONSOLE

Figure 5. Annunciator Panel (1A1) Layout

- 6.2.4.1 Verify that the heater turns on when the temperature of the enclosure drops below 50°F and turns off when the temperature is above 60°F (temperature sensor is TE11).

Accept/Reject _____

Cognizant EE's signature _____ Date _____

6.2.5 Intrinsic Safety Barrier

- 6.2.5.1 Measure the resistance between the intrinsic safety barriers mounting bus bar and the VFI mast. Record equipment calibration information. QC verify reading.

Instrument #: _____ QC Stamp/Date _____

Reading _____ QC Stamp/Date _____

- 6.2.5.2 Visually inspect the intrinsic barriers and verify that they are adequately installed and ready for field service.

Fire Protection Engineer's signature _____ Date _____

6.3 LEAK TESTS

All welds on the lines inside the VFI were leak tested per Fabrication Travelers VFI-002 and VFI-003. System leak checks will be made of the void fraction piping, valves, fittings, actuators, seals, and other pressure-containing components. Excessive leaks, as determined by the cognizant ME, shall be repaired and retested. The procedure below is presented as guidance for this test and may be deviated from per the cognizant ME's direction.

- 6.3.1 Visually verify that all pneumatic connections have been made. Verify closed or close YV9 and YV8. Fill water tank as full as possible.

Note: Fill the sample chamber with some hard object (plug) to minimize the gas usage during compressions of that space.

- 6.3.2 Leak check void fraction piping, valves, fittings, cylinders, etc. by isolating one section of the system at a time. Also verify that the sample chamber check valve seats properly. Use the nitrogen supply cylinder for the gas source. Perform Steps 6.3.2.1 and 6.3.2.2 until all sections of the system have been checked. Record all results on Observation/Results sheet or equivalent.

- 6.3.2.1 Open HV1 on the nitrogen supply bottle. Verify the bottle has at least 1000 psig. Isolate section of system to be leak checked using the front panel icons to open and close the appropriate valves.
- 6.3.2.2 Close the nitrogen supply bottle. Record the start and end pressures of the appropriate indicators for a 10-minute duration. Record all pressure decay findings (i.e., zero leak rate, etc.). Determine the leak rate or repair leaking systems/components.

Initial Pressure _____ Pressure @ > 10 min. _____

Accept/Reject _____

Cognizant ME's signature _____ Date _____

6.3.3 Pressurization Chamber--Inlet Valve (YV10)

- 6.3.3.1 Open HV-1.
- 6.3.3.2 Vent the pressurization chamber to atmosphere pressure by closing solenoid valve YV10, then opening YV11 and the sample chamber cover.
- 6.3.3.3 Record initial pressures from PIT1 and PIT2, then close YV11.
- 6.3.3.4 Wait 10 minutes, then record final pressures from PIT1 and PIT2.

6.3.4 Pressurization Chamber--Outlet Valve (YV11)

- 6.3.4.1 Close YV11, then pressurize the pressurization chamber to approximately 500 psia. Then close YV10 to isolate the pressurization chamber. Vent sample chamber to atmosphere by opening the chamber cover.
- 6.3.4.2 Record initial pressures from PIT1, PIT2, and PIT3 on Observation/Results sheet.
- 6.3.4.4 Wait 10 minutes, then record final pressures from PIT1, PIT2, and PIT3 on Observation/Results sheet.

6.3.5 Chamber Pressurizing Line--YV9 and Elbow

- 6.3.5.1 Vent chamber pressurizing line to atmosphere by closing YV9 and YV11; open or verify open sample chamber cover.
- 6.3.5.2 Disconnect chamber pressurizing line from sample chamber check valve. Install Swagelock plug on end of chamber pressurizing line.

6.3.5.3 Verify HV4 and HV5 are closed. Record initial pressure from PIT3. Pressurize water tank to approximately 200 psia.

6.3.5.4 Wait 10 minutes, then record final pressure from PIT3.

6.3.5.5 Close sample chamber cover. Wait 5 minutes, then record PIT3 reading.

6.3.5.6 Open sample chamber cover. Wait 5 minutes, then record PIT3 reading.

6.3.6 Sample Chamber

6.3.6.1 Remove Swagelok plug from end of chamber pressurizing line and reconnect line to sample chamber check valve. Close sample chamber cover.

6.3.6.2 Open YV10 until pressure in the pressurization chamber approximately reaches equilibrium, then close YV10.

6.3.6.3 Open YV11 until pressure approximately reaches equilibrium, then close YV11 and record reading on PIT3.

6.3.6.4 Wait approximately 10 minutes, then record final pressure on PIT3.

6.3.6.5 Loosen the end of the pressurizing line from check valve. Wait for PIT3 to reach atmosphere.

6.3.6.6 Use a bubble solution to characterize any leakage back from the check valve.

6.3.6.7 Retighten the pressurizing line.

6.3.7 Actuators

6.3.7.1 Open sample chamber cover. Verify lower arm is in the deployed position. Close HV1, then record readings from PE4, PE5, PE6, and PE7.

6.3.7.2 Wait approximately 5 minutes, then record readings from PE4, PE5, PE6, and PE7.

6.3.7.3 Open HV1 and sample chamber cover. Retract lower arm.

6.3.7.4 Close HV1, then record readings from PE4, PE5, PE6, and PE7.

6.3.7.5 Wait approximately 5 minutes, then record readings from PE4, PE5, PE6, and PE7.

6.4 OPERATIONAL TESTS

6.4.1 Motion of Lower Arm

A pneumatic cylinder rotates the lower arm by 90°. If power fails to the VFI, the lower arm is designed to spring return to a vertical position when the VFI is in the vertical position.

6.4.1.1 Rotate and retract the lower arm approximately 15 times as directed by the cognizant mechanical engineer.

1. Determine the minimum time from start to stop of each rotate/retract cycle.
2. Record the flowmeter indication after each cycle.
3. Record start and end reading on PEI for each rotate/retract cycle.
4. Mechanically prevent arm motion (once each direction). Actuate arm and record flow indicator reading.
5. Record the transverse load required to start motion of the arm against the pneumatic cylinders in both directions.

Observe whether the following conditions are met:

- a) The rotational motion is smooth.
- b) The mechanism does not jam.
- c) The mechanical parts are not damaged or galled and that the fasteners do not show excessive wear or looseness.

Accept/Reject: a) _____ b) _____ c) _____

Cognizant ME's signature _____ Date _____

6.4.1.2 Utilize the data recorded during Step 6.4.1.1 to determine the average consumption of nitrogen for the arm rotation/retraction cycle.

Rotate/Retract Cycle Nitrogen Consumption _____ in³

Test Engineer's signature _____ Date _____

6.4.1.3 With the lower arm in the 90° position, remove power. Verify that the arm returns towards alignment with the upper arm and is free to return to the aligned position.

Note: The VFI will be tested in a horizontal position and, therefore, the arm will not fully return to the vertical position (i.e., not be aligned with the upper arm and VFI mast).

Accept/Reject _____

Cognizant ME's signature _____

Date _____

6.4.2 Water and Nitrogen Consumption

Water and nitrogen are used to clean and dry the lines, through an automated sequence (wash and dry). This test is intended to establish how much water and nitrogen are used in a wash and dry operation.

6.4.2.1 Measure the pressure in the nitrogen bottle (initially 2200 psi). Measure the level of the water in the tank (from the computer display).

6.4.2.2 Perform approximately 32 automated wash and dry sequences.

6.4.2.3 Measure the pressure in the nitrogen tank and the level in the water tank again. Record the number of "actual" cycles performed.

6.4.2.4 Determine nitrogen and water usage utilizing the data recorded during the wash and dry cycle.

Average wash and dry operation
uses: _____

_____ cubic inch water

_____ cubic inch nitrogen

Cognizant ME's signature _____

Date _____

6.4.3 Verification of Void Fraction Calculation

The software acquires the data required to calculate void fraction. The purpose of this test is to introduce a known void fraction in the sampling chamber and compare the known value to the value obtained by reducing the data. Testing will be performed with three void simulants: air, water, and some filler with known volume.

6.4.3.1 Perform three void fraction test sequences each at 0, 20, and 100 percent simulated void fraction. This can be done with the lower arm in a rotated position.

6.4.3.2 Compare the calculated void fraction (based on the measured pressures and temperatures) with the actual void in the sample chamber. Record results below or on attached Observation/Results sheet.

6.4.3.3 Repeat Steps 6.4.4.1 through 6.4.4.3, as required.

TEST NO./SIMULANT	ACTUAL VOID FRACTION (cc)	CALCULATED VOID FRACTION (cc)

Accept/Reject _____

Cognizant ME's signature _____

Date _____

PNL R&D Engineer's signature _____

Date _____

6.4.4 Opening/Closing of Sample Chamber

A pneumatic cylinder opens and closes the sample chamber cover that contains the waste sample. If power fails while the chamber is closed, the chamber is designed to open. Opening and closing the cover while in the waste has the potential to wear or damage the O-ring seals. Any initial lubrication on the seals might be removed during operation. In order to test these effects, the sample chamber will be submerged in a container of PNL-supplied chemical simulant.

6.4.4.1 Lubricate the O-ring seals. Operate the device 5 times with the sample chamber suspended in air.

1. Determine the minimum time from start to stop of each open/close cycle.
2. Record the flowmeter indication after each cycle.
3. Record start and end reading on PEI for each open/close cycle.
4. Mechanically prevent sample chamber motion (once each direction). Actuate chamber and record flow indicator reading.

Observe whether the following conditions are met:

- a) The motion of the sample chamber cover is smooth.
- b) The mechanism does not jam.
- c) The mechanical parts are not damaged or galled. The fasteners do not show excessive wear or looseness.

Accept/Reject: a) _____ b) _____ c) _____

Cognizant ME's signature _____ Date _____

6.4.4.2 Utilize the data recorded during Step 6.4.2.1 to determine the average consumption of nitrogen for opening and closing the sample chamber.

Chamber Open/Close Cycle Nitrogen Consumption _____ in³

Cognizant ME's signature _____ Date _____

6.4.4.3 Verify the chamber is empty. Close the chamber cover. Pressurize the chamber pressurizing line to 500 psia. Open the chamber cover and verify that the O-rings remain on the VFI sample chamber.

Note: This test shall be done with well lubricated O-rings to simulate the most rapid movement that would ever be encountered in the tank.

Accept/Reject _____

Cognizant ME's signature _____ Date _____

CAUTION

FOR THE FOLLOWING TESTS, SPECIAL CARE MUST BE TAKEN TO PREVENT UNCONTROLLED SPLASHING OF THE CHEMICAL SIMULANT. PERSONNEL PROTECTIVE EQUIPMENT (FACE SHIELD AND GLOVES) ARE REQUIRED FOR PERSONNEL WORKING WITHIN TEST AREA.

6.4.4.4 Submerge the sample chamber into the chemical simulant.

- 1. Close chamber cover, then pressurize the sample chamber twice without sequencing through the wash/dry cycle.
- 2. Open chamber cover.
- 3. Repeat sequence approximately 30 times.

Observe whether the following conditions are met:

- a) The initial pressure in the pressurization chamber and the final system pressure stabilizes and there is no indication of pressure leaks in the system. If leaks occur, record leak rate and path on Observation/Results sheet.
- b) The cover opens and closes each cycle.
- c) The O-ring seals remain functional for the entire test sequence. Visually inspect O-rings for damage.

Accept/Reject: a) _____ b) _____ c) _____

Cognizant ME's signature _____ Date _____

6.4.4.5 With the sampling chamber closed, remove power. Verify that the sampling chamber opens.

Accept/Reject _____

Cognizant ME's signature _____ Date _____

6.5 MEASUREMENTS

6.5.1 Volume Measurements

The sample chamber, pressurization chamber, and nitrogen line volumes need to be measured in order to calculate the void fraction. The volumes of the sample chamber, pressurization chamber, and lines should be about 22, 5, and 3 cubic inches, respectively. Volume measurements will be performed by PNL. Instrument calibration information, sketches, and results will be documented in the ATR.

Volume of sampling chamber: _____ cubic inches

Volume of pressurization chamber: _____ cubic inches

Volume of nitrogen lines: _____ cubic inches

PNL R&D Engineer's signature _____ Date _____

Test Engineer's signature _____ Date _____

6.5.2 Void Fraction Instrument, Decontamination Spool Piece Weights

6.5.2.1 Weigh void fraction instrument, decontamination spool piece (including wipers and flanges), impact limiters, and plug gauge. Record results.

Void Fraction Instrument: _____ 1bs
Decontamination Spool Piece: _____ 1bs
Short Impact Limiter, 1/2: _____ 1bs
Tall Impact Limiter, 1/2: _____ 1bs
Plug Gauge: _____ 1bs
Test Engineer's signature _____ Date _____

6.6 DECONTAMINATION SYSTEM TEST

The decontamination system provides hot and cold water for washing the mast and arms. A rubber wiper is used during withdrawal of the VFI.

6.6.1 Prepare a testing area on the concrete pad outside the 306E building.

6.6.2 Water Hose Connections

- Interconnect the pump (hot and cold high pressure) and flow meter per SK-2-61342.
- Connect the hoses to the decontamination spool piece and the pumps per SK-2-61342.
- Connect a hose from a potable water source to the intake of the feed pump.

Test Engineer's signature _____ Date _____

6.6.3 Visually observe the spray patterns, leakage, flow rates, nozzle convergence, and spray efficiency. Compare observations to design basis for acceptance.

Accept/Reject _____

Cognizant ME's signature _____ Date _____

6.6.4 Attach rubber wiper to the decontamination spool piece. Insert a 3-inch dummy pipe through the rubber wiper and record the drag loads observed on the Observation/Results sheet.

Drag load (dry) _____

Cognizant ME's signature _____ Date _____

6.6.5 Wet the rubber wiper with water and repeat Step 6.6.4.

Drag load (wet with water) _____

Cognizant ME's signature _____ Date _____

6.7 SOFTWARE

6.7.1 Nitrogen Supply Alarm

Note: External nitrogen source may be used to characterize this portion of the testing.

6.7.1.1 Close or verify closed nitrogen supply cylinder valve, HV1. Start software. Software should display dialog box that warns that the nitrogen supply is not full.

6.7.1.2 Click OK on the dialog box. The dialog box should reappear continually until the start pressure is greater than 2000 psia.

6.7.1.3 Terminate the program.

6.7.1.4 Attach a supply pressure greater than 2200 psia. Start the software. Software should display a dialog box that warns the nitrogen supply is overfull.

6.7.1.5 Click OK on the dialog box. The box should reappear continually until the start pressure is less than 2200 psia.

Accept/Reject _____

Test Engineer's signature _____ Date _____

6.7.2 Three-way Solenoid Valve Alarms (PE4 through PE7)

6.7.2.1 Observe that PE4 through PE7 read above 35 psia.

6.7.2.2 Open valve YV6. Software should display a dialog box that warns that pressure on PE4, PE5, PE6, and PE7 has dropped below 35 psia.

Accept/Reject _____

Software Engineer's signature _____ Date _____

6.7.2.3 Close YV6 and click on OK in dialog box.

6.7.3 Software developer will temporarily change the alarming thresholds for the 660, 550, and 220 psi lines.

6.7.3.1 Run software with 660 psi alarm changed to 400 psi. Software should display a dialog box warning that the pressure has exceeded the limit for PE2.

6.7.3.2 Stop software and change 550 psi alarm to 400 psi. Change 660 psi alarm back to 660 psi.

6.7.3.3 Run software. Dialog box should warn that the pressure was exceeded on PE9.

6.7.3.4 Stop software and change 220 psi alarm to 100 psi. Change 550 psi alarm back to 550 psi.

6.7.3.5 Run software. Dialog box should warn that the pressure was exceeded on PE3.

6.7.3.6 Stop software and change 220 psi alarm back to 220 psi.

Accept/Reject 660 Alarm (Step 6.7.3.1) _____

Accept/Reject 550 Alarm (Step 6.7.3.3) _____

Accept/Reject 220 Alarm (Step 6.7.3.5) _____

Software Engineer's signature _____ Date _____

6.7.3.7 Verify all alarms are set to operating values 660, 550, and 220 psi, respectively.

Software Engineer's signature _____ Date _____

6.7.4 Additional acceptance criteria for software-related aspects (and some additional electromechanical features) are documented in the software ATP (WHC-SD-WM-ATP-081)

APPENDIX A

**VOID FRACTION INSTRUMENT
FUNCTIONAL TESTING
OBSERVATION/RESULTS SHEET**

VOID FRACTION INSTRUMENT FUNCTIONAL TESTING OBSERVATION/RESULTS SHEET

[illegible]

APPENDIX B

EXCEPTION TO VFI ACCEPTANCE TEST

EXCEPTION TO VFI ACCEPTANCE TEST

Title of Test Void Fraction Instrument Test

EXCEPTIONS			CORRECTION APPROVAL		
PARAGRAPH NO.	DATE	DESCRIPTION	ORGANIZATION	INITIALS	DATE
<u>TEST APPROVED - NO EXCEPTIONS:</u> Cognizant Engineer Date Quality Assurance Date Test Witness Date			<u>TEST APPROVED - WITH EXCEPTIONS:</u> Cognizant Engineer Date Quality Assurance Date Test Witness Date		

APPENDIX C

**PREJOB SAFETY MEETING FORM
AND ATTENDANCE ROSTER**

**PREJOB SAFETY MEETING FORM
AND ATTENDANCE ROSTER**

PRE-JOB SAFETY MEETING FORM		Page 1 of 2
Job Description/Title Void Fraction Instrument Acceptance Test		Date
Work Package No.: WHC-SD-WM-ATP-103	Person in Charge (PIC): D. B. Graves/K. L. Pearce	
First Aid Qualified Person:		
Check Items Discussed		
☒ Procedures/Plans to be Used	No.	WHC-SD-WM-ATP-103
☐ Applicable OSR's	No.	
☐ Radiation Work Permit	No.	
☒ Job Hazard Analysis	No.	
☐ Construction Permit (as needed)	No.	
☐ Additional Permits (i.e., confined space, excavation, etc.)	No.	
☒ Review All Applicable Safety Precautions and Prestart Conditions per Procedures/Plans to be used		
☐ Components Locked and Tagged		
☒ ALARA Considerations (applicable MSDS's)		
☐ Respiratory Protection (fresh air, PAPR's, chemical filters, etc.)		
☐ Radioactive Contamination Containment Device		
☒ Emergency Response and Actions		
☒ Summary of Job Sequence (or steps)		
☐ Work Area Conditions (high/low temperatures, lighting, etc.)		
☒ All Equipment Functionally Checked and at Work Site		
Special Circumstances or COMMENTS:		
Chairman Signature:		
	Operations	_____
	Maintenance	_____
	Other	_____

[illegible]

APPENDIX D

HANFORD JOB HAZARD ANALYSIS CHECKLIST

HANFORD JOB HAZARD ANALYSIS CHECKLIST						Page 1 of 2					
Prepared By K.L. Pearce			Date 09/12/94		Area 300		Bldg. 306E				
Scope/Description: Operation of void fraction instrument and perform acceptance testing of VFI in accordance with WHC-SD-WM-ATP-081 and WHC-SD-WM-ATP-103.							☒ New ☐ Revised				
Emergency Contact Person(s): Primary: FH Nunamaker Secondary: JC Krogness Emergency Radio/Phone Number: 376-5518							JHA Number (not required):				
Specific Work Location(s): 306E Highbay											
KNOWN OR POTENTIAL HAZARDS											
	Yes	No	✓	•	Reference		Yes	No	✓	•	Reference
1. Radiation Area Work		X	✓	•		10. Respiratory Hazards		X	✓	•	
2. Hazardous Waste Operations		X	✓	•		11. Electrical Hazards	X		✓	•	
3. Confined Space Entry		X	✓	•		12. Lock and Tag		X	✓	•	
4. Cutting/Welding		X		•		13. Scaffolding		X		•	
5. Roof Work		X				14. Aerial Lifts		X	✓		
6. Fall Hazards (> = 10')		X				15. Asbestos Removal		X	✓	•	
7. Excavation/Trenching		X		•		16. Other (see JHA Sht. 2):	X				WHC-CM-4-3
8. Asbestos Inspection Report		X		•		✓ = Formal training required. • = Items that require a permit/form/report.					
9. Hazardous Materials	X		✓								
Other Hazards		Yes	No	Control Measures							
1. Temperature Extremes			X								
2. Noise			X								
3. Poor Lighting			X								
4. Animals/Insects			X								
5. Process Chemicals/Steam		X		MSDS will be provided.							
6. Dust			X								
7. Flammable/Combustible Materials			X								
8. Ladders			X								
9. Wet/Slippery Floors			X								
10. Uneven Terrain			X								
11. Open Excavations/Trenches			X								
12. Adjacent Water Hazard			X								
13. Vehicle Traffic			X								
14. Heavy Equipment			X								
15. Rigging Operation		X		Follow Rigging Manual and appropriate safety proc. as req'd.							
16. Manual Lifting		X		Minimize manual lifting. Use proper lifting technique.							
17. Power Tools			X								
18. Pinch Points		X		Wear gloves as required to reduce abrasions.							
19. Falling Objects			X								
20. Sharp Objects			X								
21. Overhead Obstructions			X								
22. Site Control (Signs/Barricades)		X		Chain 5 ft. area around simulant when in use.							
23. Remote Work Area			X								
24. Other (see JHA Sht. 2):		X		See Sheet 2.							
MINIMUM DRESS REQUIREMENTS: Normal lab clothing with exceptions as noted in Control Measures.											
APPROVALS											
Does further evaluation of the job steps, associated hazards, or safety measures need to be performed? ☒ Yes ☐ No											
If Yes, continue job hazard analysis on the following pages.											
Supervisor, Person in Charge M Gimera/DB Graves/KL Pearce Industrial Safety/Hygiene E. J. Krejci (Signature) <i>[Signature]</i> (Signature) <i>[Signature]</i> <i>OR 9/14/94</i> <i>9-14-94</i>											

HANFORD JOB HAZARD ANALYSIS (Sheet 2)

Page 2 of 2

Sequence of Basic Job Steps or Work Activity	Hazards Present	How to Eliminate Hazards
Operate VFI and leak test	Nitrogen bottles, compressed gas, asphyxiant	Bottles are vented through regulator. Only operating personnel will be permitted to handle. Use in well ventilated area.
Open/Close Cover in Simulant	Caustic/Poisonous Chemicals	Place simulant in double containment. Wear face shield and gloves. Restrict access to test area. Glove material as required by MSDS.
Load test lower arm/chamber	Flying objects, Noise	Place screens around lower arm and sample chamber when testing. Place standards at appropriate distance with chain/yellow tape to define work area and control protect other workers. Place signs on boundary area to alert others of hazards.

Westinghouse
Hanford Company

Internal
Memo

From: Engineered Process Applications
Phone: 376-8653 L5-31
Date: September 6, 1994
Subject: SY-101 STIMULANT MATERIAL

94-115-MDC

To: F. H. Nunamaker L6-36

cc: W. O. Greenhalgh L5-31
J. A. Hunter L5-31
K. L. Pearce L6-37
MDC File/LB

This is to summarize and document my opinion on the subject material, based on information supplied by Sam Bryan (the maker of the material) and basic chemistry sources.

Although the mixture has some solids, it should be handled as a liquid. It has about 10% sodium hydroxide, which makes it similar to cleaning and etching solutions. There are fluoride and copper ions at fractional percentages, which are poisonous if ingested, and also enough chrome, about 75 ppm, to make it a listed waste when it has to be discarded.

The mixture should be non-reactive with mild steel, stainless steel, and most seal materials, and should be chemically stable and not out-gas. However, I would recommend secondary containment for drips and spills. Personnel in the near vicinity should have some sort of eye protection and wear rubber gloves as they would when handling other caustic solutions.

With the understanding that the contents are "caustic and poisonous," I recommend that you go ahead with the planned tests.

Sincerely,

M. D. Crippen
Senior Principle Engineer

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