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7. Abstract

This plan establishes the requirements, objectives, and responsibilities for qualification testing of the 241-SY-101 Flexible Receiver System.

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LIST OF TERMS

ALARA	as low as reasonably achievable
FFTF	Fast Flux Test Facility
FRS	flexible receiver system
LDF	load distribution frame
MASF	Maintenance and Storage Facility
WHC	Westinghouse Hanford Company

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TEST PLAN FOR QUALIFICATION TESTING OF THE 241-SY-101 FLEXIBLE RECEIVER SYSTEM

1.0 INTRODUCTION

A mixer pump was installed in tank 241-SY-101 on July 3, 1993, to support hydrogen mitigation testing. This test mixer pump has proven to be very successful in mitigating the large gas releases, or "burps," from the tank waste. Therefore, a decision has been made to fabricate a spare pump that will be installed upon failure of the existing test pump. Before replacement activities can be initiated, equipment must be available to remove the existing pump. A pump removal system is currently being designed and fabricated that will support the retrieval, transportation, and disposal of the existing pump. The Equipment Removal System consists of six major components: the flexible receiver system (FRS), the equipment storage container, the container strongback system, the container transport trailer, the support cranes, and the pump washdown system.

This plan focuses on testing of the FRS, which is designed to function as a waste/aerosol-containment device during removal and handling of the pump prior to installation in the storage container. The FRS consists of a flexible receiver (containment bag), pump cap, blast shield, and gamma-detector system. The flexible receiver itself is essentially a long, cylindrical, plastic bag that is slipped over the pump as it is lifted from the tank. Its primary function is to maintain tank containment during pump removal to prevent the release of radioactive and toxic aerosols created by the operation of the high-pressure spray system. The FRS is also designed to prevent any waste spills in the pump pit or tank farm during removal and handling of the contaminated pump. The design of the FRS, therefore, must be adequately verified to ensure that the system functions as intended. The design verification method appropriate for the FRS is qualification testing as described in WHC-CM-6-1, *Standard Engineering Practices*.

2.0 OBJECTIVE

The primary objective of this test is to verify the adequacy of the FRS design. This objective will be accomplished in five phases.

- Phase I will consist of a leak test of the containment bag to ensure that the seams along the length of the bag have been adequately sealed.
- Phase II will be a load test of the containment bag. There is a potential for 257 L (68 gal) of waste to be entrapped in the pump-down legs and impeller casing. This test will ensure that the strength of the bag and bag bottom closure is sufficient to support this waste in the event that it shakes loose from the pump and collects in the bottom of the bag.

- Phase III will be a leak test of the entire FRS. The pump cap assembly, the seal between the top of the containment bag and the pump, the seal between the blast shield and load distribution frame (LDF), and the seal between the bag and blast shield will be leak tested to ensure there will be no significant release of aerosols or waste spills in the pump pit during removal of the pump.

- Phase IV testing will evaluate the form, fit, and overall function of the FRS and its associated equipment using a mock pump and mock LDF. A partial simulation of the pump removal will be performed to ensure that there are no physical interferences between the various components and that manual operations can be performed easily and safely, keeping personnel exposure minimized to levels as low as reasonably achievable (ALARA) during removal of the pump.

- Phase V testing will demonstrate that the gamma-detector system with data logger functions as intended by design.

This test will be considered complete when all phases of testing have been completed and the acceptance criteria specified in Section 4.5.6 have been satisfied.

3.0 SCOPE

This test plan establishes requirements and direction for the qualification testing of the FRS. Phase I testing will be performed offsite at the bag fabricator's facility. Phase II testing will be performed at the Hoisting and Rigging Facility in the 600 Area. Phase III and phase V testing will be performed at the 306E Facility in the 300 Area, and phase IV testing will be performed at the Maintenance and Storage Facility (MASF) in the 400 Area. Because this test has been divided into several parts and will be conducted at different facilities, separate test procedures will be prepared. Acceptance test procedures for phase I, II, and III testing will be provided by the FRS cognizant engineer. Procedures for phase V testing will be provided by the gamma-detector system cognizant engineer.

Test specifications for phase IV testing are provided in this test plan and will be used by Fast Flux Test Facility (FFTF) plant personnel to develop test procedures, which will be controlled in accordance with FFTF plant manuals and procedures. This plan is the controlling document for all activities associated with qualification testing of the 241-SY-101 Flexible Receiver System. This test plan does not include the testing of other components of the Equipment Removal System.

4.0 DESCRIPTION OF TEST

4.1 TEST ITEMS

The following sections describe the components of the FRS, shown in Figure 1, that will be tested under this plan. Other components of the Equipment Removal System that may be included in phase IV of this test also are identified below.

4.1.1 Flexible Receiver (Containment Bag)

As previously described, the containment bag is a long, cylindrical, plastic bag that fits over the pump to prevent the release of aerosols and waste spills in the pump pit or tank farm while the pump is removed from the tank and maneuvered into the storage container. The bag is intended to provide a reasonably air-tight seal around the test pump and blast shield during removal. It also provides containment of liquid waste that could be trapped inside the pump as well as decontamination spray water that will be dripping down the outside of the pump.

The containment bag is constructed of Herculite[1], which is a thin, flexible, fiber-reinforced plastic. The bag is 1.8 m (70 in.) in diameter, approximately 17.7 m (58 ft) long, and open on both ends. The bag is shorter than the test pump because it only covers the part of the pump below the mounting flange. The bag also contains enough absorbent material around the inside bottom of the bag to absorb approximately 380 L (100 gal) of liquid. A bag attachment mechanism secures the bag and seals it to the pump-cap assembly and a manually operated cinching mechanism closes the bag bottom and pulls it up to one side of the pump.

4.1.2 Blast Shield

The blast shield is essentially a large, cylindrical, carbon-steel tube that is used to contain the water spray from the high-pressure nozzles located in the LDF. The containment bag is fitted over the outside of the blast shield so that spray from the nozzles does not directly impact the inside of the bag. The blast shield also supports the bag and prevents the bag from collapsing in on itself if a vacuum exists in the tank during pump removal. Inflatable bladders installed on the outside of the blast shield will be used to seal the bottom of the bag to the blast shield. The mounting plate on the base of the blast shield is designed to mate with the spray ring on the LDF. A gasket affixed to the bottom of the mounting plate provides a seal to prevent contamination of the pump pit during operation of the high-pressure spray ring. To help maintain this seal, four latches at the base of the blast shield secure the FRS to the spray ring of the LDF.

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[1] Herculite is a trademark of Herculite Products, Incorporated, a subsidiary of Health-Chem Corporation.

4.1.3 Gamma-detector System

The gamma-detector system consists of two Eberline RO-7 mid-range gamma detectors, two RO-7 low-range detectors, and four RO-7 digital readout units. Each detector and readout unit is powered by two 30 V NEDA-type 210 batteries and three 9 V NEDA-type 1604 batteries. The low-range detectors provide gross dose-rate measurements from 0 to 2 R/h with a resolution of 0.001 R/h. The mid-range gamma detectors provide dose-rate measurements from 0 to 200 R/h with a resolution of 0.1 R/h. The response time of the instrument is approximately 2.5 seconds to 90% of the final reading. The detectors are enclosed in rigid conduit and mounted in a carbon steel collimator at the base of the blast shield. One of the mid-range detectors is uncollimated. The conduit provides an explosion-proof housing for the detectors to permit their operation in an NEC Class I Division I hazardous environment (NFPA 1990).

The gamma-detector system also includes a data converter and a data logger to gather dose rate data electronically. The four analog voltages generated by the RO-7 detectors are sent to the data-converter box, which passes the signal to the readout units and converts the voltages to 4-20 mA signals. The 4-20 mA signals are then sent to the data-logger box, which logs the signals periodically. In order to correlate the dose rate with the vertical position on the pump, a signal from the crane line counter can be fed to either the data-converter box or data-logger box depending on the signal type.

4.1.4 Pump-cap Assembly

The pump-cap assembly is used to seal off the top of the pump just above the mounting flange because leak paths exist around the pump bearing and ring gear. The pump cap will consist of two sheet-metal pieces that are bolted together around the pump's upper column and lifting lugs. The cap will be installed on the top of the pump prior to removal. The containment bag will seal against an outer ring on the pump cap.

4.1.5 Associated Equipment for the Flexible Receiver System

The following items will be used with the FRS during pump removal and may be used in phase IV testing to ensure that there are no interferences with these components and the FRS.

- A lifting yoke is used to provide an interface between the crane rigging and lifting lugs on the pump mounting flange. The yoke is needed because the pump column extends several feet above the mounting flange.

- A yoke brace vertically stabilizes the yoke by clamping it to the upper column of the test pump. The yoke must be stabilized so that the crane rigging can be disconnected from the yoke and attached to the FRS. Attachment of the yoke to the pump after the FRS is in place is not possible; the yoke must be pinned to the pump first. The crane is then used to lower the FRS over the yoke and onto the spray ring of the LDF.

- Two aluminum stages will be used to span across the opening of the pump pit so that manual operations, such as attaching the yoke brace to the yoke, can be performed. These stages are 0.7 m (28 in.) wide, 3.7 m (12 ft) long, and equipped with guardrails and toeboards. The stages will be positioned on both sides of the upper pump column.

- Long extension poles with a hook on one end will be used if the bag attachment mechanism does not engage properly on the pump mounting flange or if binding of the bag occurs. The poles telescope so that the length can be varied from approximately 2.4 to 4.9 m (8 to 16 ft).

A schematic of the equipment set up in the 101-SY pump pit is depicted in Figure 2.

4.2 TEST ENVIRONMENT

Phase I testing will be conducted in the bag fabricator's facility. Phase II will be conducted outside at the Hoisting and Rigging Facility in the 600 Area in a location where water drainage is adequate. Phase III testing will be conducted in the 306E Facility. Phase V testing will be performed in one of the shielded vaults in the 306E Facility. A Co^{60} or Ir^{192} radiation source will be used by the 306E Facility's nondestructive examination technicians to test the gamma-detector system. The air cell next to the large-diameter cleaning vessel in MASF Building 437, in the 400 Area, will be utilized for phase IV testing. This cell is approximately 11.6 m (38 ft) deep and rectangular in shape but has a flange opening on the top of the pit that is approximately 3.0 m (10 ft) in diameter. The height from the floor to the crane hook is approximately 25.9 m (85 ft).

4.3 TEST EQUIPMENT AND FACILITIES

4.3.1 Phase I Testing

The following equipment will be needed for phase I testing:

- Partially fabricated containment bag (without cinch mechanism) with inflation/deflation valve and sealed on both ends

- Dry compressed-air source with necessary hoses and connections

- One pressure transducer with a minimum range of 0 to 3,700 Pa (0 to 15 in. H_2O) and a minimum precision of ± 25 Pa (0.1 in. H_2O) (pascals, Pa, is the standard international unit for pressure)

- Thermocouple or other device for measuring bag air temperature with a minimum precision of ± 0.56 °C (1 °F).

4.3.2 Phase II Testing

The following equipment will be needed for phase II testing:

- Mock containment bag of reduced length (without bungie cords and absorbent material)
- Pump-cap assembly
- Test fixture to mock up the top of the pump (pump flange)
- Crane with a minimum 12.2-m (40-ft) lift height and 1,814-kg (2-ton) lift capacity or other support structure for hanging bag
- Water source with necessary hoses and connections
- Totalizer with precision of ± 3.8 L (1 gal) and a range of 946 L (250 gal) for measuring the amount of water added to containment bag.

4.3.3 Phase III Testing

The following equipment will be needed for phase III testing:

- Mock containment bag of reduced length (without bungie cords and absorbent material)
- Mock LDF with spray-ring housing and catch basin with a minimum capacity of 18.9 L (5 gal)
- Crane with a minimum 3-m (10-ft) lift height and 900-kg (1-ton) lift capacity or other support structure for suspending the test fixture and mock bag
- Pump-cap assembly
- Test fixture to mock up the top of the pump (pump flange)
- Dry compressed-air source with necessary hoses and connections
- Flow meter with a minimum range of 0 to 4.7×10^{-3} m^3/s (0 to 10 ft^3/min) and a minimum precision of ± 2.35×10^{-4} m^3/s (0.5 ft^3/min).
- One pressure transducer with a minimum range of 0 to 500 Pa (0 to 2 in. H_2O) and a minimum precision of ± 25 Pa (0.1 in. H_2O)
- One pressure gage with a minimum range of 0 to 350 kPa (0 to 50 $lb/in.^2$) and a minimum precision of ± 7 kPa (1 $lb/in.^2$)
- Water source with necessary hoses and connections

- Minimum 1.5-m- (5-ft-) long tape measure for measuring depth of water in blast shield and catch basin
- Stop watch for determining the leak rate.

4.3.4 Phase IV Testing

In addition to the FRS and associated equipment listed in Section 4.1, the following equipment will be needed for phase IV testing at the MASF:

- Spreader bars with appropriate rigging for lifting flexible receiver assembly
- Mock pump with middle 3.3-m (10-ft 10-in.) section removed (the mounting flange on the mock pump will bolt directly to a mock LDF)
- Support structure for supporting the mock pump, mock LDF, and FRS over the MASF air cell
- Man-lift or other temporary structure to simulate ground level
- Dynamometer with a minimum range of 0 to 13,600 kg (0 to 30,000 lb) with a precision of ± 45 kg (100 lb).

4.3.5 Phase V Testing

In addition to the gamma-detector system equipment listed in Section 4.1.3, the following equipment will be needed for phase V testing:

- 3 1/2 digit multi-meter
- 4 1/2 digit multi-meter
- Adjustable DC power supply, 0 to 2 V minimum at 100 mA (nominal)
- Adjustable DC power supply, 0 to 10 V minimum at 100 mA (nominal)
- Interface cable, 9-pin "D"
- IBM[2] (or compatible) computer/monitor with DeTerminal software
- Radiation source, Co^{60} or Ir^{192} isotope
- Assorted hand tools
- Assorted jumper wires.

2 IBM is a trademark of International Business Machines, Incorporated.

4.4 DATA

4.4.1 Measured Parameters

The measured parameters for the bag leak tests (phase I) are the initial pressure in the containment bag and the final pressure after a specified period of time. The precision required for measuring the bag pressure is ± 25 Pa (0.1 in. H_2O).

For the load test (phase II), the measured parameter is the volume of water added to the mock containment bag. The precision required for measuring this parameter is ± 3.8 L (1 gal).

The measured parameters for the FRS leak test (phase III) are the volume of water leaked through the seal between the blast shield and mock LDF and the leak rate of air through the assembled FRS. The volume of water leaked will be measured for a specified period of time to obtain a leak rate. The precision required for measuring the volume of water leaked is ± 0.38 L (0.1 gal). The total air-leak rate through all of the seals (blast shield to mock LDF, blast shield to bag, bag to pump-cap assembly, and pump-cap assembly to mock pump flange) will be measured. The precision required for this parameter is ± 2.35×10^{-4} m^3/s (0.5 ft^3/min).

For phase IV testing, there are no parameters to be measured. This test is a qualitative test with no specific numerical data to be recorded unless equipment interference occurs. When equipment interferences (binding) or tight clearances are witnessed, a description of the parts in conflict and the pertinent dimensions need to be recorded, including the amount of interference or gap, respectively. During testing, inspection and data recording will be conducted by Westinghouse Hanford Company (WHC) Engineering. This test is only intended to ensure that the operation of fitting the containment bag over the pump can be performed safely and reliably and that there are no interferences between components of the FRS and other key components of the Equipment Removal System specified in Section 4.1.

The measured parameters and corresponding acceptable ranges for phase V testing will be given in WHC-SD-WM-ATP-106, *Acceptance Test Procedure for the 241-SY-101 Flexible Receiver Gamma Detector System*, when it has been completed (WHC 1994a).

4.4.2 Calibration

Calibration will be adequate to ensure that the specified measurement accuracy is met. If the calibration date on a particular instrument has expired, the instrument shall be calibrated prior to conducting the test. The calibration procedures and documentation of the results will be included in the test report.

4.4.3 Acceptable Range

For the containment-bag pressure test (phase I), the pressure shall remain above 75% of the initial pressure of 2,500 Pa (10 in. H_2O), or 1,875 Pa

(7.5 in. H_2O), for one hour. This test will ensure that there are no holes in the bag greater than approximately 0.13 cm (0.05 in.) in diameter. Controls will be in place during pump removal to limit the tank pressure to 250 Pa (1 in. H_2O). Under this pressure, the expected leak rate will be less than 4.7×10^{-5} m^3/s (0.1 ft^3/min).

For the containment-bag load test (phase II), the volume of water added to each bag shall be a minimum of 909 L (240 gal), which corresponds to approximately 907 kg (2,000 lbs) of water. The weight of 257 L (68 gal) of waste with a specific gravity of 1.6 is approximately 408 kg (900 lbs). A load capacity of 907 kg (2,000 lbs) will provide a safety factor of about two.

For the FRS leak test (phase III), the volume of water leaked shall be less than 18.9 L (5 gal) during a one-hour period of time for a specified static pressure on the gasket between the blast shield and the mock LDF. For the air-leak test, the total leak rate through the system shall be less than 2.35×10^{-3} m^3/s (5 ft^3/min) under 250 Pa (1.0 in. H_2O) internal gage pressure.

4.5 CRITERIA/CONSTRAINTS

4.5.1 Licensing Requirements

There are no licensing requirements.

4.5.2 Training Requirements

All personnel working in the 306E Facility or MASF will be trained to operate the required test equipment and perform the required test functions.

4.5.3 Environmental Constraints

No environmental constraints apply for this test.

4.5.4 U.S. Environmental Protection Agency Regulations

No U.S. Environmental Protection Agency Regulations apply for this test.

4.5.5 U.S. Department of Energy Orders

All hoisting and rigging operations will comply with DOE-RL-92-36, *Hanford Site Hoisting and Rigging Manual* (DOE-RL 1992).

4.5.6 Acceptance Criteria

For phase I, II, III, and V tests, the acceptability of the test results will be based on whether or not equipment performance is within the acceptable range specified in Section 4.4.3 and, for the phase V test, in WHC-SD-WM-ATP-106 (WHC 1994a). If the measured parameters are within this range, then the tests will be considered satisfactory.

Phase IV testing will indicate whether or not the FRS performs the intended function. Because there are no measured parameters for phase IV, the acceptability of the equipment will be based on test observations. A check list, similar to that shown in Figure 3, will be used to evaluate the performance of the FRS. A representative from Safety Engineering will observe the test to ensure that operation of the FRS conforms to WHC safety standards. If all of the items specified in Figure 3 are satisfied and WHC safety requirements are fulfilled, then the FRS will be functioning as intended and the test will be considered satisfactory.

5.0 TEST SPECIFICATIONS

5.1 PHASE I TEST SPECIFICATION

Phase I testing consists of a pressure-decay/leak test of the containment bag. The bag leak test is essentially an acceptance test performed during the fabrication phase to demonstrate that the seams along the length of the bag have been properly sealed. The ends of the bag will be fabricated approximately 0.3 to 0.6 m (1 to 2 ft) longer than the final bag length. Before completing fabrication, the open ends of the bag will be sealed. The bag will then be pressurized with air to 2,500 Pa (10 in. H_2O) using an inflation/deflation valve on the bag. After a one-hour period, the pressure in the bag will be measured and recorded. The bag's internal temperature will also be measured and the bag pressure change will be compensated for any temperature variation. Upon completion of this test, the initial and final pressure shall be recorded on the containment bag near the top of the bag. The ends of the bag will then be cut off and the bag fabrication will be completed by adding the bag attachment mechanism to the top and the cinching mechanism to the bottom of the bag.

5.2 PHASE II TEST SPECIFICATION

The bag load test will be performed on a mock containment bag approximately 12.2 m (40 ft) long, without the bungie cords and absorbent material. The bag will be suspended from a crane or other support structure, and the bag bottom will be cinched and raised to one side using the bag cinching mechanism. The bottom of the bag will then be filled with water by connecting a hose to a fill valve in the side of the bag (near the bottom), and the amount of water added to the bag will be measured. Water will be added to the bag until failure occurs or until 909 L (240 gal) has been added. The bottom of the bag will be closely observed during the test to ensure that there are no leaks indicating holes in the bag. If failure occurs, the volume of water added to the bag will be recorded. The bag will be repaired or a new bag will be fabricated, and this test will be repeated until the acceptance criterion is satisfied.

5.3 PHASE III TEST SPECIFICATION

The first part of the FRS leak test will be performed by setting the blast shield onto a mock LDF and engaging the blast-shield latches. The blast shield and mock LDF assembly will then be filled with water to obtain a specified static pressure on the seal between the blast shield and mock LDF. A catch basin will be used to collect water that leaks through the seal. The volume of water that leaks during a one-hour period will be measured and recorded. This process will be repeated three times, and the maximum leak volume will be used to determine the acceptability of the test. If significant variation in the test results is observed, the process may need to be repeated several more times.

The second part of the FRS leak test will check the air-leak rate of the entire system under 250 Pa (1.0 in. H_2O) internal gage pressure. A shortened mock bag approximately 1.8 m (6 ft) long will be loaded on the blast shield and sealed using the inflatable bladders. The blast shield will then be lowered onto the mock LDF and secured with the latches. The pump-cap assembly will be installed on the test fixture (a mock up of the pump flange) and suspended by an overhead crane or other support structure. This assembly will be lowered down above the blast shield and the bag will be secured and sealed to the pump-cap assembly. This attachment will be the same as the attachment to the existing test pump during actual removal. An air supply will be connected to a valve in the side of the mock bag and the system will be pressurized to 250 Pa (1.0 in. H_2O). The system's internal pressure will be monitored through another access port in the mock bag and the flow rate required to maintain the system pressure at 250 Pa (1.0 in. H_2O) will be measured and recorded. This process will be repeated three times, and the maximum flow (leak) rate will be used to determine the acceptability of the test. If significant variation in the test results is observed, the process may need to be repeated several more times.

5.4 PHASE IV TEST SPECIFICATION

The test requirements and a brief summary of how phase IV testing will be performed are given in this section. Specific requirements and acceptance criteria are provided in Section 4.5.6. The test requirements consist of performing operations to simulate the removal of the mixer pump using a mock pump, mock LDF, and other equipment listed in Section 4.1.5.

The primary requirements are summarized below.

- Locate the mock pump on the mock LDF and support structure over the MASF air cell using the lifting yoke.
- Verify the fit and function of the yoke brace by attaching the brace to the yoke and observing any interferences or tight clearances. This operation may be performed from a man-lift or other temporary support structure to simulate ground level.
- Verify that the FRS will fit over the vertically restrained yoke by attaching crane rigging with a spreader bar to the FRS and lowering the FRS over the yoke and onto the mock LDF.

- Verify that the blast-shield restraining latches function as intended and provide a secure attachment to the mock LDF. A man-lift may be used to simulate ground level, and the latches will be engaged using the long-handled latch tool provided with the blast shield.

- Test the bag attachment to the pump. Verify that the bag attachment mechanism functions properly and that the bag remains securely in place during the entire pump extraction. The extension poles may be needed if the bag mechanism does not engage automatically. Again, a man-lift may be used to simulate ground level.

- Verify that the pump can be lowered a minimum of 0.6 m (2 ft) back into the air cell without significant bag binding or tearing. Significant bag binding is defined as binding that cannot be easily resolved using the extension poles. This operation will be performed for four bungie cord locations relative to the top of the blast shield: a bungie cord just released from the blast shield, a bungie cord approximately 0.3 m (1 ft) above the blast shield, a bungie cord approximately 0.6 m (2 ft) above the blast shield, and a bungie cord approximately 1.2 m (4 ft) above the blast shield with a new bungie about to be released.

- Test the bag-closure cinching mechanism. Verify that the cinching strap will function as intended, free of binding. The cinching strap will be pulled by a worker located a minimum 15.2 m (50 ft) away from the pump.

If the acceptance criteria are not satisfied, it will be necessary to repeat specific parts of the test. Equipment will be modified as required until the acceptance criteria are satisfied. Bag deployment (the last three steps outlined above) shall be repeated ten times to ensure reliable operation. If poor repeatability is observed, equipment modification and further testing may be required.

5.5 PHASE V TEST SPECIFICATION

Phase V testing is a system checkout to ensure that the gamma-detector system, with data converter and data logger, functions as intended. Basically, the test consists of varying the input voltage on the data converter and measuring and recording the corresponding output current for each voltage-to-current converter along with logging the current on the data logger. After the data converter and data logger are verified to function correctly, the system will be assembled as it would be in the field and placed in one of the shielded vaults in the 306E Facility. Each detector will be exposed to radiation fields of 100 R/h and 140 R/h inside the shielded vault. The readings on the RO-7 display units will be recorded, and the data logger current will be measured and recorded. The data logger will then be connected to a computer and the data on the data logger will be displayed and verified to ensure that it agrees with the previously recorded data. Details on phase V testing will be given in WHC-SD-WM-ATP-106 (WHC 1994a).

6.0 TEST PROCEDURE

The acceptance test procedures for conducting phase I, II, III, and V testing are presently being prepared. When they have been completed, the procedures for conducting phase I testing will be provided in WHC-SD-WM-ATP-091, *Acceptance Test Procedure 241-SY-101 Flexible Receiver System Phase I Testing* (WHC 1994b). *Acceptance Test Procedure 241-SY-101 Flexible Receiver System Phase II Testing*, WHC-SD-WM-ATP-092 (WHC 1994c), will contain the procedures for phase II testing, and *Acceptance Test Procedure 241-SY-101 Flexible Receiver System Phase III Testing*, WHC-SD-WM-ATP-093 (WHC 1994d), will provide the procedures for phase III testing. Procedures for phase V testing will be provided in WHC-SD-WM-ATP-106, *Acceptance Test Procedure for the 241-SY-101 Flexible Receiver Gamma Detector System* (WHC 1994a). During phase I, II, III, and V testing, one master copy of the acceptance test procedure document, clearly identified as "Test Control Copy," will be maintained by the FRS cognizant engineer. All data entries will be logged directly in the test control copy.

The test procedures for phase IV testing will be issued under the 400 Area Job Control System.

7.0 SAFETY

The work of setting up and conducting this test involves the common industrial hazards of rigging and hoisting, scaffolding, and pressurized fluids. The test procedures shall be performed in accordance with the *Industrial Safety Manual*, WHC-CM-4-3, and the *Hanford Site Hoisting and Rigging Manual* (DOE-RL 1992). A radiation source will be used for the gamma-detector system test. The 306E Facility's nondestructive engineering technicians shall be responsible for all work performed with the radioactive source. It is not expected that any person involved in this testing will receive a significant radiation dose as a consequence of this test. No chemical hazards are known to be present with the FRS testing.

The performance of this test is considered a Safety Class 3 activity. Failure of equipment associated with FRS testing could result in harm to facility workers caused by industrial safety hazards (e.g., lifting, hoisting, moving).

8.0 QUALITY ASSURANCE

Testing and recording of data will be verified by a Quality Assurance representative, who will indicate approval of the completed testing phases by signing and dating the test records after a testing phase. For phase I, II, III, and V testing, the requirements of the *241-SY-101 Test Pump Equipment Removal Fabrication Quality Assurance Project Plan* (WHC 1994e) will be met as a minimum. For phase IV testing, testing and data recording will be controlled in accordance with FFTF plant manuals and procedures.

Once the testing has been completed, any remaining nonconforming items will be resolved by the responsible Quality Assurance representative, the FRS cognizant engineer, and the FFTF test engineer (for phase IV testing only). Additional details may be obtained from the *Quality Assurance Manual*, WHC-CM-4-2, QR 15.0 "Control of Nonconforming Items," QI 15.1 "Nonconforming Item Reporting," and QI 15.2 "Nonconformance Report Processing."

9.0 ORGANIZATION AND FUNCTION RESPONSIBILITIES

9.1 GENERAL RESPONSIBILITIES

The following sections describe the responsibilities of individuals and organizations involved in all phases of FRS testing.

9.1.1 Equipment Removal System Cognizant Manager

- Has overall responsibility for control of the Equipment Removal System, including the design, fabrication, testing, and use of the FRS
- Assigns responsibilities related to the Equipment Removal System, which includes the FRS
- Approves the test plan, acceptance test procedures, and test reports.

9.1.2 Equipment Removal System Lead Engineer

- Coordinates the design of the Equipment Removal System
- Identifies and specifies requirements for the Equipment Removal System
- Provides technical expertise during testing of the FRS and Equipment Removal System
- Approves the test plan, acceptance test procedures, and test reports.

9.1.3 FRS Cognizant Engineer

- Assigns FRS related responsibilities
- Provides drawings, sketches, plans, and instructions related to the FRS to the lead engineer
- Identifies facilities for FRS testing

- Acts as a liaison between the participants in acceptance testing
- Prepares and approves the test plan
- Monitors testing for compliance with test procedures
- Reviews test results and prepares the test report.

9.1.4 Quality Assurance Manager

- Assigns and manages Quality Assurance representatives participating in this test activity.

9.1.5 Quality Assurance Representative

- Approves the test plan, acceptance test procedures, and test report
- Monitors testing activities and data recording
- Assists in maintenance and control of test records
- Concurs with acceptance criteria changes.

9.1.6 Safety Engineering

- Reviews the test plan and acceptance test procedures for safety conformance
- Provides inspection and support as needed to conduct testing within the safety standards of WHC.

9.2 RESPONSIBILITIES ASSOCIATED WITH PHASE I TESTING

The following sections describe the responsibilities associated with only phase I testing of the FRS.

9.2.1 Bag Fabricator

- Provides a facility for acceptance testing
- Responsible for equipment setup
- Responsible for conducting acceptance test.

9.2.2 FRS Cognizant Engineer

- Responsible for preparing acceptance test procedures
- Provides equipment and instrumentation needed for performing this test that is not available at the bag fabricator's facility
- Provides guidance during acceptance testing.

9.3 RESPONSIBILITIES ASSOCIATED WITH PHASE II AND III TESTING

The following sections describe the responsibilities associated with only phase II and phase III testing of the FRS by 306E Facility personnel.

9.3.1 FRS Cognizant Engineer

- Responsible for preparing acceptance test procedures
- Provides guidance and records data during acceptance testing.

9.3.2 Equipment, Design, and Fabrication Group Manager

- Assigns personnel to perform FRS testing
- Responsible for training of personnel performing testing.

9.3.3 Equipment, Design, and Fabrication Group Technicians

- Transport equipment to the 306E Facility
- Set up equipment and calibrate instruments, if necessary
- Conduct acceptance tests.

9.4 RESPONSIBILITIES ASSOCIATED WITH PHASE IV TESTING

The following sections describe the responsibilities associated with phase IV testing at the MASF.

9.4.1 FRS Cognizant Engineer

- Responsible for preparing test specifications.

9.4.2 MASF Person In Charge

- Assigns responsibilities related to FRS testing
- Has overall responsibility for control of the FRS testing activities at MASF
- Responsible for coordinating the day-to-day activities associated with FRS testing and FFTF Plant interfaces.

9.4.3 FFTF Test Engineer

- Responsible for developing the test procedures for phase IV of FRS testing
- Responsible for control of the FRS test work package
- Responsible for controlling the testing at MASF.

9.4.4 FFTF Examination and Decontamination Services Operations Manager

- Assigns personnel to perform FRS testing
- Has overall responsibility for control of activities at MASF
- Responsible for training of personnel performing testing.

9.4.5 Safety Engineering

- Observes testing to ensure that operation of the FRS conforms to WHC safety standards.

9.5 RESPONSIBILITIES ASSOCIATED WITH PHASE V TESTING

The following sections describe the responsibilities associated with phase V testing at the 306E Facility.

9.5.1 Gamma-detector System Cognizant Engineer

- Coordinates acceptance testing with 306E Facility
- Responsible for preparing acceptance test procedures
- Provides equipment required for performing test that has not been designated as being provided by others
- Responsible for conducting acceptance test
- Takes necessary action to clear exceptions to the acceptance test.

9.5.2 FRS Cognizant Engineer

- Provides guidance during acceptance testing.

9.5.3 306E Facility Nondestructive Examination Technicians

- Responsible for using the radiation source in the 306E shielded vault in accordance with the applicable radiation work permit.

10.0 SCHEDULE

Phase I preliminary testing is currently being performed on test bags. These preliminary tests will indicate whether or not the actual removal bag will be capable of meeting the acceptance criteria. The official test for phase I will be performed upon fabrication of the final bag and will occur after the other phases of testing. Phase II testing is scheduled to begin on October 31, 1994, and to be completed by November 4, 1994. Phase III testing is scheduled to begin on approximately November 7, 1994, and to be completed by November 11, 1994. The scheduling of phase IV testing activities is the responsibility of FFTF plant personnel. Phase IV testing will begin on approximately October 10, 1994, and be completed by October 20, 1994. Phase V testing is scheduled to begin on October 12, 1994, and to be completed by October 18, 1994. Depending on results of preliminary testing, this schedule may be subject to change.

11.0 REPORTS

Results of the tests will be documented in a supporting document. The preparation, format, control, retention, and traceability of all supporting documents will conform to the requirements of appropriate sections of *Standard Engineering Practices*, WHC-CM-6-1. Drawings of the test configuration will be included in the report along with any repairs, adjustments, maintenance, or other unplanned events.

12.0 REFERENCES

DOE-RL, 1992, *Hanford Site Hoisting and Rigging Manual*, DOE-RL-92-36, U.S. Department of Energy Field Office, Richland, Washington.

NFPA, 1990, *National Electrical Code*, NFPA 70, National Fire Protection Association, Quincy, Massachesetts.

WHC, 1994a, *Acceptance Test Procedure for the 241-SY-101 Flexible Receiver Gamma Detector System*, WHC-SD-WM-ATP-106, Draft, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994b, *Acceptance Test Procedure 241-SY-101 Flexible Receiver System Phase I Testing*, WHC-SD-WM-ATP-091, Draft, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994c, *Acceptance Test Procedure 241-SY-101 Flexible Receiver System Phase II Testing*, WHC-SD-WM-ATP-092, Draft, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994d, *Acceptance Test Procedure 241-SY-101 Flexible Receiver System Phase III Testing*, WHC-SD-WM-ATP-093, Draft, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994e, *241-SY-101 Test Pump Equipment Removal Fabrication Quality Assurance Project Plan*, WHC-SD-WM-WP-275, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-2, *Quality Assurance Manual*, latest revision, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-3, *Industrial Safety Manual*, latest revision, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-6-1, *Standard Engineering Practices*, latest revision, Westinghouse Hanford Company, Richland, Washington.

13.0 DATA SHEETS

Data sheets will be used for recording data and observations. These data sheets will be supplied with the acceptance test procedures for phase I, II, III, and V testing. A data sheet similar to that shown in Figure 3 will be used for phase IV testing.

"Exception to Acceptance Test" data sheets will also be provided with the test procedures and shall be used if exceptions to the specified test sequence occur during the test execution. The paragraph number of the test sequence shall be recorded and a description of the discrepancy shall be given. Exceptions to the test will be dispositioned and agreed to by all witnesses. Actions taken regarding disposition will also be noted on the exception data sheet.

The data sheets will be retained per the requirements of Section 8.0 of this test plan. These data sheets will have the current date, time, and name of the person recording data.

Figure 1. 241-SY-101 Flexible Receiver System.

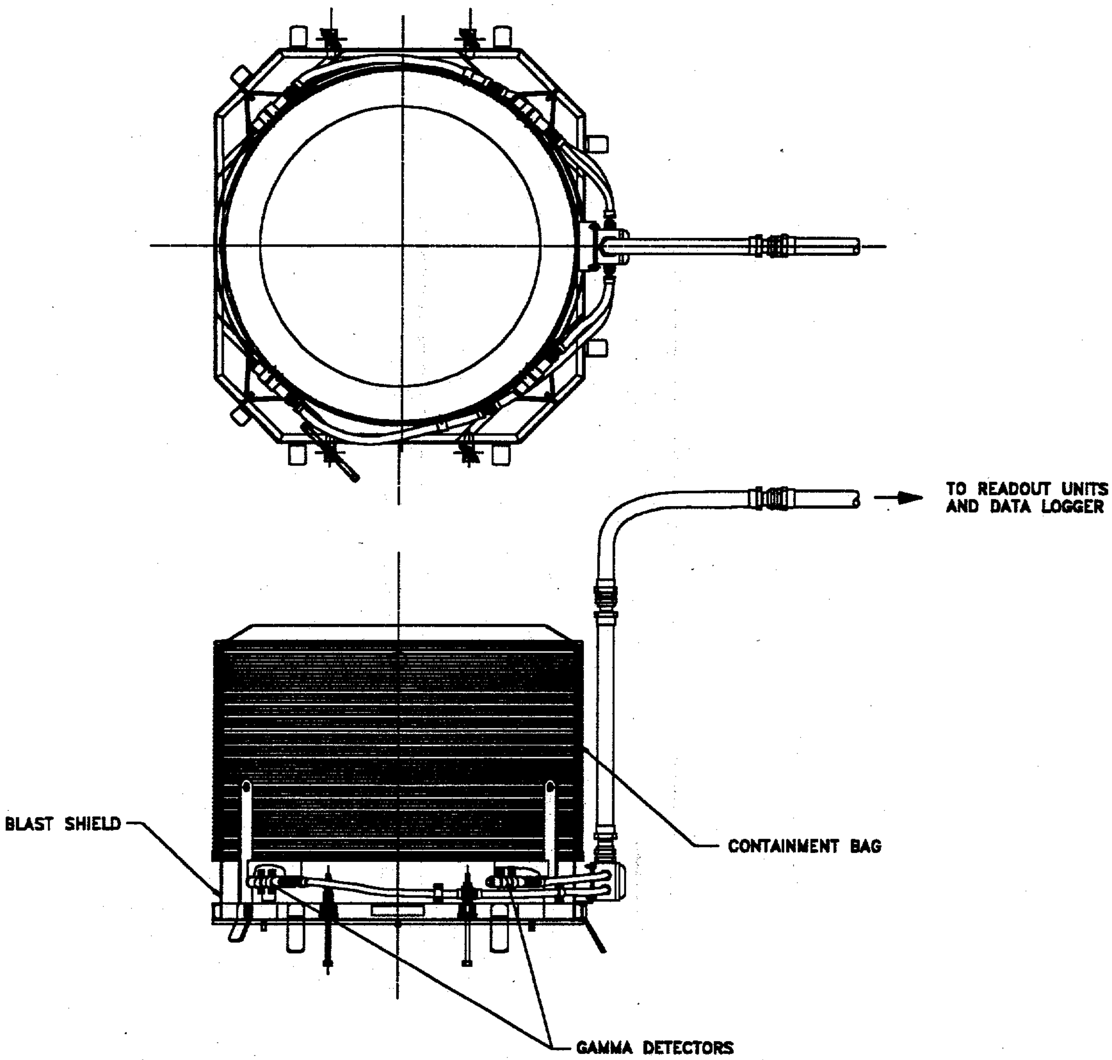

Figure 2. Flexible Receiver System Installed in the 241-SY-101 Central Pump Pit.

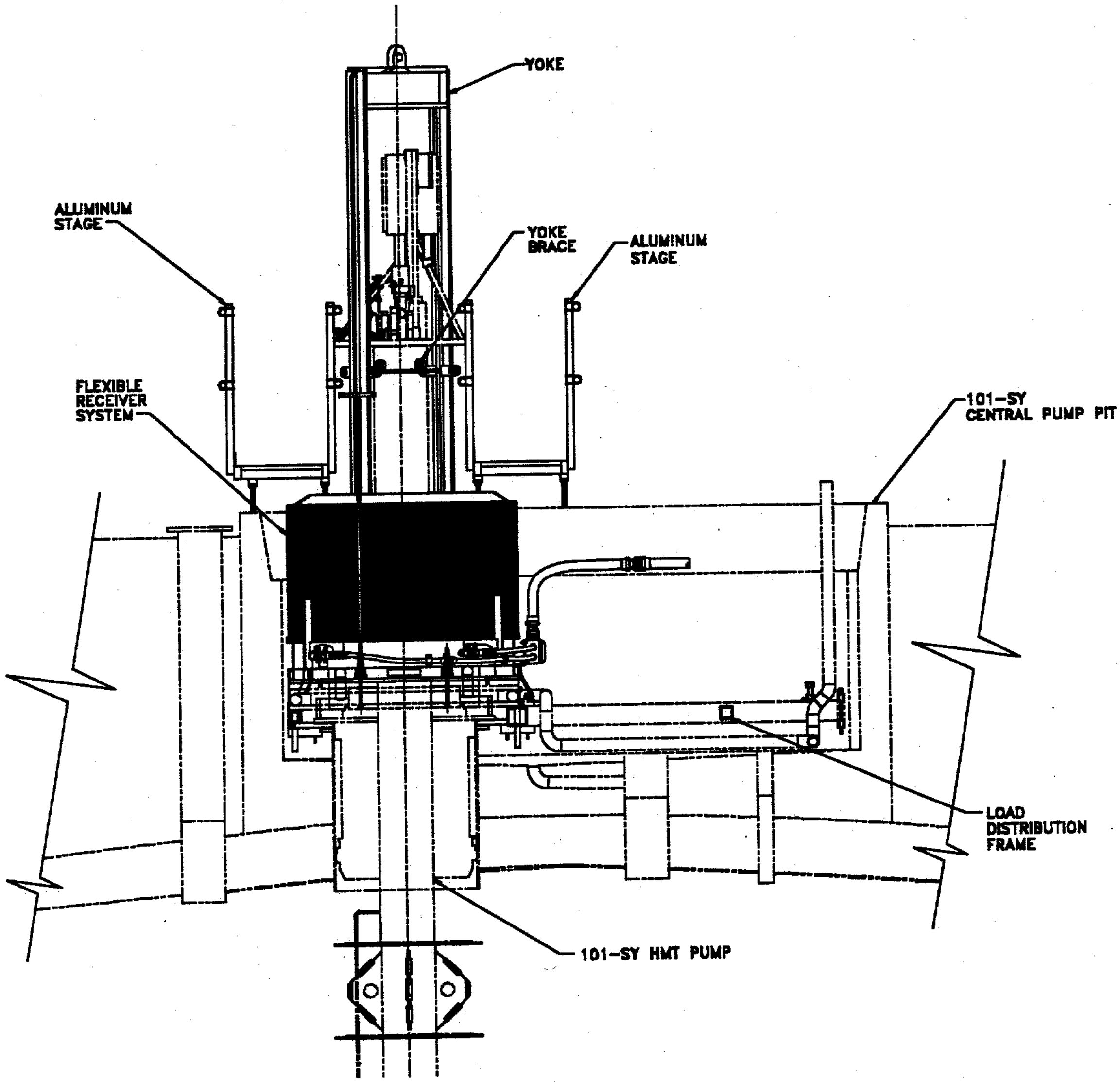

Figure 3. Sample Checklist for Qualification Testing of the 241-SY-101 Flexible Receiver System.

Date: ______________________ Document Number: ______________________

Title of Test: ______________________

Test Performed by: ______________________

Yes	No	
[ ]	[ ]	Was the yoke brace easily attached to the lifting yoke, without physical interferences? If no, provide brief description of interference and record pertinent dimensions below in the comment section.
[ ]	[ ]	Was the FRS lowered over the vertically restrained yoke without significant binding or interference of equipment?
[ ]	[ ]	Did the blast shield restraining latches engage easily and provide a secure attachment to the mock LDF?
[ ]	[ ]	Did the bag attachment mechanism function properly (using the extension poles if necessary)?
[ ]	[ ]	Did the bag remain securely in place during the entire pump extraction?
[ ]	[ ]	Other than performing observations, did test personnel remain at least 4.6 m (15 ft) away from the pump? This question applies only after the initial attachment of the bag to the mock pump has been made and the "contaminated" part of the pump is exposed.
[ ]	[ ]	Could the mock pump be lowered a minimum of 0.6 m (2 ft) back into the air cell without any significant binding of the containment bag? Significant binding is defined as binding that cannot be easily resolved using the extension poles. If no, describe in the comment section below.
[ ]	[ ]	Did the 180° window in the bottom of the bag line up within ± 0.3 m (1 ft) of the pump bottom?
[ ]	[ ]	Was the bag bottom cinch mechanism easily operable from a minimum distance of 15.2 m (50 ft)?
[ ]	[ ]	Did the operation of removing and bagging the mock pump proceed without breaking or tearing of the containment bag?

COMMENTS:

Test Witnesses:

______________________ Cognizant Engineer ______________ Date

______________________ Safety ______________ Date

______________________ Quality Assurance ______________ Date