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Project Title/Work Order 241-AP-102 Flexible Receiver System		EDT No. 700676 ECN No.

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Page 1 of 1

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1	1	Cog. Eng. SP Roblyer	SP Roblyer		H0-38						
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APPROVED FOR PUBLIC RELEASE

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SUPPORTING DOCUMENT

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5. Key Words	6. Author
Flexible receiver, Pump removal Waste tanks, 241-AP-102	Name: Steven P. Roblyer SP Roblyer Signature Organization/Charge Code 8M720 / D46EA

7. Abstract

This document describes the functional design criteria of the flexible receiver for pump removal from tank 241-AP-102. These criteria include the funcitonal and performance requirements of the flexible receiver as a barrier to contamination during normal conditions and contingencies, and to define requirements for instrumentation.

8. RELEASE STAMP

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CONTENTS

FUNCTIONAL DESIGN CRITERIA
241-AP-102 FLEXIBLE RECEIVER SYSTEM

1.0 INTRODUCTION

1.1 BACKGROUND

A mixer pump was installed in the 1.07 m (42-in.) riser of the central pump pit of tank 241-AP-102 to mitigate potential fluid separation particle sedimentation by mixing the tank's contents. The mixer pump performed this function until failure. Its removal is now necessary to meet possible tank content removal commitments or other corrective actions. The proposed removal procedure requires a flexible receiver that will provide a barrier to contamination during removal and transfer of the pump to the mixer pump storage container.

1.2 SCOPE

This document describes the functional design criteria of the flexible receiver. These criteria include the functional and performance requirements of the flexible receiver as a barrier to contamination during normal conditions and contingencies and the instrumentation requirements.

1.3 SITE LOCATION

Tank 241-AP-102 is located in the 200 East Area tank farms. Tank 241-AP-102 is a double-shell tank with a 4,390 m^3 (1,160,000 gal) capacity. The tank contains 4,190 m^3 (1,108,000 gal) of supernatant liquid. The mixer pump assembly is located within and below a 1.07 m (42-in.) ID dome riser in a pump pit at the center of the tank. The region above the tank is inside an exclusion area that limits the access of personnel and equipment.

1.4 PROJECT INTERFACES

The function of the flexible receiver is to provide a barrier to contamination on the mixer pump as it is removed from tank 241-AP-102 and is transferred to the mixer pump storage container. Instrumentation is required to measure the residual contamination as the mixer pump is lifted from the tank. The flexible receiver must interface with the tank's central pump pit and the 1.07 m (42-in.) riser, the tank ventilation system, the riser spray system, the lifting crane rigging, the mixer pump container, and the contamination and radiation measuring instrumentation.

2.0 PROJECT CRITERIA

The purpose of this project is to provide an acceptable barrier to the spread of contamination during the mixer pump's removal from tank 241-AP-102 and subsequent transfer to the mixer pump storage container. Instrumentation will provide information that will be used to determine whether tank liquid is trapped in the pump, means of draining this liquid from the pump, and the extent of the shielding required in the mixer pump storage container. To meet these project purposes, the following requirements must be met.

2.1 PERFORMANCE REQUIREMENTS

2.1.1 The flexible receiver shall provide a barrier to contamination on the removed pump that will withstand the maximum overpressure or vacuum of the tank ventilation system. These pressure extremes will include normal operation and expected abnormal operation of the tank ventilation system, including shutting off the ventilation system. The pressure inside the tank will include the induced pressure of the riser wash spray system, the accumulation of spray water at the base of the flexible receiver, and the natural forces identified in Section 5.4.

2.1.2 Leakage of pump contamination from seams and seals of the flexible receiver shall be adequately controlled to prevent exceeding environmental and personnel safety criteria listed in Section 5.0 during overpressure conditions that may occur while the flexible receiver is in communication with the tank ventilation system.

2.1.3 The flexible receiver shall attach to the modified top portion of the pump and unravel uniformly on the pump surface as the pump is raised from the tank riser. The flexible receiver shall be protected from damage by contact, adverse weather, and abrasion against equipment parts.

2.1.4 Spray water condensation from the riser wash system shall drain back into the tank riser or its contamination shall be reduced to acceptable levels, specified in Section 5.0, by seals and contamination control methods.

2.1.5 The flexible receiver shall be cinched closed after the pump has been removed from the riser. The cinching operation shall limit contamination releases to the atmosphere or surfaces inside the pump pit to acceptable levels, specified in Section 5.0, during transfer to the mixer pump storage container.

2.1.6 The sealed flexible receiver shall contain the weight of the liquids that may potentially drain from the internal and external surfaces of the removed pump in its vertical position and while being loaded into the mixer pump storage container.

2.1.7 The flexible receiver shall be compatible with chemicals in the tank with which it may come into contact so that its integrity will be maintained until the pump is sealed in the mixer pump storage container.

2.1.8 The pump lifting-lug modifications will be considered part of the flexible receiver system. The modified lifting-lug design shall be compatible with the lifting rigging and shall adequately withstand all forces resulting from lifting the pump and transferring it to the storage container.

2.1.9 The flexible receiver shall provide for removing waste tank liquids that may have entered closed air space sections of the pump. The design will address positioning, reliability, and verification of liquid removal.

2.2 OPERATIONAL REQUIREMENTS

2.2.1 The flexible receiver shall be compatible with below-the-hook lifting devices and shall provide access to pump lifting lugs.

2.2.2 The flexible receiver shall avoid interferences with lifting equipment and lifting operations so that it maintains its integrity until it is sealed into the mixing pump container.

2.2.3 The design of the flexible receiver shall accommodate recovery actions that respond to operational contingencies in the removal of the mixer pump and the transfer to the mixer pump receiver. These recovery actions will satisfy the objectives of safety, radiation protection, and environmental protection as listed in Section 5.0.

3.0 PROCESS CRITERIA

3.1 INSTRUMENTATION AND CONTROL

3.1.1 The flexible receiver system shall include a gamma monitoring system that provides measured dose rate data to quantify the extracted pump's residual contamination. The shielding requirements of the mixer pump receiver will be determined from these measurements. The shielding requirements may include choices between lead and steel shot fill over certain lengths of the mixer storage container, or possibly, the use of no additional shielding.

The gamma monitoring system shall have a minimum range of 0 - 0.2 Gy/h (0 - 20 R/h) with a minimum accuracy of $\pm$ 0.0001 Gy/h ($\pm$ 10 mR/h). Collimation of the detectors should be considered. The instruments shall be calibrated prior to use in the field. Signal conditioning and conversion shall be used to reduce the effects of externally induced noise. A data logging system should be considered for electronically correcting dose rate information.

3.1.2 Instrumentation will be supplied, or identified if existing, to verify the functioning of the flexible receiver. The monitored functions include leak-tightness of contamination barriers, operation of seals, alignment and positioning, and other functions listed in Section 2.0.

3.2 PIPING AND VESSELS

Not applicable.

3.3 GENERAL PROCESS

Not applicable.

3.4 GENERAL MECHANICAL PROCESSES

Not applicable.

4.0 FACILITY CRITERIA

Not applicable.

5.0 GENERAL REQUIREMENTS

5.1 SAFETY

5.1.1 Criticality.

Not applicable.

5.1.2 Safety Analysis

5.1.2.1 Safety Classification. The hazards classification of the flexible receiver as a barrier of contamination to personnel involved with installing and implementing the flexible receiver and to the environment is Safety Class 3, as defined in WHC-CM-1-3, *Management Requirements and Procedures*.

5.1.3 Contamination Control

Contamination control will be provided by the plans and procedures required in WHC-CM-7-5, *Environmental Compliance*, to mitigate the release of contamination to acceptable levels and to provide control and cleanup of subsequent leakage.

5.1.4 Shielding

Shielding will be provided, if required, along with other ALARA (as low as reasonably achievable) practices to meet the objectives of WHC-CM-4-11, *ALARA Program Manual*. The design may use remotely operated mechanisms to reduce personnel radiation exposure to ALARA levels if shielding is not practical.

5.1.5 Industrial Safety

The personnel protection practices in WHC-CM-4-3, *Industrial Safety Manual*, that apply to set up and conduct of operations of the flexible receiver will be addressed.

5.1.6 Fire Protection

Appropriate sections of WHC-CM-4-41, *Fire Protection Program Manual*, will be applied to the design and operation of the flexible receiver. Design considerations will address flammability of flexible receiver materials, preventive measures, presence of combustible materials and initiators, and fire extinguishing requirements.

5.1.7 Traffic Safety

Not applicable.

5.1.8 Industrial Hygiene

Engineering controls and personnel protective equipment will be applied in accordance with WHC-CM-4-40, *Industrial Hygiene Manual*, and WHC-SD-WM-HSP-002, *Tank Farms Health and Safety Plan*.

5.2 ENVIRONMENTAL PROTECTION COMPLIANCE

The applicable environmental requirements for new and modified facilities, as defined in Section 9 of WHC-CM-7-5, *Environmental Compliance Manual*, shall be identified and followed. Applicable permits will be identified, if required, and obtained prior to installation.

5.3 SAFEGUARDS AND SECURITY

Not applicable.

5.4 NATURAL FORCES

The requirements of the U.S. Department of Energy (DOE) Order 5480.28, *Natural Phenomena Hazards Mitigation*, shall be complied with in the design wherever applicable.

5.5 DESIGN FORMAT

Two-way traceability shall be provided between project drawings and the reference drawings from which they are developed. Project drawings shall identify existing drawings that will be affected by the project.

Design drawing formats shall be in accordance with the following:

WHC-CM-6-1, *Standard Engineering Practices*, Section EP-1.3, "Preparation of Engineering Drawings."

WHC-CM-6-3, *Drafting Standards Manual*.

5.6 QUALITY ASSURANCE

Quality assurance activities for all participants involved in development, design, procurement, construction, or testing must be formulated and executed in accordance with DOE Order 5700.6C, *Quality Assurance*, to provide the following assurances:

1. Design data and design decisions are documented and traceable.

2. The design and design criteria are adequately supported by the prepared plans, specifications, and analyses.

3. The design meets the baseline design criteria.

4. Construction is performed in accordance with the definitive design documents.

5. Testing confirms the adequacy of design, the quality of construction and manufactured components, operability and maintainability, and reliability. The quality assurance activities for all parties involved in Westinghouse Hanford Company activities are formulated and executed through the use of the project-specific quality assurance plan in accordance with WHC-CM-4-2, *Quality Assurance Manual*, Section QI 2.1.

The basis for establishing quality assurance program requirements is the safety classification.

5.7 DECONTAMINATION AND DECOMMISSIONING

The project design shall facilitate decontamination as prescribed in WHC-CM-7-5, Section 6.4, *Environmental Compliance*. The blast shield shall have a smooth exterior, which minimizes crevices that can trap waste, that will be easy to clean during removal. The project will also minimize hazardous waste generation and use of hazardous materials during construction, installation, and operation.

5.8 OPERATING PERSONNEL AND SERVICES

The design shall describe impacts to the operating staff requirements, including support organizations (e.g., maintenance, security, operations, and health physics). The services needed should also be addressed if they are not included in other sections of the functional design criteria.

5.9 TESTING

The design shall provide requirements for special testing that is to be imposed by the project to confirm that design requirements are met. Design verification and testing will follow the methods described in WHC-CM-6-1, *Standard Engineering Practices*. Testing from similar projects may be used if critical design features can be demonstrated to be generic.

6.0 CODES AND STANDARDS

The American Society for Testing and Materials standards will be used as a reference for specification and testing of materials. The most current revision will be used.

7.0 REFERENCES

DOE Order 5480.28, *Natural Phenomena Hazards Mitigation*, "Interim Guidance for Preparing Safety Assessments," Revision 2, U.S. Department of Energy, Washington, D.C.

DOE Order 5700.6C, *Quality Assurance*, U.S. Department of Energy, Washington, D.C.

WHC, 19XX, *Tank Farms Health and Safety Plan* WHC-SD-WM-HSP-002, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-1-3, *Management Requirements and Procedures*, Westinghouse Hanford Company, Richland, Washington.

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

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

WHC-CM-4-11, *ALARA Program Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-40, *Industrial Hygiene Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-41, *Fire Protection Program Manual*, Westinghouse Hanford Company, Richland, Washington

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

WHC-CM-6-3, *Drafting Standards Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-7-5, *Environmental Compliance*, Westinghouse Hanford Company, Richland, Washington.