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Functions and Requirements Document, WESF Decoupling Project, Low Level Liquid Waste System

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Abstract: This document defines the functions and requirements to decouple the Waste Encapsulation and Storage Facility (WESF) Low Level Liquid Waste system from B Plant.

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B Plant/WESF Decoupling Project
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FUNCTIONS AND REQUIREMENTS DOCUMENT
B PLANT/WESF DECOUPLING PROJECT
LOW LEVEL LIQUID WASTE SYSTEM

Issued by:

B & W HANFORD COMPANY

(February 21, 1997)

PREPARED BY: WESF CAPSULE MANAGEMENT TEAM

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FUNCTIONS AND REQUIREMENTS DOCUMENT
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LOW LEVEL LIQUID WASTE SYSTEM

1.0 INTRODUCTION

1.1 Background

The Waste Encapsulation and Storage Facility (WESF) was constructed in 1974 to encapsulate and store cesium and strontium which were isolated at B Plant from underground storage tank waste. The WESF, Building 225-B, is attached physically to the west end of B Plant, Building 221-B, 200 East area.

The WESF currently utilizes B Plant facilities for disposing liquid and solid waste streams. With the deactivation of B Plant, the WESF Decoupling Project will provide replacement systems allowing WESF to continue operations independently from B Plant. Four major systems have been identified to be replaced by the WESF Decoupling Project, including the following:

- Low Level Liquid Waste System
- Solid Waste Handling System
- Liquid Effluent Control System
- Deionized Water System

1.2 Scope

The purpose of this document is to define the functions and requirements to decouple the WESF Low Level Liquid Waste (LLLW) system from B Plant. Currently, LLLW generated at WESF is transferred directly from the WESF Process Cells, Pool Cells, and TK-100 to B Plant for interim storage and treatment before eventual transfer to the 200 East Area Tank Farms. The performance basis for the WESF LLLW System is documented in the WHC Internal Memo, (MOA, 1996).

The LLLW stream for normal WESF operating conditions includes water collected from manipulator decontamination, various drains connected to TK-100, capsule pool cell sumps, and other miscellaneous sources.

The LLLW stream for emergency operating conditions includes: water released into process cells (due to pipe leaks, inadvertent cell flooding, and fire protection system, etc...), water intrusion into the 225-B Truckport, K-3 filter and TK-50 pits, TK-100 pit, contaminated water from the process cells and pool cells (following recovery from a capsule leak in the capsule storage pool utilizing the emergency ion exchange system).

The WESF Decoupling Project will provide a system capable of transferring, storing and disposing LLLW from WESF prior to deactivation of B Plant.

Waste handling capability is provided for existing LLLW stream projections only. Reduced capabilities include:

- Reduced volume handling capability

- Reduced radiation handling capability
- Inability to handle "dangerous waste" as defined by WAC 173-303.
- Inability to use the process cell closed loop cooling system

1.3 Site Location

The WESF LLLW System will be primarily adjacent to the existing WESF facility. Some modifications may be necessary within the 225-B building. A Site Evaluation Report/Letter shall be generated during preliminary design when determination is made for potential expansion of existing facilities. No new (unreviewed) land disturbances are anticipated. A cultural resources/biological review has been previously performed in conjunction with the overall B Plant/WESF Decoupling Project (Letter, L.L. Hale to M.T. Jansky).

1.4 Project Interfaces

Design and construction of the WESF LLLW System will be integrated with ongoing Hanford Site functions and B Plant/WESF operating systems including the following:

- WESF Plant Monitoring and Control System (WPMCS)
- B Plant/WESF LLLW system
- WESF ventilation system
- WESF emergency ion exchange system
- WESF capsule storage system
- B Plant/WESF chemical sewer system
- Tank Farm LLLW disposal
- 15" and 24" cooling water drains
- 200-Area Effluent Treatment Facility (ETF)
- B Plant Deactivation
- Waste Minimization activities by WESF
- Steam elimination project

1.4.1 WESF Plant Monitoring and Control System (WPMCS)

The WESF Plant Monitoring and Control System (WPMCS) shall be utilized to perform any remote monitoring and control functions feasible unless otherwise herein specified.

1.4.2 B Plant/WESF LLLW System

The new WESF LLLW system shall be isolated from B-Plant and will not utilize B-Plant LLLW piping or process cell equipment. The chief interfaces between the existing WESF LLLW system and B-Plant include the existing piping connections from the WESF hot pipe trench to B-Plant (221-B) Cell 39, and the Cooling Water Drain, High Level (CDH) connection to TK-100. Any use of existing WESF hot pipe trench piping or routings connected to the WESF hot pipe trench shall include provisions to prevent any inadvertent intrusion of LLLW into 221-B and associated facilities. The B Plant Canyon deactivation will cap the B Plant end of the WESF LLLW routes. Any use of WESF Hot Pipe Trench routings by the new LLLW system will require more positive isolation and must be approved by B Plant Deactivation Planning prior to use.

1.4.3 WESF Ventilation System

The existing WESF ventilation system may be utilized for venting of the LLLW system tanks, piping, vaults, etc. Any new connections to the WESF ventilation system must be approved by the WESF HVAC System Engineer.

1.4.4 WESF Emergency Ion Exchange System

The LLLW project design must be coordinated with the WESF emergency ion exchange system design currently in progress. As currently contemplated, the trailer-mounted emergency ion exchange module would only be installed and connected in the unlikely event of a capsule failure in the pool cells. Therefore, the emergency ion exchange system capabilities shall not be utilized for routine LLLW handling. The existing LLLW transfer route from the pool cells to TK-39-1 must remain in service until the emergency ion exchange system is declared operational.

1.4.5 WESF Capsule Storage System

Safe storage of capsules is the primary, overriding mission of WESF. Any modifications in the capsule storage area must be coordinated with Facility Operations, Engineering, and Plant Management to assure continuous water coverage of the capsules and compliance with the Nuclear Safety Authorization Basis (SAR and BIO).

1.4.6 B Plant/WESF Chemical Sewer System

The sources selected for inclusion in the LLLW system are isolated from the B Plant/WESF Chemical Sewer System.

1.4.7 Tank Farm LLLW Disposal

The LLLW transport vehicles/methods selected must be compatible with Tank Farm waste receiving systems. It is anticipated that the WESF LLLW stream may require disposal to Tank Farms. The selected transport vehicle/method shall be compatible with the 204-AR waste receiving facility, which will provide the capability to perform any necessary chemical addition function at Tank Farms and subsequent disposal to double shell tanks (DSTs).

1.4.8 15" and 24" Cooling Water Drains

The sources selected for inclusion in the LLLW system must be isolated from the 15" and 24" Cooling Water drains. The existing connection between the CDH line and the 15" cooling water drain shall be isolated as part of this project. The existing connector between the cooling water drain, low level (CDL) line and the 24" drain shall also be eliminated as part of this project.

1.4.9 200-Area Effluent Treatment Facility (ETF)

The LLLW transport vehicles/methods selected must be compatible with the LEF waste receiving systems in the event that sampled LLLW meets LEF acceptance requirements. The Effluent Treatment Facility (ETF), which is considered a part of the LEF, has two tank trucks and a truck unloading facility. If the LLLW can meet ETF's waste acceptance specifications, the ETF could potentially treat and dispose the normal WESF LLLW.

1.4.10 B Plant Deactivation Project

The LLLW System shall be designed and constructed to support B Plant Deactivation activities, to the maximum extent possible.

1.4.11 Waste Minimization Activities by WESF

The LLLW System shall be responsive to waste stream projections which may be revised as WESF waste minimization activities continue (see 2.1.4).

1.4.12 Steam Elimination Project

Existing steam jets in F & G cells, the K3 pits and filters, and the TK100 pit will continue to be operated by steam supplied by a "package boiler" to be furnished by the steam elimination project.

2.0 PROJECT CRITERIA

2.1 Functional Requirements

2.1.1 System Definition

In general, LLLW is defined as the liquid waste which is contaminated by mixed fission products beyond environmental release limits, but does not require handling and disposal as high level waste. The LLLW in the WESF potentially contains high fission product (principally $^{90}Sr/Y$ and $^{137}Cs/Ba$) activity. Therefore, shielding may be required. The design basis for radiological content of the LLLW stream is 1 Ci/l (see Appendix B). The resulting radiological exposure conditions shall comply with 10 CFR 835.

2.1.2 Liquid Waste Source

The LLLW design basis source flow for WESF, under normal and emergency operating conditions, are provided in Appendix A, Future Stream. The values provided may be modified as ongoing WESF waste minimization activities are performed. In conjunction with the Decoupling Project, WESF will be responsible to attain "future condition" status as represented in Appendix A and MOA, 1996, attached.

2.1.3 WESF Low Level Liquid Waste Transport System

The WESF Low Level Liquid Waste System will provide capability to collect, store, monitor, sample, transfer and dispose LLLW. Transfer methods to be considered include, but are not limited to, the following:

- open-air LLLW transfer (isolation tank to tanker truck)
- shielded LR-56H tanker truck
- Waste Sampling and Characterization Facility (WSCF) tanker truck
- UO3 Plant UNH (uranyl nitrate hexahydrate) trailer
- 222-S LLLW trailer
- ETF tanker trucks
- Other existing and readily available transport systems

An assessment of available transport methods shall be provided early in the design phase with sufficient cost, schedule, and performance data to support selection of the preferred transport system.

2.1.4 Waste Minimization

In conjunction with the WESF Decoupling Project, WESF Operations will improve current operational methods/procedures to reduce LLLW stream volume by the time the new LLLW system is operational. Projected LLLW generated under normal operating conditions will be reduced to less than 1000 gallons per year, and accident conditions will be potentially reduced to no more than 4,000 gallons per year.

2.1.5 Design Life

The WESF LLLW System will be designed to function for a minimum of 20 years. Equipment, instrumentation and consumable components may have a design life of less than 20 years if it is economically feasible to accommodate repair and/or replacement.

2.1.6 Reliability

The provided degree of reliability shall be sufficient to ensure the LLLW System will function safely and efficiently throughout the design life of the system without undue maintenance, repair or radiological exposure to personnel.

2.1.7 System Exceptions

The design basis for the provided LLLW System is not intended to accommodate the following:

- Capsule decontamination for a large scale re-encapsulation program
- Flushing the capsule storage pools to remove the radioactivity released by a capsule leak in the WESF Pool Cells
- New programs/missions for the WESF Process Cells
- The storage or generation of a "dangerous waste".
- Flushing of process cells A-E and/or equipment for decontamination.

2.2 Performance Requirements

2.2.1 Storage Capacity

The LLLW system will provide two 4000 gallon (minimum) tanks to accommodate normal and emergency LLLW streams (Reference Appendix A). On a "straight-through basis", the first tank shall be used for LLLW collection, and the second shall be isolated from any LLLW inputs during sampling, shipment approval, and truck loading. Both tanks shall have radiological monitoring capability.

2.2.2 Level Detection

Liquid level instrumentation in collection and isolation tank(s) will be provided to monitor the liquid level and prevent overflow. Level indication and alarms will be provided locally and to the WPMCS.

2.2.3 Waste Sampling/Monitoring

The LLLW system will provide capability to monitor and sample the isolation tank. Means shall be provided to mix or agitate the tank contents when staged for shipment in order to ensure that samples are representative of the LLLW contained therein. Instrumentation will be provided to measure radiation in both the LLLW tanks. Indication will be both local and at the WPMCS.

2.2.4 Waste Transfer Capabilities (tank to truck)

The LLLW system will provide capability to safely transfer LLLW from an isolation tank to an above-ground transport vehicle for final disposal. Transfer capability from the isolation tank to transport vehicle will be provided at a rate of 50 gpm (minimum). The LLLW system shall provide capabilities to vent the transport container, as required. A vented container must be included in any notifications to or requests for approval from WDOH. The waste transfer system shall provide automatic shut down capability to prevent overflowing the transport container and shall provide the capability to contain leaks and/or spills.

2.2.5 Tank Ventilation/Filtration

The design of gaseous effluent monitoring systems will comply with DOE requirements (ANSI N42.18), WAC 246-247, and will require approval of the Washington State Department of Health (WDOH) prior to construction and installation.

Any system that may discharge airborne effluents from confinement will be exhausted through a ventilation system designed to remove particulate materials, vapors, and gases as needed to comply with the guidance provided in DOE Order 6430.1A, Section 1300-1.4.3, WAC 246-247, and the ASHRAE Handbook.

If dangerous materials are present, design will be in accordance with DOE Order 5480.4 and WAC 173-400. Current assumptions made by the Decoupling Project are that no dangerous materials are or will be present.

All effluent concentrations and quantities of hazardous material will be ALARA (WHC-IP-1043 and HSRCM-1).

2.2.6 Radiation/Contamination Levels

The LLLW system will be designed to maintain occupational radiation and contamination levels to 20% of applicable dose standards and ALARA. (Ref. 10 CFR 835.1001, .1002; DOE 6430.1a, Div. 13, Sec. 1300-6.2, HSRCM-1)

2.2.7 Operations/Maintenance Accessibility

The LLLW system shall be designed to minimize system operations downtime during normal maintenance activities.

Location and arrangement of equipment shall allow convenient accessibility for operations and maintenance activities.

2.2.8 Weather Protection

Protection from the environment shall be provided as required to assure safe operations of the LLLW system. Equipment shall be protected from deleterious effects of environmental conditions. Weather protection enclosures shall be considered, and freeze protection will be provided as required to support all-weather operation.

2.2.9 Construction Accessibility

Design shall consider hazardous work areas and installation methods to facilitate safe and cost-effective construction practices.

2.2.10 Materials of Construction

All equipment and materials used shall be selected for compatibility with the intended service. Construction materials and components will be selected to minimize the potential for radioactive material buildup. Materials of construction will be compatible with anticipated LLLW stream characteristics. Ease of decontamination shall be considered in equipment and material selection.

2.2.11 Containment/Confinement

Materials and equipment shall be selected and systems designed to provide and maintain control of radiological materials during normal and emergency operations. Radiological containment and/or confinement systems shall be included in system design, operation, and maintenance.

3.0 PROCESS CRITERIA

3.1 Instrumentation and Control

Where practical, new instrumentation and control equipment will be compatible with existing equipment to facilitate operations and maintenance.

The LLLW system shall operate automatically to collect LLLW from floor drains to prevent potentially contaminated LLLW from backing up into the facility. Passive, gravity drains are preferred over transfer systems requiring pumping, active instrumentation and control.

Transfer of LLLW from F-Cell, G-Cell, K-3 Filter, K-3 pits, and TK-100 pit sumps will continue to be performed by existing equipment. Other LLLW pumps shall be controlled from local panels and from the WESF Plant Monitor and Control System (WPMCS) (i.e. an enabling signal will be supplied by the WPMCS, allowing the pump to be started locally, and the pump will then be operated locally). The pump will normally be shut down from the local panel, but may, in an emergency situation, be shut off remotely from the WPMCS. High and low level signals and interlocks shall be provided as appropriate.

Transfer of LLLW from the isolation tank into the transport container shall be initiated manually to ensure that this transfer does not occur until hoses are properly connected, truck is in position, and each batch has been administratively approved for shipment.

The liquid level, pressure, and gross radiation level of LLLW collection and isolation tanks shall be monitored, displayed, and alarmed on the WPMCS. Any above-ground tanks shall also have temperature instrumentation that shall be monitored, displayed, and alarmed on the WPMCS.

The LLLW transport container loading system shall be instrumented and controlled to prevent overfilling the transport container.

Capability to obtain direct radiation monitoring of both collection and isolation tanks (displayed on the WPMCS) shall be provided.

3.2 Piping and Tankage

Tanks will be designed to collect and store the LLLW wastes. Two - 4,000 gallon (minimum) tanks will be provided. Methods to transfer LLLW from the isolation tank to an above-ground transport vehicle will be provided.

The LLLW piping system will be designed to transfer the LLLW from initial source points to the collection tank, from the collection tank to the isolation tank, and from the isolation tank to the transport vehicle. Piping systems shall be designed and installed to eliminate unintentional low points and minimize line holdup. Any new pumped lines shall be sloped back to the origin tank. All underground piping shall have cathodic protection.

The new tank will be designed and constructed in accordance with ASME Boiler and Pressure Vessel Code Section VIII, Div. 1, and piping will be designed and constructed in accordance with ASME B31.3. The isolation tank shall be provided with a minimum of four (4) spare 2" nozzles and the pit will be provided with four (4) 2" pipe penetrations for future connections.

Valves used shall meet the requirements of the piping code that governs the piping to which they are attached.

The materials of construction will be compatible with the WESF LLLW stream. Material thickness will be adequately sized to accommodate required conditions.

All equipment exposed to the environment will be designed to operate under adverse conditions as defined in DOE 6430.1A and ICF KH A/E STD, GC-LOAD-01.

3.3 General Process Description

3.3.1 Chemicals

WESF will control the quantity and type of chemicals added to the LLLW system to prevent all contributors to the LLLW stream from being designated as a Dangerous Waste per WAC-173-303.

3.3.2 AMU Area

LLLW generated in 225-B second floor areas such as the AMU and AMU mezzanine, drains via header 2"DR-9200-M8, which, in turn, has been diverted to 2"DR-9224-M8. This portion of the LLLW stream will consist of water and decontamination chemicals with trace amounts of radioactivity (< .001 Ci/liter). The radioactivity present in this portion of the LLLW stream will not require special radiological shielding.

3.3.3 225-B Second Floor

LLLW generated in 225-B second floor areas such as the canyon, transmitter rooms, canyon decontamination sink, manipulator repair shop, and crane maintenance and decontamination area, drains via header 2"DR-9254-M8. This portion of the LLLW stream will consist of water and decontamination chemicals with trace amounts of radioactivity (< .001 Ci/liter). The radioactivity present in this portion of the LLLW stream will not require special radiological shielding.

3.3.4 225-B First Floor

LLLW generated in 225-B first floor areas such as the hot and cold manipulator shops, operating gallery, service gallery, air locks, decontamination sink, decontamination shower, truck port, and south east portion of the capsule storage pool area drains via headers 8"DR-9253-M8 and 2"DR-9254-M8. This portion of the LLLW stream will consist of water and decontamination chemicals with trace amounts of radioactivity (< .001 Ci/liter), and decontamination chemicals. The radioactivity present in this portion of the LLLW stream will not require special radiological shielding.

3.3.5 Pool Water Collection Area (pools 9&10)

Liquid effluent generated in the capsule storage pool areas will normally meet environmental discharge limits, and will not be part of the LLLW stream. However, following recovery from a capsule failure in the capsule storage pool, most or all liquid wastes generated in the capsule storage pool area could exceed environmental discharge limits and require disposal via the LLLW stream. The bulk clean-up would be performed by the Emergency Ion Exchange System (EIES). All liquids discharged to the LLLW system from the capsule storage pool area would be sufficiently free of radiological contamination that no special shielding provisions need be made. Connection points shall be provided by the Decoupling Project for future tie-in of capsule storage pool liquid waste sources. The existing connection to transfer water directly from each capsule storage pool to B-Plant via the LLLW system shall be eliminated as part of the emergency ion-exchange project.

3.3.6 F & G Cells

LLLW generated in the Process Cells F and G will normally be sufficiently free of radiological contamination to permit being contact handled without special shielding requirements. However, under capsule failure accident conditions, LLLW from F and G cells could potentially contain over 1000 Ci/liter ^{137}Cs/Ba. Radiological design basis (for contained systems) for Decoupling LLLW system project shall be 1 Ci/l ^{137}Cs/Ba (Appendix B). Any equipment installed in F and G cells as part of the Decoupling Project, shall be capable of withstanding continuous exposure to 100,000 rad/hr external radiation fields, and total radiological exposure of 1×10^8 rads (lifetime accumulative) since these process cells are currently being used to inspect and store unshielded capsules. Cumulative radiation exposure for material degradation shall be addressed for any equipment installed as part of this project.

3.3.7 K3 Filters & Duct

After decoupling, the K-3 duct, filters, and filter system pits will not normally contribute significant radiological contamination to the LLLW, resulting in a LLLW stream that can be contact handled without special shielding requirements. However, if residual contamination in the K-3 duct and filter system is inadvertently dislodged, LLLW from future K-3 duct and filter washes could potentially contain up to 1 Ci/liter ^{137}Cs/Ba in the collection tank. Also, the K-3 filter prefilter(s) may be washed to extend the life of the filter or to reduce dose rates prior to K-3 filter changeout.

3.3.8 Outdoor Areas

LLLW generated in outdoor areas such as the K-1 filter area, exhaust stack, TK-100 sump, TK-50 pit drain, will generally be sufficiently free of radiological contamination to permit being contact handled with minimal shielding requirements. However, postulated upset conditions could result in significant radiological contamination of these contributors, and shielding is required.

3.4 General Mechanical Processes

Pumps will be selected to operate in the middle (or design optimum) of their flow and head ranges.

LLLW shall be transferred from generating points to the collection tank by gravity drain wherever practical and cost-effective. It is recognized that this may not be possible for certain low-elevation sumps such as the K-3 filter pits, capsule storage pool cell sumps, and process cell sumps.

The final LLLW isolation tank shall be equipped with mechanical agitation and/or pumped recirculation loops and samplers in order to obtain representative samples of the LLLW prior to shipment to the selected disposal location. It is not necessary for any tank located upstream or downstream of the sampling location to be so equipped provided that the requirement to obtain representative samples of the LLLW to be loaded into transport containers is met.

It is anticipated that some or all of the selected disposal locations will require sample analyses prior to accepting LLLW from WESF. Therefore, an isolation tank must be provided to store the LLLW staged for shipment after sampling while awaiting approval from the LLLW receiving organization. Newly generated LLLW must not be allowed to contaminate or mix with the isolated LLLW. This isolation staging activity must not interfere with ongoing collection of LLLW as it is generated.

4.0 FACILITY CRITERIA

The Low Level Liquid Waste system shall be designed in accordance with DOE order 6430.1a.

4.1 Architectural and Civil/Structural

Any structures constructed as part of the Decoupling Project shall meet pertinent provisions of the Uniform Building Code (UBC), AISC, AISI, ASCE, AWS, MBMA, and ICF KH A/E STD, GC-LOAD-01.

4.2 Heating, Ventilating, and Air Conditioning

The ASHRAE Handbook shall be utilized in the design of any new or additions to the 225-B HVAC system, including tank ventilation.

4.3 Utilities

4.3.1 Steam

Existing steam applications remaining after decoupling will be operated from package boilers supplied by the Steam Elimination project. Replacement of existing steam-operated equipment in the LLLW system such as the F&G-cell sump jets, the pool cell LLLW jet, the pool cell utility jet, the K-3 filter & sump jets and the TK-100 sump jet is not included in the scope of this project. No new steam operated equipment will be added as a result of this Decoupling Project.

4.3.2 Water

LLLW system pipe and tank internal flushing capability shall be provided where applicable. Safety showers and/or eyewashes may be required at the loadout station.

4.3.3 Sewage

No WESF specific requirements have been identified.

4.3.4 Electrical

The LLLW system may utilize the existing WESF electrical supply and distribution system. Anticipated loads shall be submitted to BWHC for approval early in the design phase.

4.3.5 Lighting

Lighting shall be provided in all locations requiring routine operator access for surveillance, operation, and/or maintenance per ICF KH A/E STDS, GE-IPWR-01, GE-EPWR-01 and per DOE 6430.1A.

4.3.6 Compressed Air

The LLLW system may utilize the existing WESF compressed air system for pneumatic instruments, controls, actuators, etc. Any major air consumption requirements such as air spargers, air ejectors, air-powered pumps, etc, requires BWHC approval to ensure that the capacity of the existing (or projected) facility compressed air system is not exceeded.

4.4 Communications Systems

Any LLLW handling, sampling, or load-out facilities outside the 225-B building shall be provided with connections to the WESF PAX telephone system.

4.5 Automatic Data Processing

Instrumentation shall be compatible with and tied into the WPMCS for critical parameters such as tank levels, temperatures, radiation levels, pump enabling, etc. Specifics will depend on the design and lay-out of the LLLW system.

4.6 Energy Conservation

Energy conservation shall be considered when selecting the optimal insulation thickness for outdoor piping and equipment which requires heat tracing per DOE 4330.2D. Energy efficiency shall be considered in selecting any pumps or other energy consuming equipment added by the Decoupling Project.

4.7 Maintenance

4.7.1 Facility

Information furnished by vendors shall include Operation and Maintenance instructions, calibration requirements, and recommended calibration and preventative maintenance intervals.

4.7.2 Equipment

Equipment shall be provided with test ports where appropriate to minimize disassembly and downtime during routine testing and calibration.

Certified Vendor Information (CVI) shall be provided for all equipment purchased for the WESF Low Level Liquid Waste system per WHC-CM-6-1, EP 3.3 and WHC-IP-1026, EPG 3.3.

4.7.3 Materials

Materials of construction shall be compatible with the environment to which they are exposed.

5.0 GENERAL REQUIREMENTS

5.1 Safety

5.1.1 Criticality

WESF does not handle fissionable material and is classified as fissile exempt. As such, criticality mitigation or prevention need not be considered.

5.1.2 Safety Analysis

New or revised safety documentation will verify design features, operating requirements and administrative controls required for the facilities prior to operations. As a minimum, project documentation will include an Unreviewed Safety Questions (USQ) Screen/Evaluation. Additional documentation, including a Fire Hazards Analysis (HFA) and a Preliminary Safety Evaluation (PSE) may be required depending on the outcome of the USQ. The FHA and PSE are the Project's responsibility. The USQ is WESF's responsibility. Appropriate input will be provided to the WESF

Safety Equipment List (SEL), the Basis for Interim Operations (BIO) and Safety Analysis Report (SAR). The WESF LLLW System is currently designated Safety Significant per WHC-CM-4-46.

5.1.3 Contamination Control

Potential contamination risks exist during construction of the LLLW System. Work procedures will be implemented as appropriate (per 10 CFR 835, HSRCM-1, and applicable facility RadCon requirements) to ensure the safety of construction and operations personnel.

The LLLW system shall be designed to minimize, to ALARA, the possibility of spread of contamination outside the facility per 10 CFR 835.404(b).

Piping and tanks shall be constructed of 300 series Stainless Steel to minimize holdup of contamination and facilitate decontamination.

5.1.4 Shielding

Operating/Maintenance personnel will be protected from exposure to potential radiation sources from accident conditions. The risk of personnel radiation exposure will be minimized by appropriate equipment placement and shielding methods. The amount of shielding will be determined by analysis and will comply with as-low-as-reasonably-achievable (ALARA) principles (WHC-IP-1043) and the Hanford Site Radiological Control Manual (HSRCM-1), 10 CFR 835.1001 and .1002 and DOE 6430.1A, Section 1300-6.2.

5.1.5 Industrial Safety (OSHA)

Design will ensure construction of this project can be accomplished in accordance with all OSHA safety requirements (OSHA, 1996). This is required by DOE Order 5480.4 and successor Order O 440.1. The DOE Orders require contractors and subcontractors performing work in DOE owned or leased facilities at Hanford to comply with the OSHA Regulations in Title 29 of the Code of Federal Regulations (CFR), Part 1910, 1915, 1918, 1926, and 1928; as well as to comply with additional health and safety requirements set forth in the order.

5.1.6 Fire Protection

Fire Protection will be provided in accordance with DOE Orders 6430-1A, 5480.7A, and the National Fire Protection Agency (NFPA, 1996), as required. Any new fire alarm system provided will be connected to the Hanford Site Radio fire Alarm System. Basis for elimination of the fire protection system from WESF process cells will be documented by BWHC/WESF in the Fire Hazard Analysis (FHA). Additional requirements may be contained in HNF-CM-4-41.

5.1.7 Traffic Safety

The location of the LLLW equipment shall be designed to minimize adverse effects on traffic safety per HNF-CM-8-7, Section 906. Traffic safety shall also be considered in the layout of the transport container loading area.

5.1.8 Double Isolation/Redundancy

No WESF specific requirements identified.

5.1.9 Facilitated Lockout

Components purchased for the WESF LLLW system shall facilitate lockout for isolation of hazardous energy sources per HSL&T-1 and WHC-CM-1-5, Section 9.1.

5.1.10 Radiological concerns

The design basis for the Low-Level Liquid Waste system shall be 1 Ci/l ^{137}Cs-Ba. Appropriate shielding to protect personnel for this level of radiation dose shall be provided. Any equipment introduced into F or G cells shall be able to withstand dose rates of up to 100,000 Rad/hr.

5.2 Environmental Protection and Compliance

5.2.1 Permitting and Reviews

Environmental permits, sampling, and monitoring will be commensurate with applicable federal, state and local regulations and the Hanford Site Environmental Compliance Manual (WHC-CM-7-5) as follows:

- Notice of Construction from Washington Department of Health (Clean Air Act permit)
- RCRA permit (Needed only if Dangerous Waste is present)
- NEPA CX (approved)
- Cultural/Historical Review, specific to WESF LLLW system
- Cultural/Biological Resources Review
- LLLW acceptance criteria at Tank Farms (204-AR)
- LLLW acceptance criteria at the Effluent Treatment Facility (ETF)

Obtaining the permits is WESF's responsibility.

5.2.2 Monitoring and Sampling

The monitoring and sampling will comply with WHC-CM-7-5 and WAC 246-247. WAC 173-303 may also be applicable if dangerous waste will be generated or stored. Current assumptions made by the Decoupling Project are that no dangerous materials are or will be present.

5.2.3 Surveillance and Inspection

New installations shall provide convenient access for surveillance and maintenance activities. If the Notice of Construction (NOC) to WDOH is required, certain surveillances and/or inspections may be necessary. If a RCRA permit is required, additional surveillances will be required.

5.2.4 Hazardous Wastes/Materials

The Decoupling Project will minimize the use and generation of hazardous substances. Hazardous substances will be identified and, if used, will be encapsulated to prevent contamination while permitting recovery, recycle, and/or reuse wherever feasible.

Material Safety Data Sheets (MSDS) will be provided for all hazardous materials utilized in the construction of the project. Hazardous waste which is generated will be handled in accordance with established B Plant/WESF methods and procedures. All Hazardous Materials brought into the facility must be approved by the facility Industrial Hygienist and the Hazardous Material Specialist prior to purchase.

5.2.5 Secondary Containment

Secondary containment is not required from an environmental standpoint since the WESF LLLW system does not handle dangerous waste.

5.2.6 Integrity Assessment

No provisions for integrity assessments are required.

5.3 Safeguards and Security

The WESF LLLW System is located in the 200 East Area and will not contain any quantities of special nuclear materials. However, design and construction activities will comply with requirements of DOE Order 6430.1A and Hanford Site security procedures (WHC-CM-4-33).

5.4 Natural Forces

The facility structure provided to decouple the LLLW system will comply with the criteria defined in DOE Order 6430.1A.

5.5 Design Format

Project-specific drawings will be provided for the WESF LLLW System. Design media will be generated in accordance with Hanford Site Drafting Practices (WHC-CM-6-3). The project shall provide ECNs to affected essential facility drawings. In general, facility drawings will not be revised to reflect as-built conditions. Changes to facility drawings identified as "Essential" will be documented in accordance with established B Plant/WESF configuration management practices per WHC-CM-5-6, Section 5.22, "B Plant/WESF Configuration Management Program".

5.6 Quality Assurance

Quality Assurance (QA) activities for all engineering and construction activities for the WESF LLLW system will be executed through the use of WHC-CM-5-6, "B Plant/WESF Transition Projects Administration", Section 10, "Quality Policies" (QPs), which is the B Plant/WESF Quality Assurance Program Plan. A graded approach to QA will be applied as reflected by the QPs and procedure 5.12 of the same manual. Engineers shall employ quality assurance provisions as necessary to assure system performance when failure could significantly affect worker safety, plant mission, or cost.

5.7 Decontamination and Decommissioning

The design will facilitate decontamination and decommissioning of the WESF LLLW System in accordance with DOE Order 6430.1A and other applicable standards. System design shall minimize buildup of residual contamination by avoiding practices which promote accumulation of contamination in piping and equipment.

5.8 Operating Personnel and Services

The design will consider human factors for maintenance, testing, and operations activities, including equipment, valve location and orientation, waste handling and building layout. (Reference: MIL-STD-1472C)

5.9 Testing

B&W Hanford approved Acceptance Test Procedures (ATPs) will be successfully performed on all applicable systems and equipment. All completed systems will be subject to satisfactory completion of customer performed Operational Test Procedures (OTPs).

6.0 CODES AND STANDARDS

The WESF LLLW System will be designed to handle LLLW streams based on the applicable provisions of the DOE Orders 6430.1A and 5400.1, 5400.5, 10 CFR 835, and HSRCM-1.

All equipment shall be UL listed as applicable.

Electrical installations shall meet National Fire Protection Association (NFPA) No. 70 requirements per the 1996 National Electrical Code (NEC).

Applicable codes, standards and requirements identified in the WESF Standards/Requirements Identification Document (S/RID) shall be adhered to.

Structures shall meet applicable provisions of the Uniform Building Code (UBC).

7.0 REFERENCES

Note: if any of the following references are superceeded, renamed and reissued, or eliminated during the course of the project's design phase, the newest replacement requirements, documents or orders will be used.

10 CFR 835, "Occupational Radiation Protection", Code of Federal Regulations, Washington, D.C.

AISC Manual of Steel Construction, "Allowable Stress Design", 9th Edition, American Institute of Steel Construction.

AISI Cold Formed Steel Design Manual, Part I, "Design of Cold-Formed Steel Structural Members", American Iron and Steel Institute.

ANSI N42.18, "DOE Requirements for Radiological Effluent Monitoring and Environmental Surveillance for U.S. Department of Energy Operations", {1980 (R1991)}

ASCE Manual, July, 1993, "Minimum Design Loads for Buildings and Other Structures", American Society of Civil Engineers.

ASHRAE Handbook, 1996, "HVAC Systems and Equipment", American Society of Heating, Refrigerating and Air-Conditioning Engineers.

ASME, 1992, Boiler and Pressure Vessel Code, Section VIII, Division 1, "Pressure Vessels", American Society of Mechanical Engineers, New York.

ASME, 1993, Code for Pressure Piping, B31.3, "Chemical Plant and Petroleum Piping", American Society of Mechanical Engineers, New York.

AWS D1.1, 1996, Structural Welding Code, Steel, American Welding Society.

Brehm, J.R., 1996, "WESF Interim Safety Basis Project Plan, WHC-SD-WM-PAP-063, Rev.0, Westinghouse Hanford Company, Richland, Washington

DOE Order 4330.2D, "In-House Energy Management", 1992, U.S. Department of Energy, Washington, D.C.

DOE Order 5400.1, "General Environmental Protection Program, 1988 (R1990)", U.S. Department of Energy, Washington, D.C.

DOE Order 5400.5, "Radiation Protection of the Public and the Environment", 1990, U.S. Department of Energy, Washington, D.C.

DOE Order 5480.4, " Environmental Protection, Safety, and Health Protection Standards", 1984 (R1993), U.S. Department of Energy, Washington, D.C.

DOE Order 6430.1A, "General Design Criteria", 1989, U.S. Department of Energy, Washington, D.C.

EPA 1991, "National Emission Standards for Hazardous Airborne Pollutants", Title 40, Code of Federal Regulations, Part 121, as amended, U.S. Environmental Protection Agency, Washington, D.C.

HNF-CM-4-41, "Fire Protection Program Manual", Rel. 021, Westinghouse Hanford Company, Richland, Washington.

HNF-CM-8-7, Section 906, "Road and Traffic Systems", January 31, 1989, Westinghouse Hanford Company, Richland, Washington.

HSL&T-1 (DOE-RL-SOD-INST-L&T.001, REV 1), Hanford Site Lock and Tag Program, 1996, United States Department of Energy, Washington, DC.

HSRCM-1, Hanford Site Radiological Control Manual, Westinghouse Hanford Company, Richland, Washington.

ICF KH A/E STD, GC-LOAD-01, (replaced SDC 4.1, "Design Loads for Facilities"), ICF Kaiser Hanford, Richland, Washington.

ICF KH A/E STD, GE-EPWR-01, (replaced SDC 7.2, "Outside Lighting and Aerial Distribution Systems"), ICF Kaiser Hanford, Richland, Washington.

ICF KH A/E STD, GE-IPWR-01, (replaced SDC 7.5, "Interior Power and Lighting"), ICF Kaiser Hanford, Richland Washington.

Letter, 1996, L.L. Hale, PNNL, to M.T. Jansky, "Cultural Resources Review of the B Plant/WESF Decoupling", HCRC#96-200-082, dated July 12, 1996

MBMA, Low-Rise Building Systems Manual, Metal Building Manufacturers Association.

MIL-STD-1472C, "Human Engineering Design Criteria for Military Systems, Equipment, and Facilities", Department of Defense, Washington, D.C.

MOA, 1996, WHC Internal Memo, 16000-96-002, "MEMORANDUM OF AGREEMENT, WESF DECOUPLING - LOW LEVEL LIQUID WASTE SYSTEM", E.D. Robbins to J. L. Pennock, Dated February 29, 1996.

NFPA, 1996, National Electric Code, NFPA 70, National Fire Protection Association, Quincy, Massachusetts.

OSHA, 1996, "Code of Federal Regulations", Title 29, Part 1926, as amended, Occupational Safety and Health Administration - Labor, Washington, D.C.

UBC, 1994, Uniform Building Code, International Conference of Building Officials.

WAC 173-303, 1995, "Dangerous Waste Regulations", Washington Administrative Code, Olympia, Washington.

WAC 173-400, 1995, "General Regulations for Air Pollution Sources", Washington Administrative Code, Olympia, Washington.

WAC 173-401, 1994, "Operating Permit Regulations", Washington Administrative Code, Olympia, Washington.

WAC 246-247, 1994, "Radiation Protection - Air Emissions", Washington Administrative Code, Olympia, Washington.

WHC, 1994, "Radiological Design", WHC-SD-GN-DGS-30011, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-33, "Security Manual", Rel. 069, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-46, "Safety Analysis Manual", Rel. 021, February 26, 1996, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-5-6, "B Plant/WESF Transition Project Administration", Rel. 076, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-6-1, "Engineering Standards Manual", Rel. 070, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-6-3, "Drafting Standards Manual", Rel. 012, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-7-5, "Environmental Compliance", Rel. 088, Westinghouse Hanford Company, Richland, Washington.

WHC-IP-1026, "Engineering Practice Guidelines", Functional Design Criteria, Appendix D, May 27, 1994, Westinghouse Hanford Company, Richland, Washington.

WHC-IP-1043, "WHC Occupational ALARA Program", 1995, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-MP-SRID-007, Rev.0, WESF Standards and Requirements Identification Document", Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-BIO-002, Rev. 0, 1996, "Waste Encapsulation and Storage Facility Basis for Interim Operations", Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-IOSR-001, Rev. 0, 1996, "Waste Encapsulation and Storage Facility Interim Operational Safety Requirements", Westinghouse Hanford Company, Richland, Washington.

8.0 ACRONYMS and ABBREVIATIONS

A/E	Architectural/Engineer
AISC	American Institute of Steel Construction
AISI	American Iron & Steel Institute
ALARA	As Low As Reasonable Achievable
AMU	Aqueous Make-Up
ATP	Acceptance Test Procedure
ASCE	American Society of Civil Engineers
ASHRAE	American Society for Heating, Refrigeration and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
AWS	American Welding Society
BIO	Basis for Interim Operations
BWHC	B&W Hanford Company
CDH	Cooling Water Drain, High Level
CDL	Cooling Water Drain, Low Level
CFR	Code of Federal Regulations
CM	Controlled Manual
CVI	Certified Vendor Information
DOE	Department of Energy (United States)
DST	Double Shell Tank
EIES	Emergency Ion Exchange System
ETF	Effluent Treatment Facility
FDNW	Fluor Daniel Northwest, Inc.
FHA	Fire Hazard Analysis
HVAC	Heating, Ventilating and Air-Conditioning
HSRCM	Hanford Site Radiological Control Manual
ICBO	International Conference of Building Officials
ICF-KH	ICF Kaiser Hanford
IOSR	Interim Operational Safety Requirements
LEF	Liquid Effluent Facilities
LLLW	Low Level Liquid Waste
MBMA	Metal Building Manufacturers Association
MOA	Memorandum of Agreement
MSDS	Material Safety Data Sheet
NEC	National Electric Code
NEPA	National Environmental Policy Act of 1969
NFPA	National Fire Protection Association
NOC	Notice of Construction
OSHA	Occupational Safety and Health Administration
OTP	Operational Test Procedure
PNNL	Pacific Northwest National Laboratory
PSE	Preliminary Safety Evaluation
QA	Quality Assurance
RCRA	Resource Conservation and Recovery Act of 1976
SAR	Safety Analysis Report
S/RID	Standards and Requirements Identification Document
STDS	Standards
TEDF	Treated Effluent Disposal Facility
UBC	Uniform Building Code

UL	Underwriters Laboratories
UNH	Uranyl nitrate hexahydrate
WAC	Washington Administrative Code
WDOH	Washington State Department of Health
WESF	Waste Encapsulation and Storage Facility
WHC	Westinghouse Hanford Company
WPMCS	WESF Plant Monitoring and Control System
WSCF	Waste Sampling and Characterization Facility

APPENDICES

Appendix A: WESF LLLW System Projected Source Flows

WESF LOW LEVEL LIQUID WASTE SOURCES NORMAL OPERATING CONDITIONS			
EXISTING CONDITION SOURCE/DESCRIPTION	EXISTING STREAM	FUTURE CONDITIONS SOURCE/DESCRIPTION	FUTURE STREAM
Capsule Decon: 3 in F Cell. 200 gallons to decon each capsule.	600 gal	Decon cells prior to shutdown of B Plant LLLW.	0 gal/yr
Manipulator changeout/decon: A Cell - 2/yr A Cell Hood - 4/yr B Cell - 4/yr C Cell - 4/yr D Cell - 3/yr E Cell - 3/yr F Cell - 3/yr Broken Manipulators - 5/yr Total Manipulators - 28 100-200 gal per manipulator Maximum total is 2800-5600 gal/yr. G Cell does not require water to decon.	5600 gal/yr	Remove manipulators from Cells A through E. Cells must be cleaned to the point that all water sources can be deactivated; fire sources are eliminated, etc. Operations reserves potential to place manipulators back into use. F Cell manipulator may not require decon if cell is cleaned out.	0-600 gal/yr
Drains: All drains are now connected to the LLLW system to TK-100. Contaminated water for clean-up, misc uses, etc...	200 gal/yr	Plug all unnecessary drains to TK-100	0 gal/yr
Pool Cell Sump: Water jetted to TK 39-1 direct. Add 3-5 gal to sump during periodic test. Run Jet for 1-2 minutes to jet out sump after Pool Cell Leak Detector calibrations. Jet out 13 Leak Detectors biannually.	130 gal/yr	Pump to drum and test sample for radionuclides. Dispose to chemical sewer, if acceptable.	0 gal/yr
Safety Showers: Currently all safety showers have been disconnected.	0 gal/yr	Portable showers may be used if required.	100 gal/yr

WESF LOW LEVEL LIQUID WASTE SOURCES NORMAL OPERATING CONDITIONS			
EXISTING CONDITION SOURCE/DESCRIPTION	**EXISTING STREAM**	**FUTURE CONDITIONS SOURCE/DESCRIPTION**	**FUTURE STREAM**
Miscellaneous steam traps (steam condensate for ventilation directed to other streams): About 40 gallons/shift to charge lines on 2nd floor of 225-B, plus 100 gallons for each batch of TSP made up.	1000 gal/yr	Fewer TSP makeups when manipulators removed. Minimize amount of condensate routed to LLLW. Replacement of steam system will eliminate this source.	500 gal/yr; 0 gal per year after steam eliminated.
TOTAL	7530 gal		1200 gal
NOTE: Isolation study identified yearly flow to TK-100 as 5000 gallons. This estimate was based on a year where the number of manipulator change-outs was lower than normal.			

WESF LOW LEVEL LIQUID WASTE SOURCES ACCIDENT CONDITIONS			
EXISTING CONDITION SOURCE/DESCRIPTION	**EXISTING STREAM**	**FUTURE CONDITION SOURCE/DESCRIPTION**	**FUTURE STREAM**
Process Cells:			
Pipe Leaks: Pipe Leaks assumed to be minimal unless catastrophic. No catastrophic (> 1000 gal) leaks to date.	1000 gal/incident	Minimize amount of piping charged with water, to offset increasing age of facility.	1000 gal/ incident
Cell Flooding: Liquid source not turned off flooding cell. Past incidents resulted in water flowing through the K-3 duct into TK-100. , Total volume unknown; assumed to be < 1000 gal.	1000 gal/incident	Eliminate all liquid sources to process cells (except F & G).	0 gal/ incident
Fire Protection: Assume fire in G Cell. Residual pressure in line is 107 psi. The four fire fog nozzles operate at 10 GPM for fifteen minutes	600 gal/incident	Remove fire hazard from cells and/or replace fire protection with non-water system.	0 gal/ incident
Recovery after capsule failure accident: loss of capsule contents to sump after leaking capsule moved to process cell and placed on scrubber for inspection.	500 gal/ incident. Up to 50,000 Ci ^{137}Cs/Ba or ^{90}Sr/Y	Administratively limit handling of suspect or failed capsules to minimize contact with water.	500 gal/ incident Up to 1800 Ci ^{137}CsBa or ^{90}SrY/ incident
Water intrusion from canyon via cell cover blocks following roof leak, line break, etc.	100 gal/incident	Seal cover blocks, eliminate canyon water sources, and maintain roof.	0 gal/ incident

WESF LOW LEVEL LIQUID WASTE SOURCES ACCIDENT CONDITIONS			
EXISTING CONDITION SOURCE/DESCRIPTION	EXISTING STREAM	FUTURE CONDITION SOURCE/DESCRIPTION	FUTURE STREAM
Capsule Storage/Handling Pool Cells:			
Overfill Pool 6-12 in: Water presently can be transferred to B Plant LLLW System with WESF Water Removal System. Other pool cells can also be used to equalize the water level.	350-700 gal/incident	Identify alternative emergency plan to remove water from Pool Cells.	0 gal/ incident
Capsule Failure: Flush contamination to B Plant by alternately flushing increment of water to LLW and refilling with clean demineralized water. This is a low probability event. No capsule has ever leaked at WESF.	250,000 gallons/ incident	Install Emergency Ion Exchange System	300 gallons/ incident
Liner leak accident.	Low probability, up to 1000 gallon per incident.	Continue surveillance of leak alarms, and maintenance of detectors. Divert this water to pool cells 9 & 10.	0 gallons per incident.
Waste Water Pool Cells 9 & 10: Used for collection of "potentially" contaminated water from the pool cell pump trench from various sources. Pool Cells 9/10 normally discharge to the chemical sewer. Water is periodically sampled and tested to ensure compliance with radiological requirements for shipment to TEDF. <u>If found contaminated i.e., following a capsule failure accident,</u> this water must be transferred to the LLLW system.			
Pool Cell Heat Exchanger Pumps: when not maintained, leakage can generate approx 1000 gal/yr	500 gal/ year	Maintain pumps to minimize loss of water to pump trench.	50 gallons/ year
K-4 Supply Ventilation steam condensate: when K-4 heating system is used, steam condensate is generated at up to 650 gal/day.	10,000 gal/year	Eliminate steam condensate to pool cells or direct steam to alternative system (Chem sewer).	0 gallons per year
Pool Cells 9 & 10 are emptied about 15 times per year. Approximately 8400 gallons per transfer, allowing potential for 8400 gallons of LLLW if a batch is found contaminated.	8400 gal/ incident	Sample pool cell at a 2000 gal limit to reduce potential volume transfer to LLLW system.	2000 gal/ incident

WESF LOW LEVEL LIQUID WASTE SOURCES ACCIDENT CONDITIONS			
EXISTING CONDITION SOURCE/DESCRIPTION	EXISTING STREAM	FUTURE CONDITION SOURCE/DESCRIPTION	FUTURE STREAM
Water Intrusion:			
1. Incident in July, 1991: Rain storm/flash flood collected 1000-2000 gal of water in TK-100 2. Incident in January, 1997: Rapid snow melt caused by warm winds filled the K-3 filter pits with water. An additional 1000 gallons may have entered TK100 through the Truckport floor drain. Approx 5,000 gal were transferred to LLW. 3. Incident in January, 1997: Heavy rainfall on frozen ground overflowed the storm drain outside the truck port. Approximately 7,000 gallons entered Tk-100 via the truck port floor drain.	2000 gal/ incident 5,000 gal/ incident 7,000 gal/ incident	Implement methods (improved storm drain arrangement, diking, grading to direct storm water away from LLLW drains, seal covers, etc...) to preclude water intrusion.	2000 gal/ incident
TK-50 Pit: Rain water intrusion; data from 12/5/95 rain storm, jetted approximately 300 gal	300 gal/ incident	Seal to preclude water.	0 gal/ incident
Fire Protection: Assume three sprinklers are activated and suppress fire in fifteen minutes. Residual pressure is 60 psi. Flow equals 2000 gallons.	2000 gal/ incident		2000 gal/ incident

WESF LOW LEVEL LIQUID WASTE SOURCES ACCIDENT CONDITIONS			
EXISTING CONDITION SOURCE/DESCRIPTION	EXISTING STREAM	FUTURE CONDITION SOURCE/DESCRIPTION	FUTURE STREAM
K-3 Filter Sprays: Up to 5,000 Ci 137-Cs/Ba migrates to K-3 filter, requiring wash-down before filter can be replaced. Filter sprays used to wash contamination to filter sump, jetted to Tk-100.	 1000 gal/ incident. Up to 5100 Ci 137-Cs/Ba/ incident.	 Characterize K-3 duct. Clean out as needed. Assume no more than 1000 Ci 137-Cs/Ba remains in duct. Minimize activities in process cells, and canyon to minimize potential for dislodging contamination or introducing additional contamination into filters.	 500 gal/ incident. Up to 1000 Ci 137Cs/Ba per incident (0.53 Ci/Liter)
TOTAL	289,200 gal		7850 gal

Appendix B: Composition of New WESF Low Level Liquid Waste Stream

The new WESF LLLW stream will contain fewer chemical and radioactive constituents than were handled during prior operations.

B.1 Chemical Constituents

As outlined in Appendix 1, the principal component of WESF LLLW will be water. Sampling data are not available to characterize the remaining portion of the stream due to the absence of sampling locations in Tk-100 and other key portions of the existing LLLW system. Projections of the compositions of typical 3500-gallon batches of LLLW staged for load-out is presented for normal operation and accident scenarios in Tables B-1 through B-4, below.

Table B-1 LLLW Composition During Normal Operation

Constituent	Concentration	Units	Remarks
Tri-Sodium Phosphate	0.1	Weight %	
Sodium Nitrate	50	ppm	
?	?		
?	?		
pH	4-11	pH	
Hardness	?		Comparable to raw water
TOC	?		Lubricant residues removed during decontamination of manipulators, equipment
SrF_2			Principal form of 90-Sr/Y contamination
CsCl			Principal form of 137-Cs/Ba contamination
90-Sr/Y	<0.001	Ci/liter	
137-Cs/Ba	<0.001	Ci/liter	

Table B-2: LLLW Composition if Window Seal Fails

Constituent	Concentration	Units	Remarks
Tri-Sodium Phosphate	0.1	Weight %	
White mineral oil	100	ppm	1 liter oil residue from hot cell shielding window (remainder wiped up for disposal as solid waste).
Surfactants	?		Screened prior to use in order to ensure non-dangerous per applicable regulations.
Sodium Nitrate	50	ppm	
?	?		
pH	4-11	pH	
Hardness	?		Comparable to raw water
TOC	?		Lubricant residues removed during decontamination of manipulators, equipment
SrF_2			Principal form of 90-Sr/Y contamination
CsCl			Principal form of 137-Cs/Ba contamination
90-Sr/Y	<100	uCi/liter	
137-Cs/Ba	<100	uCi/liter	

Table B-3 LLLW Composition if Capsule Leaks

Constituent	Concentration	Units	Remarks
Tri-Sodium Phosphate	0.1	Weight %	
Other decontamination agents, which may include citrates, surfactants, etc.	?	?	Screened prior to use to ensure non-dangerous per applicable regulations.
Sodium Nitrate	50	ppm	
?	?		
pH	4-11	pH	
Hardness	?		Comparable to raw water
TOC	?		Lubricant residues removed during decontamination of manipulators, equipment
SrF_2			Principal form of 90-Sr/Y contamination
CsCl			Principal form of 137-Cs/Ba contamination
90-Sr/Y	< 1	Ci/liter	
137-Cs/Ba	< 1	Ci/liter	

B.2 Radiological Constituents

The new LLLW system will be designed for a maximum of 1 Curie of 90-Sr (in secular equilibrium with its 90-Y daughter product) or 137-Cs (in secular equilibrium with its 137-Ba daughter) per liter. This design basis must encompass anticipated operating conditions. Designing for too low a concentration could lead to excessive radiation exposure to operators sampling and loading out the isolation tank, or might even prevent operation of the LLLW system altogether.

The main sources of radioactivity to the LLLW system are:

- K-3 duct. It currently contains up to 5,100 curies of 137-Cs/Ba or 200,000 curies of 90-Sr/Y (Brehm, 1996). The distribution of isotopes is unknown, so other combinations are possible between these two extremes. Tk-100 will not be disconnected from B-Plant until the K-3 duct characterization/clean out is finished. If the clean out is 80% effective, there may still be up to 1000 curies of 137-Cs/Ba trapped in risers, inaccessible locations, etc. If Tk-100 does not pump out until it contains at least 500 gallons (1892 liters), then the residual contamination in the K-3 system will result no more than 0.53 curies 137-Cs/Ba per liter in the isolation tank.

- Hot cells. Cells A-E, and to a lesser extent, F cell, still contain much 90-Sr/Y and 137-Cs/Ba. The direct route from the hot cells to Tk-39-1 will not be disconnected until the hot cells have been cleaned out. Cells A-E will not be connected to Tk-100, but CDL/CDH nozzles are available in each hot cell for future connections if needed. In the unlikely event that a capsule ever fails in the pool cells, the failed capsule will be moved to F and G cells. WESF operations must be limited if a failed capsule is ever placed in one of the hot cells:

    - The capsule cannot be placed on the existing scrubber, since the CsCl is very soluble, and most of a capsule contents (50,000 curies) could dissolve in the scrubber.

    - The fire suppression sprays in F-cell and G-cell must not be operated, to prevent dissolving significant amounts of 137-CsCl in the water.

    - No water could be added to F-cell, and the F-cell sump could not be transferred to Tk-100 if there was any stain or chunk adhering to a capsule that might contain over 1800 curies. This corresponds to at least 70 grams of CsCl, or a chunk over 1 inch on a side. Through regular surveillance, operators can visually detect crusts of this magnitude on or near a failed capsule and alert management to invoke water use restrictions. This is judged to be the minimum amount of CsCl which can be reliably excluded from the LLLW system. 1800 curies in 500 gallons of water in Tk-100 results in 0.95 curies/liter in Tk-100.

- Manipulator decontamination. The number of curies removed from a manipulator during decontamination has not been quantified. However, manipulators can be contact handled, so it follows that the LLLW can be contact handled as well, especially after mixing with the other feeds to Tk-100.

Careful sequencing of transfers from Tk-100 to the isolation tank may enable WESF to keep concentrations lower in the isolation tank. The radiation instrumentation in the Tk-100 pit and in the isolation tank pit will help WESF keep isolation tank radioactivity as low as reasonably achievable.

Westinghouse Hanford Company Internal Memo

From: WESF Decoupling Project 16000-96-002
Phone: 372-0001 S4-66
Date: February 29, 1996
Subject: MEMORANDUM OF AGREEMENT, WESF DECOUPLING - LOW LEVEL LIQUID WASTE SYSTEM

To: J. L. Pennock S4-70

cc: K. A. Jennings-Mills S6-60
R. E. Heineman, Jr. S6-60
W. A. Holstein S4-66
F. H. Lee S4-66
J. C. Midgett S6-65
M. M. Serkowski S4-66
D. W. Wilson S4-66
EDR:File/LB

The purpose of this memorandum of agreement (MOA) is to provide a path forward to complete the B Plant/WESF Decoupling Project for the WESF Low Level Liquid Waste (LLLW) System. This MOA will document the future condition for WESF, defined as the operational state of WESF upon the deactivation of B Plant. It will also provide a technical baseline for the Decoupling Project, and identify individuals/organizations responsible for completion of specific tasks.

Currently, LLLW generated at WESF is transferred directly from the WESF Hot Cells and Tank 100 to B Plant for interim storage and treatment before eventual transfer to Tank Farms. Attachment 1 illustrates the current flow of B Plant/WESF LLLW for both normal and emergency conditions.

The LLLW stream for normal WESF operating conditions includes water collected from: manipulator decontamination, drains connected to TK-100, capsule pool cell sump, safety showers, and other miscellaneous sources. A specific application to decontaminate capsules returned from PNNL, to be completed in FY 1998, will generate a one-time LLLW source.

The LLLW stream for emergency operating conditions includes: release of water into Hot Cells (due to pipe leaks, inadvertent cell flooding, and fire protection system, etc...), water intrusion into K-3 filter and TK-50 pits, overfill of capsule storage pool, and drainage from safety showers.

The path forward to completion of the WESF Solid Waste System consists of several steps, as depicted on Attachment 2. Mr. E. D. Robbins will serve as the overall project lead for the completion of the WESF Decoupling Solid Waste System. Mr. Robbins will perform overall project management functions and is ultimately responsible for project performance. He will coordinate with B Plant/WESF organizations in assigning task responsibilities and resources to ensure completion of the project. Task Leads are assigned and are responsible for completion of individual steps, as follows:

1. Identify Future Facility Condition - Dewey Robbins
2. Functions and Requirements - Fred Lee
3. Conceptual Design - Fred Lee
4. Detail Design - Fred Lee
5. Fabrication and Installation - Fred Lee

Although each step is assigned to a Task Lead, input from the WESF Operations and Engineering personnel will be required for generation, review and approval of various documents. WESF Operations/Engineering agrees to review and comment on each task within a two week time period and understands that delays in completion of tasks may affect WESF's ability to dispose of solid waste. The Decoupling Project will develop a detailed project schedule from which WESF Operations/Engineering can plan necessary support resources.

The WESF Decoupling Project will provide monthly project status, or more frequently as required. Active participation by WESF craft and operations personnel will be an integral part of developing project requirements, concepts and design. Cooperative sharing of information by all project participants will ensure completion of a project meeting the needs of WESF Operations and within the time constraints associated with the B Plant Deactivation.

FUTURE WESF FACILITY CONDITION AND ASSOCIATED ACTIONS

WESF Operations/Engineering is in agreement with the following assumptions which document the future WESF facility condition. In addition, WESF Operations/Engineering agrees to be responsible to complete all associated actions required to meet the assumptions by May, 1998.

1. WESF Operations has read and is in general agreement with WESF Low Level Liquid Waste Sources for normal operating conditions and emergency conditions provided in Attachment 3. Utilization of Decoupling Project budget may be considered to facilitate WESF waste minimization and engineering support activities.

2. The WESF LLLW stream is assumed to be non-hazardous to determine design criteria and requirements. Therefore, the facility will ensure hazardous materials are not transferred to the LLLW stream.

3. The Pool Cell Water Removal System will be deactivated and not available for use.

4. The Decoupling Project will provide a method to transfer water, (if contaminated) from Pool Cell 9 and 10 to the new LLLW system.

5. WESF Hot Cells A-E will be cleaned out to the extent the existing Fire Protection system will not be required. The solid waste in these cells will be removed prior to deactivation of B Plant so that all manipulators can be removed from the cells. The manipulators will be removed from the cells, but can be re-installed by operations, if required. All potential liquid sources to these cells will be eliminated to decrease the risk of accidental flooding of the hot cells, the K-3 filter duct and the K-3 filters. Therefore, no LLLW will be generated in WESF Hot Cells A-E. No solid waste will be generated in

the WESF Hot Cells A-E after September 30, 1997. Specific actions include:

a. Document in Fire Hazard Analysis (FHA) requirements for hot cells to eliminate fire protection requirements.

b. Identify the clean-out/decontamination criteria for the WESF Hot Cells A - E which will maintain the hot cell windows in a safe configuration, will allow manipulators to be removed from the hot cell windows, and will meet the FHA fire protection requirements.

c. Identify all nozzles or liquid sources in the WESF hot cells which should be blanked or disconnected to eliminate the risk of accidental release of liquids to the Hot Cells and/or the K-3 duct or the K-3 filters.

d. Identify ventilation requirements to place the WESF hot cells in a "Laid up" configuration.

e. Clean out hot cells to meet the criteria in Actions 6a. and 6b. Blank or disconnect nozzles identified in Action 6c. Implement ventilation requirements as identified in Action 6d. Remove manipulators from the hot cells.

6. WESF Operations methods/procedures will be revised to reduce LLLW streams to an operating volume of 1000 gallons per year (maximum) for normal operating conditions. Actions include:

a. Shut down all safety showers except the AMU mezzanine, 1st floor AMU (between transmitter rooms), and service gallery. All test water will be collected in a drum and will not be added to the LLLW.

b. Shut down drains no longer required to be used for the WESF LLLW system. These drains will be identified by the Decoupling team and agreed upon by WESF Operations after final LLLW system configuration design criteria is complete.

c. Uncontaminated cleaning waste water will not be directed to the LLLW drains.

d. Pump pool cell sump water to a drum during completion of Pool Cell Leak Detector calibrations. Test for radionuclides and dispose to liquid effluent stream if acceptable.

7. WESF Operations methods/procedures will be revised to minimize the risk for accidents which could contribute to the LLLW stream. Actions include:

a. Eliminate potential leaks to the WESF Hot Cells F and G by isolating liquid sources to the cells (except for Fire Fog) when not required for process operations.

b. Develop an emergency recovery plan to remove water from pool cells when Water Removal System is deactivated.

c. Repair all leaks in timely manner to preclude catastrophic leaks. Maintain pool cell pumps to minimize loss of water to pump trench. Maintain plant piping in good condition to preclude catastrophic leaks.

d. Seal off Tk-50 pit to preclude water intrusion.

e. Seal off K-3 filter pits to preclude water intrusion. Add action to operating procedure to keep K-3 filters clear of snow.

8. The K-3 filter duct will be cleaned out if required prior to shutdown of B Plant LLLW system.

9. The Decoupling Project will not provide a LLLW system to accommodate:

a. Capsule Decontamination for a large scale re-encapsulation program

b. Capsule Leak in the WESF Pool Cells

c. New programs/missions for the WESF Hot Cells

10. All equipment presently using steam will be replaced with a system which does not generate a LLLW stream.

LOW LEVEL LIQUID WASTE PROJECT TASKS

The Decoupling Project team will provide a detailed schedule of tasks based on the agreements reached in this MOA and the path forward shown in Attachment 2. Applying the above assumptions, a conceptual vision for managing WESF LLLW will be obtained through a coordinated effort by the Decoupling Project and WESF Operations. The project schedule will be dependent on resource availability from WESF and the Decoupling Project, use of outside resources will be maximized.

MEMORANDUM OF AGREEMENT APPROVAL

The following B Plant Transition Projects and WESF Operations/Engineering personnel concur with this Memorandum of Agreement.

E. D. Robbins, Project Lead
WESF Decoupling Project
B Plant/WESF Transition Project

pan:phl

Attachments (3)

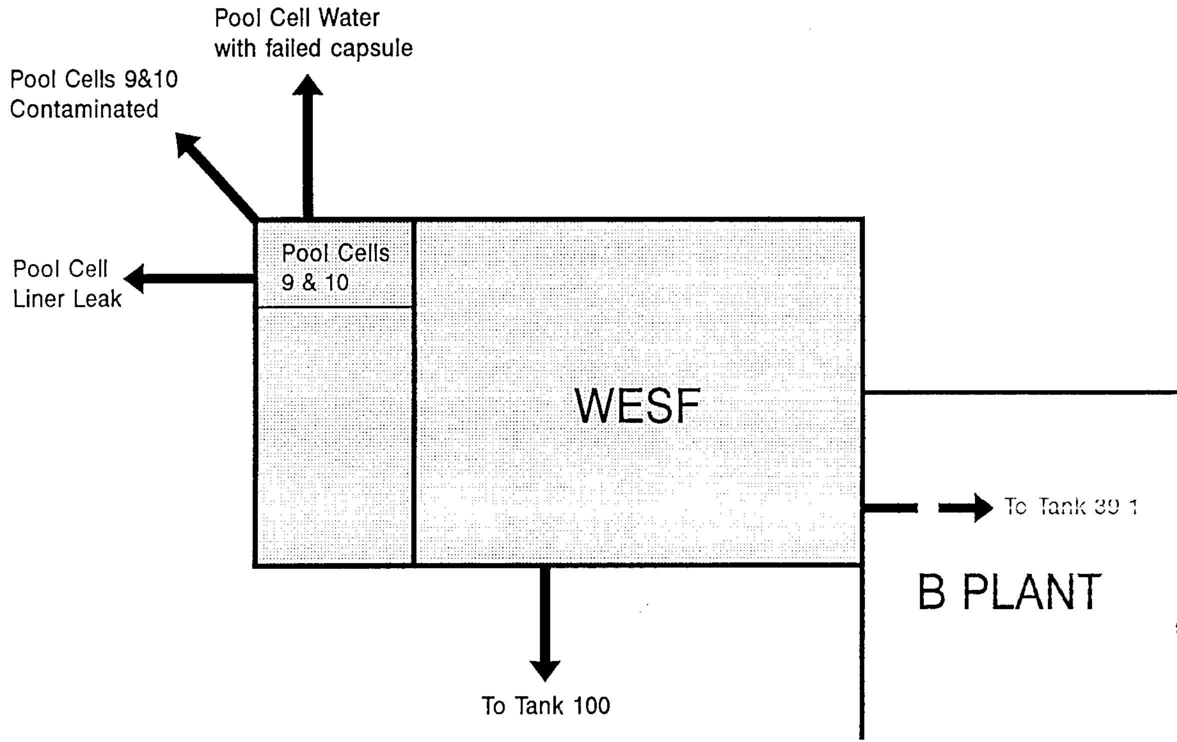
CONCURRENCE:

2/29/96
K. A. Jennings-Mills, Manager
WESF Engineering

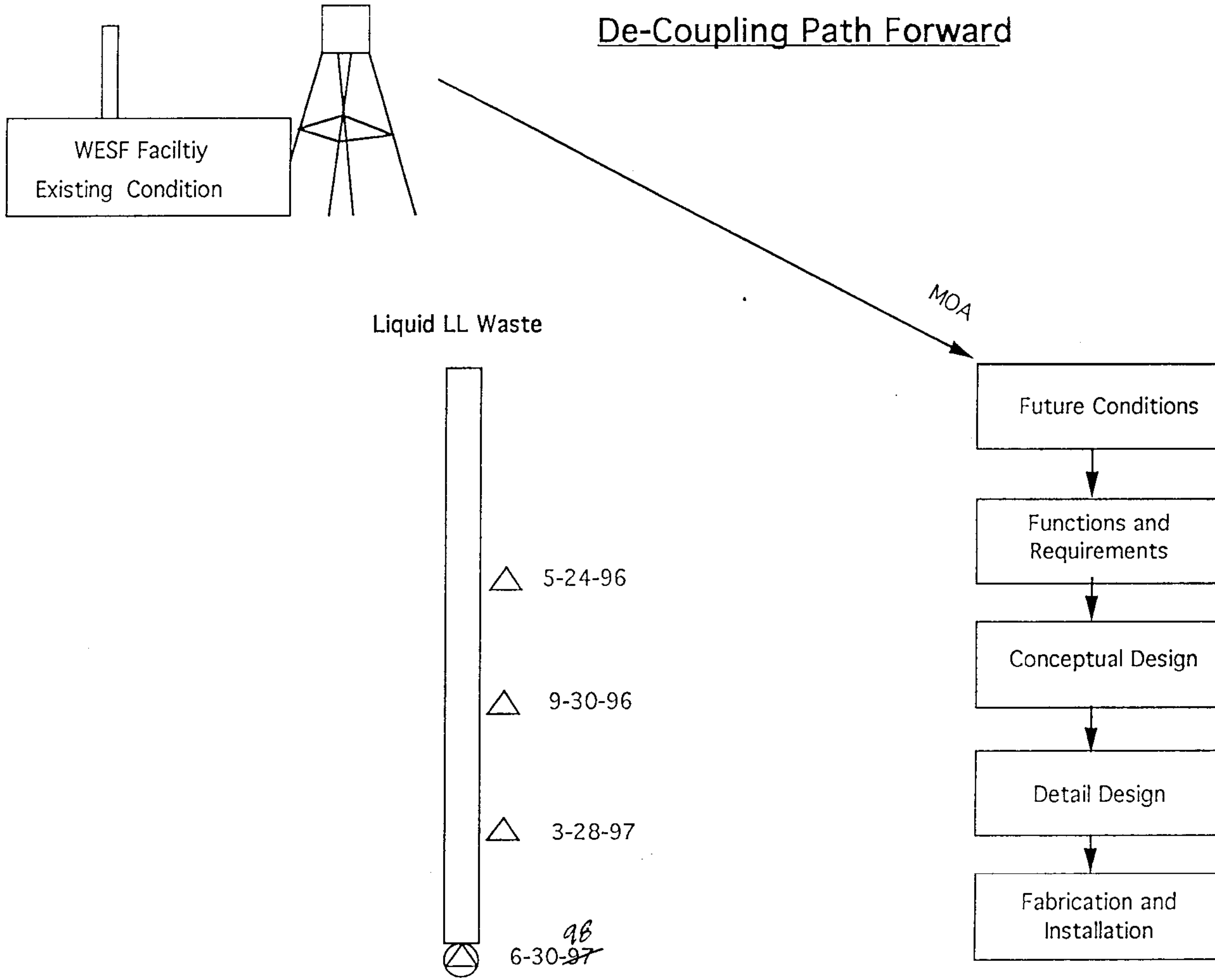
2/29/96
F. H. Lee, Project Engineer
WESF Decoupling Project

2-29-96
J. L. Pennock, Manager
WESF Facility

B PLANT/WESF LOW LEVEL LIQUID WASTE FLOW CHART



De-Coupling Path Forward



WESF LOW LEVEL LIQUID WASTE SOURCES
NORMAL OPERATING CONDITIONS

EXISTING CONDITION SOURCE/DESCRIPTION	EXISTING STREAM	FUTURE CONDITIONS SOURCE/DESCRIPTION	FUTURE STREAM
Capsule Decon: 13 Capsules to be reencapsulated at PNNL, due back to WESF in 1998. 200 gallons to decon each capsule.	2600 gal FY98 only	Decon cells prior to shutdown of B Plant LLLW.	0 gal/yr
Manipulator changeout/decon: A Cell - 2/yr A Cell Hood - 4/yr B Cell - 4/yr C Cell - 4/yr D Cell - 3/yr E Cell - 3/yr F Cell - 3/yr Broken Manipulators - 5/yr Total Manipulators - 28 100-200 gal per manipulator Maximum total is 2800-5600 gal/yr. G Cell does not require water to decon. F Cell manipulator may not require decon if cell is cleaned out.	5600 gal/yr	Remove manipulators from Cells A through E. Cells must be cleaned to the point that all water sources can be deactivated; fire sources are eliminated, etc. Operations reserves potential to place manipulators back into use.	0-600 gal/yr
Drains: All drains are now connected to the LLLW system to TK-100. Contaminated water for clean-up, misc uses, etc...	200 gal/yr	Plug all unnecessary drains to TK-100	0 gal/yr
Pool Cell Sump water jetted to TK 39-1 direct. Add 3-5 gal to sump during calibration. Run Jet for 1-2 minutes to jet out sump after Pool Cell Leak Detector calibrations. Jet out 13 Leak Detectors biannually.	130 gal/yr	Pump to drum and test sample for radionuclides. Dispose to chemical sewer, if acceptable.	0 gal/yr

EXISTING CONDITION SOURCE/DESCRIPTION	EXISTING STREAM	FUTURE CONDITIONS SOURCE/DESCRIPTION	FUTURE STREAM
Safety Showers: 12 showers tested monthly @ 3.5 gal each; water drains to TK-100. 2 - Hot/Cold Manipulator Shop 2 - Canyon 2 - Pool Cell Area 1 - Operating Gallery 1 - Truck Port 1 - Service Gallery 3 - AMU	500 gal/yr	Shut down all showers except the AMU Mezzanine, 1st floor AMU (between transmitters), and service gallery. Collect water, test and dispose to process sewer	0 gal/yr
Miscellaneous steam traps (steam condensate for ventilation directed to other streams).	Minimal gal/yr	Replacement of steam system will eliminate this source	0 gal/yr
TOTAL FY98 ONLY OTHER	 9030 gal 6430 gal		 3200 gal 600 gal

NOTE: Isolation study identified yearly flow to TK-100 as 5000 gallons. This estimate was based on a year where the number of manipulator change-outs was lower than normal.

WESF LOW LEVEL LIQUID WASTE SOURCES ACCIDENT CONDITIONS

EXISTING CONDITION SOURCE/DESCRIPTION	EXISTING STREAM	FUTURE CONDITION SOURCE/DESCRIPTION	FUTURE STREAM
Hot Cells:			
Pipe Leaks: Pipe Leaks assumed to be minimal unless catastrophic. No catastrophic (>1000 gal) leaks to date.	1000 gal/incident	Repair all leaks to preclude catastrophic incident.	0 gal/incident
Cell Flooding: Liquid source not turned off flooding cell. Past incidents resulted in water flowing through the K-3 duct into TK-100. Total volume unknown; assumed to be <1000 gal.	1000 gal/incident	Eliminate all liquid sources to hot cells (except F & G).	0 gal/incident
Fire Protection: Assume fire in G Cell. Residual pressure in line is 107 psi. The four fire fog nozzles operate at 10 GPM for fifteen minutes	600 gal/incident	Remove fire hazard from cells and/or replace fire protection with non-water system.	0 gal/incident
Overfill Pool 6-12 in: Water presently can be transferred to B Plant LLLW System with WESF Water Removal System. Operations typically uses other pool cells to equalize the water level.	350-700 gal/incident	Identify alternative emergency plan to remove water from Pool Cells.	0 gal/incident

EXISTING CONDITION SOURCE/DESCRIPTION	EXISTING STREAM	FUTURE CONDITION SOURCE/DESCRIPTION	FUTURE STREAM
Pool Cells 9 & 10: Used for collection of "potentiallly" contaminated water from the pool cell pump trench from various sources.			
Project W-252 will reroute Pool Cell 9/10 from the low risk cooling water (24") to the chemical sewer. Water will be sampled and tested to radiological requirements prior to shipment. <u>If found contaminated</u>, this water must be transferred to the LLLW system.			
Pool Cell Heat Exchanger Pumps: when not maintained, leakage can generate approx 19,000 gal/yr		Maintain pumps to minimize loss of water to pump trench.	
K-4 Supply Ventilation condensation: when K-4 is operational, steam condensate is generated at 650 gal/day.		Eliminate steam condensate to pool cells (Steam Elimination Project) or direct steam to alternative system (Chem sewer).	
Pool Cell is switched every 2-3 months. Approx 5000 gal transferred when switched between pool cells, allowing potential for 5000 gal LLLW.	5000 gal/incident	Sample pool cell at a 2000 gal limit to reduce potential volume transfer to LLLW system.	2000 gal/incident

EXISTING CONDITION SOURCE/DESCRIPTION	EXISTING STREAM	FUTURE CONDITION SOURCE/DESCRIPTION	FUTURE STREAM
Water Intrusion: 1. Incident in July, 1991: Rain storm/flash flood collected 1000-2000 gal of water in TK-100 2. Snow melt caused by chinook filled the K-3 filter pits with water. Approx 1000-2000 gal were transferred to LLW. Note: Both of these events were remembered by operations and engineering personnel, but there is no documented data.	2000 gal/incident	Implement methods (weather enclosure, seal covers, etc...) to preclude water intrusion.	0 gal/incident
TK-50 Pit: Rain water intrusion; data from 12/5/95 rain storm, jetted approximately 300 gal	300 gal/incident	Shut down TK-50 pit. Seal to preclude water.	0 gal/incident
Fire Protection: Assume three sprinklers are activated and suppress fire in fifteen minutes. Residual pressure is 60 psi. Flow equals 2000 gallons.	2000 gal/incident		2000 gal/incident
Safety Showers: Use shower for 15 minutes. Design flow rate is 30 gallons/minute. One time safety shower use is 450 gal.	450 gal/incident	Remove safety showers	0 gal/incident
TOTAL	13,050 gal		4,000 gal