B PLANT - WESF ISOLATION STUDY

WHC-SD-WM-ES-313, REV.0

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B PLANT - WESF ISOLATION STUDY

EXECUTIVE SUMMARY

B Plant has an unique status compared to other Hanford facilities. Although idle since the last major process mission, the plant is "operated" to contain highly radioactive inventories and general contamination. In addition, B Plant supplies cooling water to WESF, deionized water for the capsule storage pools, and accepts low level waste streams, liquid effluents, and solid waste from WESF.

Transitioning B Plant to the Long Term Surveillance and Maintenance (LTS&M) state prepares the facility for eventual Decontamination and Decommissioning (D&D). To achieve this objective, the B Plant Cleanout and Stabilization Program, issued October 1993, assumes that D&D Readiness End Point Criteria must be met and the configuration of the combined B Plant/WESF facilities must be revised to decouple WESF from B Plant. A study was requested by DOE-RL to determine the feasibility of isolating WESF from B Plant. This Engineering Study, initially called the "Decoupling Study," was to consider replacement or elimination of the WESF support services currently provided by B Plant.

WESF MISSION ANALYSIS

The definition of the baseline mission for WESF is critical to the overall strategy and recommendations. The decision to isolate WESF is dependent upon future plans, yet to be determined, for capsule storage at WESF. The key WESF program assumptions are listed below:

- The maintenance of existing pool cell operating systems will continue for at least 15 years. The final inventory will include capsules returned as part of the Capsule Return Program.
- The TWRS program will continue to have responsibility for the ultimate disposition of the strontium and cesium capsule inventory.
- Maintenance of the WESF hot cells will continue to generate solid and liquid waste.

SIGNIFICANT ISSUES

Several issues have been identified that may affect the decision to isolate WESF from B Plant or the selection of the best alternative for each system.

- The surveillance of B Plant after deactivation, and formal transfer to EM-40, has been assumed to be independent of WESF surveillance and performed by a different organization/contractor. Therefore, the WESF operations and surveillance organization will not participate in the surveillance of the deactivated B Plant, physically enter the facility, or operate and maintain the B Plant canyon ventilation.
- It is unknown whether the current level of maintenance will continue for the WESF hot cells. Several scenarios are possible:
 - 1) Clean up the hot cells prior to B Plant deactivation and isolation to use available space in Cell 4 and therefore reduce future waste volumes.
 - 2) Reduce the maintenance of hot cells; abandon equipment in place.
 - 3) Modify or upgrade the hot cells for future mission availability.
- B Plant deactivation End Point Criteria have yet to be established/negotiated and the potential exists for the results to change the conclusions of this study.
- The permitting strategy of B Plant deactivation and WESF liquid waste handling needs to be established.
- Projects W-252, Closed Loop Cooling System (CLCS), W-028, pipeline to Tank Farms, the WESF Emergency Ion Exchange project, the WESF control room, and the Capsule Return program are important to the conclusions of this Isolation Study. These projects are expected to be funded and outside the scope of the proposed Isolation Project. Despite the fact these projects are funded, and will be managed separately, they must be integrated fully into the B Plant deactivation.

WESF SUPPORT SYSTEMS SUMMARY

Individual evaluations of the five WESF support systems were completed by a team of B Plant engineers. Alternatives were selected by the study team and a contractor (ICF-KH) provided engineering support in the form of system descriptions, sketches, and preliminary cost estimates.

It is recommended that the five systems be modified/replaced to allow independent, stand alone operation of WESF. The preferred configuration of each new system is described below, based on the evaluations performed in support of this study:

Cooling Water - Project W-252 has been initiated to provide a closed-loop cooling system (CLCS) that will eliminate WESF's reliance on B Plant to supply water and receive the cooling water effluent. The implementation of the CLCS project (W-252) should be completed before the separation of B Plant and WESF.

Deionized Water - The recommended alternative for an independent deionized water system is the "Culligan multi-tank system". The system consists of two sets of one cation tank, one anion tank, and one mixed-bed resin tank. The proposed location is on the second floor of the 225-B AMU building following equipment removal and decontamination of storage areas.

Low Level Liquid Waste (LLLW) - Of the five options evaluated, the recommended system is: pipeline intertie to Project W-028, using the existing tanks in 221-BF for waste collection. This alternative requires that the project W-028 pipeline to Tank Farms be completed. WESF's LLLW will be piped from the lines feeding TK-100 into new tanks installed inside one of the existing large tanks at 221-BF. From 221-BF, the LLLW will be pumped to the pipeline in Project W-028. The pipeline for the transfer will be a double encased (pipe-in-pipe) transfer line. The selection of this option assumes that current codes can be met by the modified 221-BF facility, including seismic requirements.

Liquid Effluents - The recommended system is continued operation of the 211-BA facility after WESF isolation from B Plant. The controls of 211-BA will be relocated and monitoring may be performed from a control room in WESF. Additional work scope includes an Engineering Work Station and alternative electric power for 211-BA.

Solid Waste - The recommended alternative system for remote handled radioactive waste generated in WESF hot cells includes the following features:

- 1) Use of approved containers, loaded in A cell. A major cleanup of A cell will precede the installation of the new system.
- 2) Contamination prevention by bagging the container to control surface contamination. Separate drum inner and outer liners will become part of the waste. The system will include a hood and a bag sealer and cutter.
- 3) 222-S laboratory analysis will characterize the ^{90}Sr and ^{137}Cs ratio of each waste item. A high purity Germanium (HPGe) gamma drum counter system will complete the characterization of each container in a drum counter located in the WESF canyon.
- 4) The characterized, externally clean, waste container is moved to an approved shielded cask container. The shielded container is transported directly to the burial ground by current solid waste disposal procedures.

COST ANALYSIS

Because WESF will continue to store capsules indefinitely, the isolation of WESF from B Plant is necessary to complete the deactivation of the B Plant facility. The B Plant deactivation is urgent, because of the high annual costs to maintain and operate B Plant.

Table E-1 summarizes cost estimates of all the alternates evaluated for the 5 support systems. The recommended alternative for each system is the lowest cost alternative, with a total cost of \$5,619,000. This table also illustrates that the maximum cost of the entire project could be as high as the highest estimate for each system if each of the high cost alternatives was justified. This would bracket the high side of the total project cost at approximately \$19,000,000.

Table E-2 summarizes current and planned projects that are related to the Isolation project but not included in the scope or the costs presented in this study. Note that the most direct impacts are from the cooling water system, which has no cost to this project (covered by Project W-252) and the LLLW alternative cost assumes Project W-028 will be completed.

Based on the CSP, it will first be assumed the B Plant budget can be reduced to \$8,300,000 at the end of deactivation, with the plant providing minimum services to WESF. If the Isolation Project is completed in FY2002, to coincide with completion of deactivation, the B Plant O&M costs will then be reduced from \$8,300,000 to \$1,000,000, for an annual savings of \$7,300,000.

The cost of the proposed Isolation project is \$5,619,000. The cost/benefit comparison is obvious and the project cost will be recovered in the first year after Deactivation, then rapidly accrue annual cost savings of \$7,300,000. The actual Isolation Project costs will probably be incurred earlier, mostly in the year or two prior to completion, making the cost/benefit slightly less attractive.

In conclusion the proposed Isolation Project is clearly justified at the initial estimated \$5,619,000 project cost. The project should be completed on a schedule to coincide with the end of Deactivation (projected to be FY2002) with project costs delayed where possible to maximize the economic benefits. Failure to complete the Isolation with the Deactivation will delay the potential annual cost savings of \$7,300,000.

Table E-1
Cost Estimate Summary WESF Support Systems Alternatives

WESF Support System	Alternative	Cost of Alternative	Decoupling Project Cost *
Cooling Water	Project W-252 Implementation	\$4,083,000	
Deionized Water	Culligan Multi-tank System	\$101,000	\$101,000
	New Ionpure System	\$310,000	
Low Level Liquid Waste	221-BF Tanks Intertie to Project W-028	\$3,574,000	\$3,574,000
	New Tanks, New Facility Intertie to W-028	\$8,614,000	
	221-BF Tanks with New Truck Loadout Facility	\$6,169,000	
	New Tanks, New Facility with Tank Truck Loadout Facility	\$11,495,000	
	New Combined Facility with Tanks and Truck Loadout Station	\$9,078,000	
Liquid Effluents	Power and Controls Modifications for 211-BA Facility	\$687,000	\$687,000
Solid Waste	A Cell Modifications, Drum Bagger, Drum Counter, Laboratory Support, Shipping Casks, and Burial Costs	\$1,257,000	\$1,257,000
	A Cell Modifications, Ice Pellet Decon, Fixative, Drum Counter, Laboratory Support, Shipping Casks, and Burial Costs	\$2,290,000	
	A Cell Modifications, Ice Pellet Decon, Fixative, CO ₂ Blasting, Drum Counter, Laboratory Support, Shipping Casks, and Burial Costs	\$2,900,000	
Total Decoupling Project Cost *			\$5,619,000

* Excludes Cost of Projects W-252 and W-028 (see table E-2)

Table E-2
Projects and Costs Not Included in Isolation Project

WESF Support System	Project Title and Description	Estimated Project Cost	Source of Funding
Cooling Water	Project W-252, Closed Loop Cooling System	\$4,083,000 (1)	FY 1995 LI
Low Level Liquid Waste	Project W-028, Aging waste Transfer Lines	\$11,600,000	FY 1990 LI
	Emergency Pool Cell Ion Exchange, F Cell	~\$500,000 (2)	CENRTC
	Capsule Leak Detection, Pool Cells	\$1,400,000	FY 1995 Unfunded GPP Submittal
Liquid Effluents	WESF Control Room, Conduct of Operations Compliance Upgrades	~\$500,000	FY 1994 Expense Carryover
Solid Waste Handling	Re-encapsulation Program	>\$1,000,000 (3)	TBD

(1) B Plant portion of total project, total project is titled "Phase II Liquid Effluent Treatment and Disposal", TEC \$40,300,000

(2) ROM total project cost

(3) Planning Case program

TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	FACILITY DESCRIPTION	1
1.1.1	The 221-B Building	1
1.1.2	The 271-B Building	1
1.1.3	The 225-B Building (WESF)	2
1.2	FACILITY STATUS	2
1.3	EXISTING WESF SUPPORT SYSTEMS	3
1.3.1	Cooling Water	3
1.3.2	Deionized Water	3
1.3.3	Low Level Liquid Waste	4
1.3.4	Liquid Effluents	4
1.3.5	Solid Waste	4
1.4	B PLANT/WESF ISOLATION STUDY WORK PLAN	5
1.4.1	STUDY WORK SCOPE	5
1.4.2	STUDY OBJECTIVES	5
1.4.3	STUDY METHODOLOGY	6
2.0	BACKGROUND STUDIES / PLANS	16
2.1	B Plant Transition Study	16
2.2	B Plant Cleanout and Stabilization Program (CSP) Plan	16
2.3	PUREX Deactivation Project	17
2.4	WESF Stand Alone Studies	17
2.5	WESF Leaking Capsule Emergency Response	18
3.0	WESF AND B PLANT MISSION ANALYSIS	20
3.1	Regulatory Issues and Assumptions	20
3.2	WESF Mission Analysis	21
3.3	Capsule Recovery Program	22
3.4	B Plant Mission Analysis	23
3.5	Methodology for a B Plant CSP Walkaway Scenario	24
4.0	WESF SUPPORT SYSTEM ALTERNATIVES	28
4.1	Capsule/Pool Cell Cooling System Alternatives	28
4.1.1	Closed Loop Cooling System, Project W-252	28
4.1.2	Closed Loop Cooling System, Descoped Project W-252	29
4.2	Deionized Water System Alternatives	30
4.3	Low Level Waste System Alternatives	32
4.4	Liquid Effluent / Control System Alternatives	36
4.5	Solid Waste Handling Alternatives	38
4.6	WESF Surveillance System Alternatives	39
5.0	COST ANALYSIS	48
6.0	ISSUES	53
7.0	RECOMMENDATIONS	55

8.0	REFERENCES	59
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FIGURES

1-1	WESF Area Site Map	8
1-2	221-B Canyon Building	9
1-3	WESF Floor Plan	10
1-4	Interior Layout West End of 225-B	11
1-5	WESF Storage Pools and Crane	12
1-6	B Plant Operations Supporting WESF	13
1-7	Typical WESF Pool Cell	14
1-8	WESF Process Cells, Cross Section	15
3-1	Cesium Recovery Program Planning Case	26
3-2	Cesium Recovery Program Target Case	27
4-1	Flow diagram of Proposed Multi-tank Deionized Water System	41
4-2	Location of Proposed Multi-tank Deionized Water System	42
4-3	Location of Proposed Low Level Liquid Waste System	43
4-4	Solid Waste Flow Path to A Cell Collection Area	44
4-5	Waste Drum Bagging / Decontamination Process	45
4-6	Solid Waste Decontamination and Characterization Process	46
4-7	Solid Waste Flow Path WESF Canyon Deck.	47
5-1	Isolation Project - Cost Breakdown by System	51
5-2	Isolation Project - Cost Breakdown Without Projects	52

APPENDICES	60
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- Appendix A: WESF ISOLATION FROM B PLANT DEIONIZED WATER SUPPLY SYSTEM
- Appendix B: WESF ISOLATION FROM B PLANT LOW LEVEL LIQUID WASTE SYSTEM
- Appendix C: LIQUID EFFLUENTS CONTROL SYSTEM ALTERNATIVES
- Appendix D: SOLID WASTE REMOVAL ALTERNATIVES

LIST OF TERMS**ABBREVIATIONS****DEFINITION**

CLCS	Closed Loop Cooling System
DWSS	Deionized Water Supply System
AMU	Aqueous Makeup
WESF	Waste Encapsulation and Storage Facility
LLW	Low Level Waste (same as LLLW)
LLLW	Low Level Liquid Waste
BCE	B Plant Chemical Sewer
CIU	Computer Interface Unit
EWS	Engineering Work Station
OIU	Operator Interface Unit
FPMCS	Facility Process/Monitoring Control System
HPGe	High Purity Germanium, Gamma Drum Counter System
PUREX	Plutonium Uranium Extraction Plant
DOT	U.S. Department of Transportation
ICF-KH	Kaiser
WHC	Westinghouse Hanford Company
TEDF	Treated Effluent Disposal Facility
D & D	Decontamination and Decommissioning
CSP	Cleanout and Stabilization Program
TWRS	Tank Waste Remediation System
HWVP	Hanford Waste Vitrification Plant
LTS&M	Long Term Surveillance and Maintenance
PMs	Preventive Maintenance Procedures

FDC	Functional Design Criteria
ADS	Activity Data Sheets
SCA	Structured Group Approach
MSL	Mean Sea Level
NSL	Nice Sea Level
CDI	Continuous Deionization Unit

1.0 INTRODUCTION

1.1 FACILITY DESCRIPTION

B Plant is comprised of three main buildings - the 221-B Processing building, or canyon; the 271-B Service and Office Building; and the 225-B WESF Building. Many smaller support buildings exist within the B Plant complex (see figure 1-1).

The 221-B Building and its attached service building, 271-B, were constructed in 1943. Radioactive processing started in 1945. Construction of the WESF was completed in 1974. These major buildings are described briefly in the following paragraphs.

1.1.1 The 221-B Building

The 221-B Building is a lightly reinforced concrete structure. The processing portion of the 221-B Building consists of a canyon and craneway, 40 process cells, a hot pipe trench, a ventilation tunnel and a railroad tunnel. The service and operating portion of the building consists of an operating gallery, a pipe gallery and an electrical gallery (figure 1-2). The canyon deck elevation is 711 ft 6 in. above mean sea level (MSL). It is 303 ft above the underlying water table and 253 ft above the elevation of the Columbia River.

The 221-B canyon is 810.5 ft long, 77 ft 2 in. high, and has a cross-sectional width of 66 ft 2 in., which is constant to a height of 59.75 ft and then increases to a maximum of 68 ft 2 in. at the rooftop. The roof slab varies in thicknesses from 3 ft at midspan to 4 ft at the edges where it is supported by the exterior walls. The building is supported on a 6-ft thick concrete slab.

1.1.2 The 271-B Building

The 271-B Building consists of a basement and three floors. It is a reinforced concrete and cement block structure 160 ft long, 45 ft wide, and 60 ft high. This building is attached to the north and center of the 221-B Building (figure 1-1). All levels are serviced by a freight elevator.

The basement contains the building maintenance pipe and instrument shops, process air compressor room, filters for the building ventilation air supply, and electrical motor control centers for the building.

The first floor provides space for offices, a locker room, and restrooms. Also located on the east end of the first floor are the aqueous makeup (AMU) and a loading dock for incoming chemicals and supplies.

The second floor contains administrative offices, a lunch room, and the dispatcher's office, which contains a Facility Process Monitoring Control System (FPMCS) Operator Interface Unit (OIU).

The third floor contains an AMU area, including the bulk of the chemical makeup tanks, space for dry chemical storage, and a portable breathing-air compressor. Approximately at the center of the 271-B Building adjacent to the canyon is a stairway to the roof of the 271-B and 221-B Buildings and access to the 221-B canyon.

There are three personnel doors and one large equipment door to the outside on the ground level. Each of the four upper floors has two doors that open onto the corresponding floor levels of the 221-B Building. Basement doors include one personnel door at the pipe maintenance shop and one large equipment door to/from the air compressor room.

1.1.3 The 225-B Building (WESF)

The 225-B Building is a two-story structure 157 ft long by 97 ft wide by 40 ft high at the outside dimensions. The building has a combined floor area of approximately 20,000 ft², which includes 14,000 ft² on the first floor and 6000 ft² on the second floor.

The floor plan is partitioned into several areas according to the functional requirements of each area (see figure 1-3). These areas include (1) the process hot cell area, (2) the hot cell service areas, (3) the operating areas, (4) the building service areas, and (5) the storage pool area. The capsule storage pools are shown in more detail in figure 1-4. The partitioned floor plan regulates the flow of personnel and material traffic throughout the building and limits access in those areas where potential contamination or radiation exposure is high.

1.2 FACILITY STATUS

The cesium and strontium feed materials to WESF were purified and concentrated in B Plant before actual processing in WESF. The cesium process system converted aqueous cesium carbonate feed solution to cesium chloride. The strontium process system converted strontium nitrate solution to strontium fluoride. Waste streams were returned to B Plant for recycle processing and B Plant sometimes returned waste to tank farms without significant processing. The products cesium chloride and strontium fluoride were doubly encapsulated and stored underwater in storage pools. Some of these encapsulated products have been shipped offsite.

Processing of cesium and strontium was completed in 1985. WESF is currently returning capsules from offsite host facilities. Capsules are received in the WESF truck port (in the shipping cask), remotely handled in G cell, and placed in the storage pools (see figures 1-4, 1-5). WESF processing is limited to decontamination of equipment used in return of capsules and surveillance of stored capsules.

B Plant initiated transition planning in FY 1991 after the realization that B Plant was excluded from full scale pretreatment of tank waste. Transition planning of the B Plant canyon and auxiliary facilities has a central goal to turnover the facility to a long term surveillance and maintenance mode (LTS&M). The **Cleanout and Stabilization Program (CSP)** plan includes major canyon cleanup activities and a systematic shutdown of plant systems. The work is scheduled to begin in FY 1997.

To complicate the transition to shutdown for the B Plant facility, several operating systems must and will remain operational to support the adjacent Waste Encapsulation and Storage Facility and its radioactive strontium and cesium capsule inventory. Long-term support of WESF is required until final disposition of the cesium-137 and strontium-90 capsule inventory in WESF is determined.

It appears the isolation of WESF from B Plant is necessary to complete the transition of the B Plant facility to shutdown, if WESF will continue to store capsules indefinitely.

1.3 EXISTING WESF SUPPORT SYSTEMS

The **Cleanout and Stabilization Program (CSP)** in B Plant becomes complex because of the need both to operate WESF support systems and to deal with highly radioactive sources in the same facility.

B Plant supplies cooling water, deionized water for pool cells, accepts low-level liquid waste streams, liquid effluents, and solid waste from WESF. A project to decouple or isolate WESF from B Plant must include replacement of these services. Figure 1-6 is a schematic diagram of the WESF liquid waste and effluent streams and shows WESF solid waste drums that are transported and stored in the B Plant canyon. The following paragraphs are a short description of the present configuration of these support systems.

1.3.1 Cooling Water

The majority of WESF cooling water consumption is utilized in the control of pool cell water temperature. Figure 1-7 shows the major components of the pool cell cooling system. Safety limits are established on water temperature to protect the integrity of cesium and strontium capsules stored in the pool cells. A Tri-Party Agreement milestone (M-17-00B) requires the installation of a closed loop cooling system be provided for the Phase II effluent stream generated by this source by October 1997. Project W-252 has been initiated to provide closed loop cooling that will eliminate WESF's reliance on B Plant to handle a cooling water effluent stream. B Plant does not supply (raw) cooling water to WESF. Cooling water is distributed from the 282E reservoir. Underground pipeline deliver raw water to 221-B and 225-B via separate headers.

1.3.2 Deionized Water

Deionized water is primarily used for WESF pool cell make-up water with some use for chemical make-ups, and general decontamination of hot cells. Loss of pool cell water is due to evaporation and recirculation pump seal leakage. Deionized water is used to minimize corrosion of the outer capsules. The continuous de-ionizer that now supplies B Plant and WESF is located at B Plant. Decoupling the facility would require duplication of this device at WESF or relocation of the existing unit.

The current Deionized Water Supply System (DWSS) is located in the northeast corner of 271-B's third floor AMU. Deionized water is produced by an Ionpure Continuous Deionizer (CDI) system. Sanitary water is passed through a series of skid mounted pretreatment components to an acceptable quality to prevent scaling of the CDI unit. The deionization is then accomplished by an Ionpure Continuous Deionization (CDI) unit. Control of the system is provided by a wall mounted Ionpure controller and individual timers which regenerate the pretreatment equipment. A wall mounted panel provides local indication of the feedwater and product water quality as well as flowrate and a flow totalizer. This panel also provides these signals to the FPMCS. This system was installed in 1993.

1.3.3 Low Level Liquid Waste

Low level liquid waste generated at WESF is transferred from Tank 100 to B Plant for interim storage and eventual treatment before being transferred to Tank Farms. WESF currently generates relatively low volumes of low level waste (LLW) in the decontamination of the facility and equipment such as the manipulators. Deactivation of B Plant's LLW system will require WESF to install a system to transfer LLW directly to Tank Farms via an underground transfer line or by a tanker truck or rail car. WESF may require a Part B Permit if treatment must be performed at WESF prior to shipment or transfer. Currently Tank Farms performs the necessary treatment of LLW received by rail cars from other facilities.

1.3.4 Liquid Effluents

The major WESF liquid effluent, pool cell cooling water, will be eliminated when Project W-252, Closed Loop Cooling, is implemented. The only other significant liquid effluent generated by WESF contributes to the B Plant Chemical Effluent Sewer (BCE) stream that is currently treated at the 211-BA facility. 211-BA currently handles the combined B Plant/WESF BCE effluent, but is external to either facility and requires no modification to decouple WESF from B Plant. WESF's major sources to this stream include the WESF air compressor's and chiller's systems. The WESF cold area floor drains are also tied into this system.

1.3.5 Solid Waste

At present, the following solid waste streams are generated from WESF:

- nonradioactive hazardous waste
- contact handled radioactive waste
- contact handled mixed waste
- remote handled radioactive waste
- remote handled mixed waste

Hazardous waste, and contact handled radioactive and mixed waste are packaged in appropriate containers, transferred to B Plant, stored at 226-B waste pad, and shipped to final waste storage/disposal sites.

Remote handled radioactive and mixed waste are generated from WESF process cells, packaged in A cell, transferred to B Plant and stored in cell 4. Figure 1-8 shows a cross section of the WESF process cells, including A cell, the canyon, and the truck port, which are used to handle solid waste. The waste drums will eventually be buried in the low-level waste burial ground or in the double-lined leachate burial trench (to be built).

Cell 4 has the storage capacity of 245 drums after addition of new racks to accommodate several layers. There are 34 WESF waste drums currently stored in cell 4. Normal waste shipping from WESF to B Plant is no more than 12 drums/yr.

1.4 B PLANT/WESF ISOLATION STUDY WORK PLAN

1.4.1 STUDY WORK SCOPE

This study was requested by DOE-RL to determine the feasibility of separating WESF from its dependence on B Plant. This engineering study, initially called "Decoupling Study" was to consider replacement or elimination of the five services described above. To be included in the study was an evaluation of reasonable alternatives, preparation of rough order of magnitude cost estimates, and selection of preferred alternatives for each support service provided to WESF by B Plant.

As this study was initiated the elimination of cooling water was already being addressed by Project W-252 and, therefore, will not be specifically addressed by this study.

The major assumptions for this study related to B Plant deactivation and the separation activities are discussed in section 3.0, WESF and B Plant Mission Analysis.

1.4.2 STUDY OBJECTIVES

The following were established as the primary objectives for the Isolation Study:

- Determine technical and economic feasibility for isolating WESF Operations from B Plant Operations
- Define the supporting systems, supporting activities, and critical interrelated functions
- Identify how (best alternative) to eliminate or replace each supporting system or activity
- Determine the potential for long term costs savings, quantify if possible, and state the conditions for realizing the cost savings
- Provide a documented basis for project implementation.
- Be a subset document and foundation for the B Plant Cleanout and Stabilization Program plan.

1.4.3 STUDY METHODOLOGY

The initial strategy for completing the Isolation study assumed that the completion of the study might be expedited by doing the evaluations internally, utilizing engineering personnel in B Plant. The expertise regarding the support systems requires extensive input and review from these same people, therefore, contracting the study would likely delayed completion.

A team of B Plant engineers cognizant of each WESF support system (system experts) was assembled. The team provided expert input to apply study objectives to deactivation / replacement of each individual system. The team was assigned to do individual evaluations of the five WESF support systems followed by a group evaluation. These mini-evaluations identified alternatives and recommended the best alternative for each system and function. The individual evaluations were followed by a group/team review. This team effort was the first phase of the study.

The system evaluations and engineers are listed below:	
<u>Evaluation Title</u>	<u>Engineer/expert</u>
Capsule / Pool Cell Cooling System	R. Weissenfels
Deionized Water System Study	M. Baron
Low Level Waste System Alternatives	D. B. Kutsch
Liquid Effluent / Control System Alternatives	G. E. Entrop / R. J. Townley
Solid Waste Handling Alternatives Study	M. M. Serkowski / T. G. Beam
Surveillance	R. J. Townley

The second phase of the engineering study focused on the overall study objectives to determine the cost of the modifications, the potential for long term cost savings, and the conditions and key assumptions required for realizing the cost savings. The number of alternatives defined for each system ranged from 1 to 7, although in each case one alternative or scenario was favored by the study team. To complete this phase of the study cost estimates were needed for the consensus favored scenario or alternatives.

Contract technical help was obtained from ICF-KH. Four systems were identified to need detailed support:

1. Low Level Waste
2. Control System for Liquid Effluents
3. Deionized Water System
4. Solid Waste Handling

The support provided by ICF-KH consisted of developing sketches and system descriptions sufficient to support ICF-KH cost estimating department in preparing a preliminary cost estimate for the above four systems. The primary deliverable is a cost estimate. Details are described later in this report and attached as Appendices.

Figure 1-1

WHC-SD-WM-ES-313, REV 0

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Figure 1-3
WESF Floor Plan

Figure 1-4

INTERIOR LAYOUT WEST END OF THE 225B BUILDING

Figure 1-5

WESF Storage Pools and Crane

B Plant Operations Supporting WESF

Figure 1-6

WHC-SD-WM-ES-313, REV 0

Figure 1-7
Typical WESF Pool Cell

Figure 1-8

WESF Process Cells, Cross Section

2.0 BACKGROUND STUDIES / PLANS

B Plant has not yet been transferred into the EM-60 Program for facility transition. The reassessment of status from EM-30 to EM-60 has been anticipated and evaluated several times since the plant was considered no longer a viable candidate for a tank waste pretreatment mission.

The following is a brief description of the recent engineering studies/program plans that are the technical basis for B Plant transition planning:

2.1 B Plant Transition Study

In FY91 the realization that B Plant will be excluded from full scale pretreatment occurred and the **B Plant Transition Study** was prepared. At this time the continued support of WESF capsule storage was essential, and the possibility of a pretreatment pilot plant considered. This study provided a strategy consistent with the waste tank program.

The focus of the Transition Study was to address two major questions: 1) How do we minimize costs to support WESF and capsule inventory, 2) what is a reasonable plan to move B Plant to standby/shutdown status? The transition activities were designed to change the way the plant is maintained and operated. Plant systems and components were to be shutdown in phases. There was no provision for restart of processes or functions that supported previous Waste Fractionization or NCAW pretreatment process missions.

One of the activities described in the report is terminal processing. Terminal processing is defined as preparation of in-cell equipment, jumpers, and embedded piping for extended dry standby status and/or eventual turnover to D & D. Included in the details of the Transition Study is an evaluation of the essential B Plant and WESF support systems and initial identification of alternative WESF systems. One of the options discussed is a major project for a WESF Annex support facility (which is discussed in a separate section below).

2.2 B Plant Cleanout and Stabilization Program (CSP) Plan

The **Cleanout and Stabilization Program (CSP)** plan, Reference 1, prepared in FY 1992 described a five year program outlining tasks and resources required for B Plant to achieve long term surveillance and maintenance status. Cleanout and stabilization was defined as those activities necessary to convert the plant from a high hazard to a low hazard facility. To accomplish the transition to low hazard, inventories or source terms were to be characterized, then removed from the plant or stabilized/isolated.

The five year CSP plan as originally defined in Reference 1 was expected to be reviewed annually, and revised, to reflect the changing financial

climate. The CSP plan left a number of B Plant systems operational in support of WESF.

The first update of the CSP, Reference 2, was issued in FY 1993. At the time of this updated CSP, the target funding levels and work scope presented in the Activity Data Sheets (ADS) (ID No. 4190-0) deferred initiation of CSP activities identified as "best management practices" until FY 1996. Reference 2 was then intended to reinforce program goals and logic, including the decision logic to achieve them, and not considered a formal revision of the CSP plan.

Future revisions to the plan were expected to expand the plan to include the transition of the B Plant canyon and auxiliary facilities to LTS&M. LTS&M will require the decoupling of WESF from B Plant and the transition of the B Plant facility to shutdown. The scope of work defined in the CSP plan (Reference 1 and 2 combined) is expected to be valid for either alternative.

2.3 PUREX Deactivation Project

The Plutonium-Uranium Reduction Extraction (PUREX) Deactivation project is designed to achieve the transition to LTS&M and will be evaluated closely for applicability to a B Plant program. PUREX is similar to several DOE canyon facilities that will enter the deactivation phase and this project is expected to be a reference model for these subsequent projects.

The key difference between the PUREX project plan and the CSP is the fact that PUREX Project responsibility lies with the DOE EM-60 office. The Isolation study may help determine when B Plant is available for deactivation, by defining how the two plants can be separated.

2.4 WESF Stand Alone Studies

An unpublished draft report by R. E. Preston addressed cost and systems required to support WESF. The costs and some of the requirements from this study are outdated, but suggest a minimum \$10M annual WESF support cost, excluding process capability for a pool cell emergency. The report introduces the concept for a new WESF support facility, or annex.

A workshop was conducted October 14-19, 1991 on the changing B Plant mission. The group session included approximately 20 people, 14 full time, over the five days and was similar to a Value Engineering meeting.

The initial goal of the workshop was to define the support to WESF from B Plant in order to scope and initiate a conceptual design of a new WESF annex project. Objectives included:

1. Identify mission(s) for B Plant and WESF.
2. Develop mission and facility requirements for selected strategy.

A preliminary definition of essential systems and support functions provided by B Plant to WESF was identified. Functions and requirements of essential systems identified in this meeting were valuable to the transition study analysis.

2.5 WESF Leaking Capsule Emergency Response

No capsule has ever leaked at Hanford, but a cesium capsule being used for irradiation purposes did leak at a private facility in Decatur, Georgia. The leak resulted in the spread of contamination and a costly cleanup. A leaking capsule is an abnormal condition which must be considered.

A Study was completed in 1992 (Reference 3) to provide information to the B Plant Cleanout and Stabilization Program (CSP) as it pertains to impacts from a leaking capsule scenario within the pool cells. The report defined alternatives to provide:

- normal operation
- emergency capabilities
- minimize B Plant support for WESF

Up until 1987, the Liquid Low-Level Waste (LLLW) generated during B Plant operations was concentrated by the B Plant Low-Level Waste concentrator, E-23-3, and concentrated low level waste was transferred to Tank Farms. Operation of the E-23-3 concentrator was discontinued in January 1987. WESF is dependent on B Plant and Tank Farms to stage and store the LLLW generated under hypothetical leaking capsule accident conditions. If a capsule leak occurred the current response involves draining the pool cell containing the leaking capsule and replacing the drained water with fresh water. The drained water is then sent to B Plant for transfer to Tank farms. As much as 250 thousand gallons of water would be used in such an event. This scenario is unacceptable due to limited allocated tank space available for emergency conditions.

Three accident scenarios were identified in the 1992 study (Reference 3) that were consistent with operating conditions of the pool cells;

- A slow leaking capsule which does not produce a radiation field above acceptable limits in the pool cell area.
- A capsule which leaks at a moderate rate such that it produces an unacceptable dose rate in the pool cell area. In addition, the pool cell water addition system may not be able to dilute this type of leak at a rate that would allow entry.
- The loss of the entire contents of a cesium capsule in a short period of time resulting in sudden elevation of dose rates around the pool cell allowing only evacuation of the immediate area.

The 1992 study (Reference 3) concluded that the solution to the problem was the design and installation of an emergency ion exchange recovery system,

combined with improved methods for early leak detection. In 1994 the design of a WESF emergency ion exchange system was initiated, and the Functional Design Criteria (FDC) document completed (Reference 4). The system will consist of an ion exchange column, located in F cell. The column will be capable of recovering from a strontium or cesium capsule leak. It will be remotely operated.

The B Plant/WESF Isolation Study will consider the completion of the WESF Emergency Ion Exchange Project outside the scope of the study (no further evaluation) but necessary for decoupling WESF from B Plant.

3.0 WESF AND B PLANT MISSION ANALYSIS

3.1 Regulatory Issues and Assumptions

To define regulatory issues and alternatives that pertain to the Isolation Study the major assumptions for the study were reviewed by the study team as listed below:

- 1) B Plant will be deactivated to End Point Criteria similar to other plants, such as PUREX. WESF will be stand alone after the Isolation Project.
- 2) The 221-B canyon ventilation system will be operating, with a single (stack) effluent release point.
- 3) WESF will generate liquid waste and collect and transfer directly to tank farms. WESF will also generate solid waste to be packaged and shipped directly to burial grounds. WESF will make its own deionized water, operate a closed loop cooling system, and discharge a residual effluent to a chem sewer stream.
- 4) B Plant will be unoccupied (including 271-B) except for quarterly walk-through/surveillance of appropriate areas.
- 5) Surveillance of B Plant, and operation of B Plant ventilation will be from a remote location outside B Plant. Operation of WESF will be from a WESF control room. It is possible that operation of the B Plant HVAC will be from WESF even though responsibility for B Plant will be with EM-40. This conceivably could be accomplished through a work order from the D & D contractor to the O & M contractor.
- 6) WESF hot cells will be maintained and will not preclude a new mission for the facility. No upgrades to support a new mission are planned as part of the Isolation Project scope.

The condition and maintenance requirements for the 221-B canyon crane have not been determined. It may be required to leave the crane in a condition where it can be fully restored for D&D. In the current strategy for B Plant deactivation it is a goal to eliminate all canyon entries during LTS&M, including routine crane work, inspections, or PM's.

The issues identified by the study team relevant to the B Plant/WESF Isolation Study are summarized here:

- The disposition of cell 4 WESF waste drum inventory was initially assumed to be a condition of completing B Plant CSP. The study team believes indefinite storage of inventory in cell 4 may be acceptable during LTS&M and the disposition of the inventory is not a requirement for decoupling.

- It may not be necessary to permit WESF if liquid waste is transported to Tank Farms without treatment, or if transferred in less than 90 days. For the WESF replacement liquid waste system there are no known scenarios that prevent decoupling from proceeding.
- Transportation issues exist for both liquid and solid waste shipments from WESF, but no show stoppers are anticipated. The possible exception is changing transportation or burial requirements for solid waste that might escalate cost and result in schedule impacts. Cost estimate for a new waste container/transporter evaluation, design, procurement, SARP's and ,loadout station could exceed \$1 million.
- The permitting strategy of B Plant was discussed by the Isolation Study team. The timing and possible corrective actions for the low level waste system can affect the decoupling decision. Cell 24 or 25 will be modified, under the current permitting strategy for B plant. This strategy was developed in line with the CSP plan which assumed liquid waste handling would continue in B Plant, after CSP, to support WESF. A potential for cost savings exists if decoupling proceeds and the low level waste system upgrades can be deleted.

Two additional regulatory questions were identified that are not specifically discussed above:

- 1) Can we operate B Plant under interim status through deactivation?
- 2) Will a shutdown notice be received from DOE concurrently with approval to do the Decoupling Project?

3.2 WESF Mission Analysis

Baseline assumptions for this study and for WESF are critical to the overall strategy and recommendations. The decision to decouple WESF is dependent upon future plans for capsule storage at WESF which have yet to be determined. The key WESF program assumptions are listed below:

Capsules stored in pool cells for 15+ years - The maintenance of existing pool cell operating systems will continue for at least 15 years. The capsules in the current inventory and the capsules returned as part of the Capsule Return program will remain in pool cell storage at WESF for this time period.

Final Disposition of Capsules with TWRS - The TWRS program currently has responsibility for the ultimate disposition of the strontium and cesium capsule inventory along with the single and double shell tank waste. The base case plan is to blend the strontium fluoride and cesium chloride directly into high level waste glass in the HWVP. The

renegotiation of the TPA has delayed the startup of HWVP to at least the year 2009. The best assumption for the B Plant/WESF Isolation study is that the removal of capsules will be after that date. It has not been decided if cutting the capsules open would take place at HWVP, at a new facility, or if this is a potential mission for WESF.

Maintenance of Hot Cells to Continue - Since the shutdown of the encapsulation process cells and removal of major process equipment components the hot cells have been maintained to support loadout of solid waste and to maintain the capability to return capsules from off-site. Maintenance of the manipulators and the hot cell windows are examples of WESF systems that can not be allowed to deteriorate to avoid major impacts to future programs as well as possible safety hazards to employees. As a result, maintenance of these components will continue to generate solid and liquid waste.

Capsule Recovery Program to be Completed - For this study it is assumed the capsule return operations will proceed to completion. The support systems will be capable of safely accommodating the final total capsule inventory.

3.3 Capsule Recovery Program

Background information is included in this section (from Reference 5) to understand the process and shipping method used to return offsite capsules may affect decoupling.

The Beneficial Uses Shipping System (BUSS) cask was developed by Sandia National Laboratories (SNL) in support of the Department of Energy - Headquarters (DOE-HQ) effort to transport cesium chloride and strontium fluoride capsules between offsite facilities and the Waste Encapsulation and Storage Facility (WESF) located at Hanford, Washington.

The primary purpose of the BUSS cask is to provide shielding and confinement for the contents during normal and accident transportation conditions. The BUSS cask is a "dry" cask that uses an inert gas (helium) in the cavity as a cooling medium.

To return capsules to WESF two types of shipping activities are currently planned:

Iotech Shipping - Shipments are scheduled for 1994 and 1995 to return cesium capsules to WESF using the BUSS cask system.

ARECO Shipping - Shipments are scheduled to return cesium capsules in 1996, using the BUSS cask.

In addition to the key WESF assumptions described above, the Cesium Recovery Program has the potential of significantly increasing the mission tasks of

WESF. The activities listed below are all additional elements of the Cesium Recovery Program planning case:

- GE2000 Cask - Shipments are planned for 1995 and 1997 to return cesium capsules to WESF.
- Onsite Cask - The onsite cask will be used to ship material/capsules from PNL to WESF.
- ORNL Shipments - The GE2000 cask will be used to ship material to WESF from Oak Ridge.
- WESF Re-encapsulation - This program element represents the potential handling and processing activities associated with re-encapsulating the material/capsules received or returned from offsite.

The Cesium Recovery Program planning case, described above, and a less aggressive target case (with the same work elements but with a delayed schedule) are shown in figures 3-1 and 3-2.

The re-encapsulation program is the most important task with regard to the Isolation Study because modifications to the hot cells will be necessary. Although this program is not well defined or funded the implementation represents the development of a process, and the procurement, installation, and operation of major equipment in WESF hot cells.

3.4 B Plant Mission Analysis

Transitioning B Plant to the LTS&M state prepares the facility for eventual D and D. To achieve this objective, the B Plant Cleanout and Stabilization Program Update assumes that D and D Readiness End Point Criteria must be met, and the configuration of the combined B Plant/WESF facilities must be revised to decouple WESF from B Plant. In the current configuration B Plant supplies deionized water for pool cells, accepts low level waste streams, liquid effluents, and solid waste from WESF. The analysis and decision to decouple must consider the replacement of these services.

The CSP plan was expected to require extensive revision to include decoupling in the scope of work. The plan specifically recommended a separate engineering study (this study) to determine if the life cycle cost of decoupling projects versus minimal B Plant operations warrants the discontinuance of WESF support prior to transitioning WESF to LTS&M.

Because of B Plant's highly contaminated process areas, it is assumed that containment and an active ventilation system must be maintained. The ventilation system will maintain negative pressures in the canyon with respect to the atmosphere at all times. This means a majority of ventilation components operating around the clock. The complexity of the final configuration is yet to be determined. It does appear, however, that control

and monitoring of the ventilation and other systems must be relocated from 271-B to an external location.

3.5 Methodology for a B Plant CSP Walkaway Scenario

During development of the Cleanout and Stabilization Program plan (Reference 1), an effort was made to define the plant condition, assumptions, risks, and a walkaway scenario. A walkaway scenario is the action plan and probable consequences for reducing plant operations to the minimum necessary to maintain safety to personnel and the environment, as soon as possible. This scenario does not consider the development of mutually acceptable end point criteria (involving stakeholders), that will be required for deactivation, but is useful to evaluate how the decoupling decision and replacement of support systems are affected.

Plant Condition / Hazards

B Plant contains an undocumented inventory of cesium and strontium residual contamination in the inactive process vessels, and strontium contaminated organic stored in process tanks. The canyon ventilation system has an estimated 1 megacurie of strontium and cesium captured on the 291B HEPA filter system, as particulates. In addition the canyon structure contains significant quantities of radioactive contamination, evident by process cell dose rates. The contamination is believed to be of two types and forms:

- Process liquids have dripped onto the process cell floors, cell drain header, and to a lesser degree the hot pipe trench floor. The material is believed to be largely chemically bonded to the concrete matrix and therefore both difficult to remove and stable.
- The plant history and configuration results in contaminated particulates migrating from the process cells toward the 291B filter system via the wind tunnel and ducting.

Either or both of these two sources of residual facility contamination are believed to exceed a megacurie of total ^{90}Sr and ^{137}Cs . These two isotopes represent >99% of the total.

The general hazard to personnel in B Plant or the public is low. The highly radioactive sources are either well isolated or totally inaccessible due to physical barriers.

B Plant operations also support control of radioactive inventory at WESF, most notably the cesium and strontium capsule inventory in pool cell storage.

Near Term Stabilization Assumptions

A walkaway scenario is assumed to mean minimizing efforts (costs) to clean up B Plant and focus on stabilizing and shutting down all possible operations.

To accomplish a near term "walkaway" the following are recommended as minimum actions required to secure the hazards:

- Liquid organic is consolidated into one cell, all electrical sources isolated and a long term storage strategy implemented. The OSR is revised.
- Alternate WESF support systems are in place.
- Cell 4 WESF solid waste handling has been terminated and replaced by a solid waste handling system in WESF.
- A WESF liquid waste handling system is operational, independent of B Plant.
- WESF pool cell cooling, demineralized water makeup, and response for leaking capsule scenario are independent of B Plant.
- B Plant process operations consist of collection of cell drainage in cell 10, the volume is minimized to the lowest practical extent. A new system transfers this liquid directly outside the canyon for sampling, chemical addition, handling as LLW with the WESF LLW system.
- The 221-B canyon ventilation system has been modified to minimum flow rate and minimum operation and maintenance.

Conclusions from Walkaway Analysis

The walkaway analysis was done for B plant prior to considering negotiated end point criteria as a critical element for deactivation. It is now expected that the liquid organic can not be left for indefinite storage in B Plant. In addition, the collection of cell drainage in B Plant and transfer to WESF appears to be well beyond the limited activities expected during LTS&M.

Cesium Recovery Program - Planning Case

Figure 3-1

Cesium Recovery Program - Target Case

Figure 3-2

4.0 WESF SUPPORT SYSTEM ALTERNATIVES

4.1 Capsule/Pool Cell Cooling System Alternatives

4.1.1 Closed Loop Cooling System, Project W-252

The Isolation Study team met to define alternatives and approaches for the Capsule/Pool Cell Cooling System at WESF. The original project scope is discussed here. The potential descoping of the project is discussed in the next section.

The plans to replace the once through capsule/pool cell cooling system predate the B Plant/WESF Isolation Study. Part of the Tri-party Agreement included plans to implement a waste treatment and minimization policy of DOE. At B Plant, project W-252 was developed to replace the once through cooling system with a Closed Loop Cooling System (CLCS).

The key features of the CLCS are listed below:

- 1) Only two existing streams from B Plant were to have been tied into the Closed Loop Cooling System (CLCS), the SW 1 C and O unit floor drains. However, it has been recommended to the KEH design team that the effluents from the contaminated drains be rerouted to TK-10-1 via the RR tunnel and tied into the existing drain from SW 1 decon sink/shower.
- 2) A tie-in of the existing emergency well pumps as an alternate makeup water source was considered. However, KEH is evaluating the total elimination of both of these stations by tying into the existing sanitary water supply.
- 3) W-252 is providing an alternative cooling system to replace the existing once through method, and a route to connect this systems' waste water into a state permitted disposal site. In that processing and storage requirements at B Plant have been eliminated, there will be no tie-in of B Plant generated effluents to the CLCS. This includes elimination of existing raw water discharges from tank cooling coils and condensers to the 15 and 24-inch headers. The existing practice of discharging to the 207-B retention basin will end when BAT/AKART has been implemented and the tie-in to TEDF has been occurred. Therefore, this CLCS is entirely WESF related.
- 4) The elimination of effluent to the 15 and 24-inch headers will require a significant amount of effort to ensure that, and convince the state, that the old practice has been safely and securely discontinued.
- 5) Due to lack of information during the preparation of the conceptual estimate, the estimate included: 1) instrumentation

connections from the new systems to the existing control room, and 2) a radiation monitoring system for the CLCS.

A cost summary of the CLCS project is shown in table 4-1.

Table 4-1

COST ESTIMATES**B PLANT/WESF PORTION OF W-252 ***

B PLANT/WESF W-252 COST ESTIMATE						
Def. Design		Procurement		Construction		Eng/Insp
Cat 1	Cat 2	Onsite	O/C	Onsite	F/P	-----
261K	275K	532K	857K	345K	1,349K	464K
Total Implementation Cost B Plant/WESF						\$4,083K

* Information as supplied by Peterson, 3/15/94

The Isolation Study team discussed alternatives or variations on the closed loop cooling system including the option of using refrigeration versus the planned cooling tower technology. The consensus was reached that a debate about use of these two competing methods of cooling was probably outside the scope of the Isolation Study and it is too late in the project schedule to make a major change to the project scope. Either option meets the objective of the Isolation Study to replace the WESF system with a standalone system independent of B Plant.

The CLCS project (W-252) is scheduled to be installed before a possible WESF Isolation Project or completion of B Plant deactivation.

4.1.2 Closed Loop Cooling System, Descoped Project W-252

A modification to the project W-252, Phase II Liquid Effluent Treatment and Disposal has been proposed (Reference 5) that may affect the Isolation Study significantly.

The proposed changes to the project request descoping by deleting the flow reduction modifications to the 244-AR Vault Cooling Water, 242-A Evaporator Cooling Water and Steam Condensate, and the B Plant Cooling Water. The W-252 effluents will continue to discharge to the 216-B-3C Pond and the interim 216 permit would then be used as the final permit based on the recent characterization data. The proposed descoping changes to the Project W-252 would save approximately \$10 million.

The impact to the B Plant/WESF Isolation Study and potential Isolation Project, by the descoping of Project W-252 is significant. If the project scope change is approved, WESF will have two new alternatives:

- 1) Install a new closed loop cooling project servicing only WESF pool cells.
- 2) Modify the existing once through cooling system to be independent of B Plant and allow deactivation to continue.

The final evaluation of these new potential alternatives has not been performed. This decision will remain an open issue.

4.2 Deionized Water System Alternatives

The Isolation Study team met to define alternatives and approaches for the deionized water supply for WESF. Six alternatives were identified and defined by the team:

ALTERNATIVES

1. New downsized system located at WESF

This alternative involves specification, procurement, and installation of a new system identical in technology to the existing system installed in 271-B AMU area. The existing system is capable of 400,000 gallons per month. The new system would be downsized significantly, to about 1000-5000 gal/mon. The new system may be manufactured by the same vendor or equivalent.

This alternative may require a new tank or tanks, probably made of fiberglass reinforced epoxy. The tank storage volume needed is 2000 gallons minimum. The storage tank(s) could be located in the WESF AMU area. There is a possibility, if needed, of locating new tanks in a separate building designed to accommodate other new systems, such as a low level waste loadout and solid waste handling facility.

2. Operate existing B Plant system with modifications

This alternative is defined as operating the existing system located in 271-B AMU to supply water to WESF. Modifications, or improvements would be made. The improvements could include conversion to fully automatic operation and some piping changes.

Although not strictly within the guidelines of the Isolation Study, to make WESF independent of B Plant, the option is listed to provide a comparison with other alternatives.

3. Use existing system without modifications ,

This alternative is defined as operating the existing system located in 271-B AMU to supply water to WESF. No significant changes or modifications to the system will be made. This is the basic do nothing alternative. Although not strictly within the guidelines of the Isolation Study, to make WESF independent of B Plant, the option is listed to provide a comparison with other alternatives.

A resin changeout will be required at some future date and maintenance will be required.

4. Move the existing system to WESF

This option moves the existing system from 271-B to WESF. The equipment modules are disassembled, transported, and reassembled at a new location.

This alternative will require extensive piping rework and a new tank or tanks, as with alternative 1. The high labor cost, new resin required, and the age of the existing system are negative factors for this option.

5. New Culligan type system

This alternative installs a new system in WESF. The new system has the capability of a cartridge changeout rather than regeneration, as needed. The supplier or vendor will maintain the system and perform periodic resin changes as a "turnkey" contract. This is a common method of operating deionized water systems in plants.

As with alternative 1, this option would be downsized significantly from the B Plant system capacity. A capacity of 1000-5000 gallons per month is needed.

6. Use Sanitary/RAW water

The final alternative defined is the use of raw or sanitary water to supply pool cell water makeup. At first review this option does not meet the water specifications and therefore is not a viable option. The pool cell ion exchange system may be exhausted quickly. However there is a possibility that review of the technical basis for the current specifications will reveal a specific component that can be treated. For example a carbon filter will remove chlorine easily.

Two alternatives were selected by the study team (alt. 1, and 5) for preparation of system descriptions and sketches, and a preliminary cost estimates. Option 2, 3, and 4 are unacceptable because 271-B must be abandoned for minimum surveillance and the existing system is too old. Option 6 does not meet the required water specifications. The details for the 2 selected options were developed by ICF-KH in Appendix A.

The conclusion from the supporting engineering study by ICF-KH is that the best alternative for an independent deionized water system is the Culligan multi-tank system. The multi-tank system consists of two sets of one cation tank, one anion tank, and one mixed-bed resin tank. This six vessel system is capable of delivering the required quantity and quality of deionized water based on the given feed water characteristics. The Culligan multi-tank system is the best alternative based on lowest cost, lowest maintenance, least required space, and lowest waste generation. The multi-tank system is recommended to be located on the second floor of the 225-B AMU building following equipment removal and decontamination of storage areas. The estimated cost of the proposed system is \$101,000.

A flow diagram of the multi-tank system is shown in figure 4-1. The proposed location for the recommended system is shown in figure 4-2.

4.3 Low Level Waste System Alternatives

The Isolation Study team met to define alternatives and approaches for the Low Level Waste stream from WESF. Seven alternatives were identified and defined as follows:

ALTERNATIVES:

1. Pipeline to diversion box 1, Project W-028.

Project W-028, "Aging Waste Transfer Lines", was originally scoped to include a pair of double encased transfer lines from B Plant to the tank farm facilities near AR Vault, to support the NCAW process mission. This original scope also included two new diversion boxes, one near the south side of B Plant/WESF, with two new double encased lines into 221-B at cell 11 and at cell 25.

The project scope was changed as the NCAW mission was suspended. As described in WHC-SD-WM-PRS-011 the project scope was most recently revised to add only a single double-encased discharge line from B Plant to a new diversion box, and two double encased pipelines from the diversion box to tank farms. The pipeline trench will be shared with another project constructing a cross site transfer line from 200W area tank farms to 200 east area tank farms. The Hanford Waste Vittrification Plant (HWVP) will connect a future line to the new diversion box south of B Plant.

In 1993, the options for tie-in to B Plant/WESF were evaluated. A single line from the west end of the 221-B hot pipe trench to the diversion box remained in the scope.

To use the W-028 tie-in for the LLLW system requires additional system requirements:

Tanks - Two tanks are needed to collect the liquid waste stream, batch transfer to the second tank, neutralize, sample, and pump to Tank Farms.

Pumps - Pumps are needed to transfer LLLW to tank farms, and between the two tanks.

Chemical addition system - This system will replace the chemical additions routinely added to LLLW to adjust pH and prevent corrosion, currently done in cell 25.

Sampling - Tank Farms requires the LLLW stream to be characterized prior to direct transfer to double shell tanks.

2. Tank Truck/Rail Car Loadout Facility

A tank truck loadout facility alternative was identified by the study team. The system would require a tank truck liquid waste loading facility with the necessary secondary containment, monitoring, and remote handling capabilities. The truck would have to be qualified to meet DOT and DOE requirements for radioactive liquid shipments. Sampling would be performed at WESF. At the tank farms receiving facility the necessary chemical additions and final sampling would be performed. This strategy of sampling at the receiving facility avoids the transport of hazardous chemicals and the expected more stringent shipping requirements.

As with the previous option, the tank truck facility also requires tanks and pumps for collection and transfer.

The use of railroad tank cars was considered as an alternative to a truck system. The nearest tracks are over 500 feet from WESF. This approach was not considered further due to cost. The larger size of railcar tanks (20,000 gallons) is also not necessary. The WESF waste stream is estimated to be less than 5000 gallons per year.

The refurbishment of the 212-B cask station facility as a tank truck loadout facility is possible. The building must meet, or be modified, to meet current design requirements. The location is acceptable and a new facility could not be easily sited that close to WESF due to existing structures.

3. Waste Minimization

This alternative reduces the volume of liquid waste and can be combined with, but probably not replace, the other options. It is expected that reductions can be made from current waste volumes if necessary.

Two approaches to waste minimization were identified;

- 1) Non-liquid decontamination technology - Most of the expected radioactive liquid waste stream is generated during decontamination activities. The use of dry decontamination techniques to accomplish the required tasks can be investigated.
 - 2) Evaporation - Volume reduction of stored liquid waste can be accomplished by non-boiling evaporation. This has been done in B Plant within containment of the facility and the ventilation systems. The possibility for performing this process at WESF also exists.
4. Deactivate / cleanup hot cells prior to decoupling

This alternative involves a significant cleanup and decontamination project that would effectively eliminate the need for future decontamination activities. An assumption is that liquid waste would not be generated routinely following this cleanup project.

5. Waste Treatment System

The waste treatment alternative requires the development, installation, and operation of a closed liquid process system to recover radioactive strontium and cesium. Low level liquid waste might be generated and collected much like the present operations but would then be pumped to a new treatment package for decontamination. The radionuclides would be stored indefinitely or until WESF D&D. A liquid effluent waste stream would be generated.

The old project W-007 evaluated several options for recovery of strontium and cesium from dilute aqueous waste. The technology should be applicable to WESF. Ion exchange technology provides the possibility of long term loading and storage of radionuclides on the media in concentrated form.

A favorable feature of this alternative is that ion exchange columns can be relatively small. Many nuclear facilities in the DOE complex probably face the same challenge of recycling and treating waste streams.

6. Operate LLLW System in 221-B

This alternative proposes that cell 25 in B Plant be refurbished to meet regulatory requirements for operation by WESF. The idea does not meet deactivation requirements for B Plant but is included for comparison.

The alternative requires the upgrade and maintenance of cell 25. The other process cells in B Plant would be deactivated independently. In order to accomplish the B Plant Deactivation end point criteria (not yet established), it is expected there will be essentially no 221-B canyon maintenance. The crane may be mothballed. Therefore an alternative LLW

sampling method will be devised to eliminate manned entry into the B Plant canyon.

To make this alternative workable, the refurbishment of cell 25 would include a self contained (with secondary containment), stand alone design, that can be operated from WESF. The piping connections will be high integrity, possible welded, and the cover blocks left closed. It will be a major design challenge to get the 221-B canyon crane out of the operating system.

7. Do Nothing at WESF

This do nothing alternative may require support from option 3 (Waste Minimization) above. The proposal would minimize liquid waste as much as possible and store the remaining waste in tanks until the deactivation of WESF or the next mission is defined. Evaporation or waste treatment could play a role with this alternative. There would be no liquid waste stream to B Plant or to tank farms.

Five alternatives (some are modifications to above alternatives) were selected by the study team for preparation of system descriptions, sketches, and a preliminary cost estimates. The details were developed by ICF-KH in Appendix B. The alternatives and rationale for selection are included below:

- 1) Pipeline intertie with Project W-028 using the existing tanks located at 221-BF.

Use of the W-028 pipeline was expected to minimize cost and provide maximum flexibility for increasing waste volumes, if the estimated volume requirement was low. The location of 221-BF is nearly ideal.

- 2) Pipeline intertie with Project W-028 using new tanks in a new facility.

If the modified 221-BF cannot meet current codes and requirements a new facility conceptual design is needed for comparison.

- 3) Tank Truck Loadout Facility using the existing tanks located at 221-BF.

A new truck loadout facility was favored over 212-B due to the expected high cost of 212-B decontamination, redesign, and upgrades that might be needed to meet current requirements. The estimated cost of a new facility was unknown at the time of this decision. It now appears that from the ICF-KH cost estimates that 212-B needs further consideration if W-028 is not available.

- 4) Tank Truck Loadout Facility using new tanks in a new facility.

This option is a combination of a new truck facility and a separate tank facility. This was expected to be a high cost alternative, useful for comparison.

5) Tank Truck Loadout Facility with new tanks included in the facility.

This alternative is more probable than option 4 and was expected to be more cost effective. The space available for new facilities in this area south of WESF is limited.

It appears that alternatives (1) and (2) require chemical treatment prior to shipment and therefore permitting of WESF as a Treatment Storage Disposal (TSD) facility. It may not be necessary to permit WESF if liquid waste is transported to Tank Farms without treatment, or if transferred in less than 90 days. The remaining alternatives listed use a stainless steel tanker truck that may allow untreated waste to be transported and treated at the Tank Farm receiving facility.

The conclusion from the supporting engineering study by ICF-KH (Appendix B) is that the best alternative for an independent Low Level Waste System is the first option listed above: a pipeline intertie to Project W-028, using the existing tanks in 221-BF for waste collection. This option is \$5,000,000 less than the next best alternative, as expected.

The proposed location for the recommended system is shown in figure 4-3. The 221-BF facility is existing and the W-028 pipeline is very close.

4.4 Liquid Effluent / Control System Alternatives

The Isolation Study team met to define alternatives and approaches for the Liquid Effluent streams from WESF.

The two liquid effluent streams from WESF are the cooling water and the chemical sewer. The disposition of the cooling water stream was evaluated for the capsule cooling system evaluation. The Project W-252 design uses cooling tower technology that generates a residual waste stream of 35-50 gpm. This residual stream will be discharged, probably to the chemical sewer effluent stream. There will be no cooling water use in B Plant and no residual waste stream from B Plant following Project W-252.

If Project W-252 is descope, the liquid effluent system requirements will change. The implications of this change are discussed in sections 4.1 and 7.0.

The chemical sewer effluent stream currently consists of several sources including the air compressor cooling water (from B Plant and WESF), overflow from the high tower, and other sources. The compressor streams make up 80% of the total flow. The chem sewer stream is routed to the 211-BA facility where monitoring and chemical additions are made to control the pH of the discharged stream. The treated effluent is routed to the B Pond via the 24 inch cooling water header. Future plans for the chemical sewer disposition include routing the stream to the Treated Effluent Disposal Facility (TEDF) (Project W049H).

The alternatives to eliminate WESF dependence on B Plant chemical sewer include:

1) Minimize or eliminate the chem sewer effluent stream

If all sources to the chemical sewer can be reduced or eliminated new alternatives may be identified. The two air compressors discharge most of this liquid stream. Project W-252 may be able to accommodate the liquid effluent from the WESF air compressor. Air cooled compressors can also be evaluated.

2) Continue operating 211-BA facility

The chemical sewer stream will be routed to TEDF by 6/95. For this alternative it is assumed this "neutralization" facility will continue to be operated after isolation from B Plant. The controls of 211-BA will be relocated or certain monitoring may be performed from a control room in WESF.

Note: A third alternative was identified to determine which parts of the 211-BA neutralization facility are actually needed to be operational and controlled at WESF. Since the WESF effluent stream is not well characterized this option was not evaluated for this report.

The selected alternative is number (2). Waste minimization efforts will continue (as described in alternative 1) but will be outside the scope of the Isolation Study. Since the 211-BA facility is located in the B Plant 211 area the control system needed to operate the facility from WESF, as part of WESF operations, will be the focus of the supporting engineering study by ICF-KH. Additional scope has been identified as follows:

1. The Engineering Work Station , including the Bailey /IBM bailey cad station and the serial interface CIU linking it to the new "WESF LOOP" WILL be needed, because it is assumed that the one in room 201 of 271B will go with the long term surveillance contractor-organization for so they can maintain the system either remotely or at 271B.

- Items needed are
- A. Bailey network 90 Engineering Work Station (EWS) and printer with serial computer interface unit (CIU01) and conduit and wiring to WESF LOOP.
 - B. An Engineering Station compatible with the Operator Interface Stations, either OIU , OIS or the newer P/C based 486-Bailey with windows, or Wonderware R .
 - C. Engineering office for above equipment located somewhere close to WESF (probably the WesF

office Trailer) with System (Cog) Engineer's personal office desk and computer station.

2. The 211-BA building will require alternative electric power, not supplied from the 221-B electrical gallery and a supply of process/sanitary water that operates the eduction jets for caustic and acid injection and supplies the 151 sump pump seal water.
3. Alternative electric emergency backup power to the net 90 PCU and the environmental samplers in 211BA.

It is has been concluded that the control loop operating 211-BA and other WESF instrumentation associated with Network 90 PCU's should be completely separate from the B Plant FPMCS to permit deactivation of B Plant.

The details of the system described above are included in Appendix C, prepared by ICF-KH.

4.5 Solid Waste Handling Alternatives

The Isolation Study team met to define alternatives and approaches for the Solid Waste stream from WESF.

The waste type that is of most interest for the study is remote handled radioactive waste. This waste type is currently packaged in A cell, transferred to B Plant and stored in cell 4. The alternatives to handle solid waste after isolation are:

- 1) Use an existing waste cask to transfer waste directly to the 200E burial ground.

An approved existing waste container was located (ECOROK overpack) that would accept several drums for direct transport and burial. This container best meets current and anticipated transportation and burial requirements.

- 2) Use a lead lined type B metal container to transport waste drums to 200E burial ground.

After locating the overpack container described above no further consideration was given to a lead lined type B container.

- 3) Overpack the 55 gal drums into a standard 85 or 110 gal drum, grout the annular space for shielding, and transport the solidified waste drum to the burial ground.

A grouting system would be needed for this option in addition to requirements common with the other two options.

4) Design and fabricate a small concrete burial box.

With this concept the burial box would remain in the truck port and be loaded in a manner similar to the old B Plant "drag-off" system. A system to remotely place a lid and seal the box would be needed. Cost is expected to be high.

The third alternative was initially favored. The overpack should be commercially available and a DOT approved container. Some WESF modifications and new operating procedures would be required. These include a grout addition system in the WESF canyon and the capability to remotely handle the full waste drums and completed overpack assembly. The first alternative was selected as the basis for the preparation of system descriptions, sketches, and cost estimates.

Three methods for contamination prevention and/or decontamination of the solid waste container were evaluated by the contractor:

- 1) Bagging of the container
- 2) CO₂ blasting
- 3) Ice (H₂O) pellet blasting

Alternatives evaluated for waste drum radionuclide characterization include:

- 1) 222-S Laboratory gamma/beta ratio analysis
- 2) Gamma detector drum counter
- 3) Calculation of radionuclide content

The details were developed by ICF-KH in Appendix D.

The conclusion from the supporting engineering study by ICF-KH is that the best alternative for solid waste handling system for WESF hot cells includes the following features:

- 1) Use of approved waste containers (drums)
- 2) Contamination prevention by bagging the container
- 3) 222-S laboratory analysis and HPGe (high purity Ge detector) portable gamma drum counter system
- 4) Use of the SEG ECOROK 25-11 shipping cask or equivalent
- 5) Direct burial at the burial grounds

Figures 4-4 through 4-7 graphically show: Solid Waste Flow Path to A Cell Collection Area, Waste Drum Bagging / Decontamination Process, Solid Waste Decontamination and Characterization Process, and Solid Waste Flow Path WESF Canyon Deck.

4.6 WESF Surveillance System Alternatives

The Isolation Study team met to define alternatives and approaches for the surveillance function at WESF. The initial study assumptions expected to affect the surveillance function are discussed in section 3.0 WESF and B Plant Mission Analysis and are listed below:

- 1) B Plant will be deactivated to end point criteria similar to other plants, such as PUREX. WESF will be stand alone after the Isolation Project.
- 2) The 221-B canyon ventilation system will be operating, with a single stack effluents release point.
- 3) WESF will handle and transfer liquid waste directly to tank farms, solid waste directly to burial grounds. WESF will generate its own deionized water, operate a closed loop cooling system, and discharge a residual liquid effluent to the chem sewer stream.
- 4) B Plant will be unoccupied (including 271-B) except for quarterly walk-through surveillance of appropriate areas.
- 5) Surveillance of B Plant will be independent of WESF operations and surveillance. Operation of B Plant ventilation will be performed by the D&D contractor. Note that it is possible that operation of the B Plant HVAC will be from WESF even though responsibility for B Plant will be with EM-40. This conceivably could be accomplished through a work order from the D & D contractor to the O & M contractor.
- 6) WESF hot cells will be maintained and not preclude a major re-encapsulation mission, but no upgrades are planned.

The key functions for surveillance after isolation fall into three areas:

- 1) 211-BA Chemical sewer neutralization
- 2) 291-B Instrumentation and operation
- 3) WESF Operations, or operating systems

Since it has been assumed that WESF operations and surveillance will be independent of B Plant function (2) above is not applicable. Function (3) is addressed by the new support systems previously provided by B Plant (sections 4.1 - 4.5) and by existing WESF operations that may need upgrades independent of the decoupling decision.

The remaining new function for WESF surveillance is to monitor and operate the chemical sewer neutralization facility, 211-BA. The upgrades associated with 211-BA operation are discussed in section 4.3.

Figure 4-1

Flow diagram of Proposed Multi-tank Deionized Water System

Figure 4-2

Location of Proposed Multi-tank Deionized Water System

WESF BLDG 225-B, SECOND FLOOR

EXISTING CONDITIONS

PROPOSED LOCATION OF DWSS

Figure 4-3

Location of Proposed Low Level Liquid Waste System

221-BF

Figure 4-4
Solid Waste Flow Path to A Cell Collection Area

Figure 4-5

Waste Drum Bagging / Decontamination Process

DRUM DECONTAMINATION PROCESS

Figure 4-6
Solid Waste Decontamination and Characterization Process

07/28/94

Figure 4-7

Solid Waste Flow Path WESF Canyon Deck

SECOND FLOOR PARTIAL PLAN AT ELVATION 718' 6"

5.0 COST ANALYSIS

B Plant supplies cooling water, deionized water for pool cells, accepts low-level liquid waste streams, liquid effluents, and solid waste from WESF. The proposed decoupling project will include the replacement of these 5 systems to allow independent, stand alone operation of WESF. The proposed configuration of each new system is described in sections 4.0 and 7.0.

Table 5-1 summarizes the cost estimates of the alternatives evaluated for the 5 systems. The recommended alternative for each system is also the lowest cost alternative, with a total cost of \$5,619,000. This table also illustrates that the maximum cost of the entire project could be as high as the highest estimate for each system if each of the high cost alternatives made sense. This would bracket the upperside of the project cost, at approximately \$19,000,000. Figure 5-1 shows the cost breakdown of the proposed Isolation Project as a percentage of the total cost. This is the minimum cost scenario for the entire project. Note that in both Figure 5-1 and Table 5-1 the cooling water system has no cost to this project (covered by Project W-252) and that the LLLW alternative cost assumes Project W-028 will be completed.

Figure 5-2 shows a different cost scenario for the Isolation Project, totalling \$12,297,000. In this case it is assumed Project W-028 and W-252 are canceled. A closed loop cooling system cost is shown equivalent to the B Plant portion of W-252 and a higher cost LLLW alternative is shown which does not use the W-028 pipeline (includes tank truck loadout facility).

To evaluate the cost/benefit of proceeding with the B Plant/WESF Isolation Project two scenarios will be used, represented by Figures 5-1 and 5-2. These two projects scenarios total \$5,619,000 and \$12,297,000. Several assumptions are necessary to proceed with a cost/benefit analysis:

- The Isolation Project will be implemented as a single construction project.
- Completion must occur before the end of B Plant Deactivation. It is likely the cost savings cannot be realized until completion of deactivation.
- B Plant Deactivation will start in FY1997 and be completed in FY2002.
- The B Plant costs for operation and maintenance at the end of the CSP program, \$8,300,000 will be used as the basis for Isolation project cost savings. At the end of CSP the function of B Plant is WESF support.
- Following completion of Deactivation and Isolation the B Plant budget will be reduced to \$1,000,000.

- This cost saving evaluation is rather simplistic, at this time, neglecting escalation/inflation factors. All dollars can be considered as FY1994.

To complete a cost/benefit analysis it is assumed that if B Plant deactivation is completed without Isolation the B Plant budget will be reduced to \$8,300,000 and remain there until the Isolation project is completed.

If completion of the Isolation Project is in FY2002, coinciding with completion of deactivation, B Plant O&M costs will be reduced from \$8,300,000 to \$1,000,000, for a savings of \$7,300,000 annually. The cost of the proposed Isolation Project is \$5,619,000. The cost of the second Isolation Project scenario (figure 5-2) is \$12,297,000. In either case the cost/benefit comparison is obviously good, without calculating return on investment and payback, etc. The project cost will be recovered in the first year after deactivation, by accruing an annual cost savings of \$7,300,000. The actual Isolation Project costs (corrected for inflation and the time value of money) will be incurred earlier, mostly in the year or two prior to completion, making the cost/benefit situation only slightly less attractive.

In conclusion the Isolation Project is clearly justified at the estimated \$5,619,000 total project cost. The project should be completed on a schedule to coincide with the end of deactivation (projected to be FY2002) with project costs delayed, where possible, to maximize the economic benefits. Failure to complete the Isolation Project with the deactivation will delay a potential annual cost savings of \$7,300,000.

Table 5-1
Cost Estimate Summary WESF Support Systems Alternatives

WESF Support System	Alternative	Cost of Alternative	Decoupling Project Cost *
Cooling Water	Project W-252 Implementation	\$4,083,000	
Deionized Water	Culligan Multi-tank System	\$101,000	\$101,000
	New Ionpure System	\$310,000	
Low Level Liquid Waste	221-BF Tanks Intertie to Project W-028	\$3,574,000	\$3,574,000
	New Tanks, New Facility Intertie to W-028	\$8,614,000	
	221-BF Tanks with New Truck Loadout Facility	\$6,169,000	
	New Tanks, New Facility with Tank Truck Loadout Facility	\$11,495,000	
	New Combined Facility with Tanks and Truck Loadout Station	\$9,078,000	
Liquid Effluents	Power and Controls Modifications for 211-BA Facility	\$687,000	\$687,000
Solid Waste	A Cell Modifications, Drum Bagger, Drum Counter, Laboratory Support, Shipping Casks, and Burial Costs	\$1,257,000	\$1,257,000
	A Cell Modifications, Ice Pellet Decon, Fixative, Drum Counter, Laboratory Support, Shipping Casks, and Burial Costs	\$2,290,000	
	A Cell Modifications, Ice Pellet Decon, Fixative, CO2 Blasting, Drum Counter, Laboratory Support, Shipping Casks, and Burial Costs	\$2,900,000	
Total Decoupling Project Cost *			\$5,619,000

* Excludes Cost of Projects W-252 and W-028

Isolation Project-Cost Breakdown by System

Figure 5-1

Excluding Project W-252 and W-028 Cost *

Figure 5-1

WHC-SD-WM-ES-313, REV 0

Isolation Project-Cost Breakdown Without Projects

Figure 5-2

Assume Cancellation of Projects W-252 and W-028

Figure 5-2

WHC-SD-WM-ES-313, REV 0

6.0 ISSUES

The following issues have been identified that may affect the decision to decouple WESF from B Plant or affect the selection of the best alternative for each support system:

Cell 4 Waste Drum Inventory

The disposition of cell 4 WESF waste drum inventory was initially assumed to be a condition of completing B Plant CSP. The study team believes indefinite storage of inventory in cell 4 may be acceptable during LTS&M and the disposition of the inventory is not a requirement for decoupling.

Surveillance of B Plant

The surveillance of B Plant after deactivation and after decoupling has been assumed to be independent of WESF and performed by a different organization/contractor. Therefore the future WESF operations and surveillance organization would not participate in the periodic surveillance of the deactivated B Plant. This assumption could prove to be incorrect. It is potentially more cost effective, for example for a WESF operations organization to operate and maintain the B Plant canyon ventilation.

Maintenance/Cleanup of WESF Hot Cells

The decoupling strategy for WESF hot cells is to continue the current level of maintenance which results in the generation of solid and liquid waste. Several different scenarios are possible: 1) Cleanup the hot cells prior to decoupling and B Plant deactivation to use available space in cell 4 and reduce future liquid waste volume, 2) reduce maintenance of hot cells to the minimum levels necessary, abandon equipment in place, and 3) modify or upgrade the hot cells for future mission availability, for example remove the manipulators from A-E cells, or decontaminate the cells. A better definition of the WESF mission may take place following the release of this Isolation Study which may alter the conclusions.

Deactivation End Points for B Plant

B plant deactivation end state criteria have yet to be established/negotiated. The potential exists for the results to change the conclusions of this study. For example, if the physical boundaries of a deactivated B Plant can be very flexible WESF can, theoretically, annex parts of B Plant to effectively lower the initial cost of isolation. Two other examples of this issue are discussed above involving cell 4 and surveillance/operation of ventilation systems.

Solid Waste Transportation and Burial

Transportation and solid waste burial requirements have a recent history of continuous changes and a trend toward more restrictions. Changing future requirements may escalate the costs or schedule requirements of solid waste disposal to effectively change the assumptions or conclusions about WESF operations.

Permitting Strategy

WESF permitting for treatment or storage of liquid waste is not a major obstacle. It may not be necessary to permit WESF if liquid waste is transported to Tank Farms within 90 days after collection and treatment. Permitting should not be a barrier to shipping solid waste to burial grounds. For the WESF replacement liquid waste system there are no known permitting issues that prevent decoupling from proceeding.

However, the permitting strategy of B Plant is evolving. The timing and what kind of corrective actions are needed for the low level waste system affects the decoupling decision. It is unclear how the cell 25 strategy affects cost of decoupling but the cost impacts are suspected to be minor. A potential for cost savings exists if decoupling proceeds and cell 25 upgrades are deleted.

Two additional regulatory questions were identified:

- 1) Can we operate B Plant under interim status through deactivation?
- 2) Will a shutdown notice be received from DOE concurrently with approval to do the Decoupling Project?

7.0 RECOMMENDATIONS

Because WESF will continue to store capsules indefinitely, it appears the decoupling of WESF from B Plant is necessary to complete the deactivation of the B Plant facility. The B Plant deactivation is urgent because of the high annual costs to maintain and operate B Plant. It was also apparent after preparation of the Cleanout and Stabilization Program that a program to effectively deactivate B Plant and deal with highly radioactive sources, while simultaneously operating WESF support systems in the same facility is complex, if not impractical.

The complexity of operating WESF support systems within the B Plant facility, particularly in the 221-B canyon, has required the Isolation study team to make major assumptions in the areas of the WESF mission and the B Plant deactivation end state. These assumptions are discussed in sections 3.0 and as issues in section 6.0.

B Plant supplies cooling water, deionized water for pool cells, accepts low-level liquid waste streams, liquid effluents, and solid waste from WESF. It is recommended that these 5 systems be modified/replaced to allow independent, stand alone operation of WESF. The preferred configuration of each new system is described below, based on the evaluations performed in support of this study:

1) Cooling Water

Project W-252 has been initiated to provide closed loop cooling that will eliminate WESF's reliance on B Plant to supply water and receive the cooling water effluent. The implementation of the CLCS project (W-252) may be completed before the separation of B Plant and WESF or completion of B Plant deactivation and cleanup.

However, a modification to the project W-252, Phase II Liquid Effluent Treatment and Disposal has been proposed that may affect the Isolation Study significantly. The proposed changes to the project request descoping by deleting the flow reduction modifications to other facilities and to the B Plant Cooling Water. The proposed descoping changes to the Project W-252 would save approximately \$10 million for the overall project and eliminate the B Plant portion.

If the project scope change is approved WESF will have two new alternatives:

- A) Install a new closed loop cooling project servicing only WESF pool cells.
- B) Modify the existing once through cooling system to be independent of B Plant and allow deactivation to continue.

Although the evaluation of these new alternatives is less complete than for other WESF support systems the preliminary recommendation for backup to project W-252 is alternative (B).

2) Deionized Water

Deionized water is primarily used for WESF pool cell make-up water with some use for chemical make-ups, and general decontamination of hot cells. The current Deionized Water Supply System (DWSS) is located in the northeast corner of 271-B's third floor Aqueous Makeup Unit (AMU) area.

The recommended alternative for an independent deionized water system is the "Culligan multi-tank system". The system consists of two sets of one cation tank, one anion tank, and one mixed-bed resin tank, capable of delivering the required quantity and quality of deionized water based on the given feed water characteristics. The system is the recommended alternative based on lowest cost, lowest maintenance, least required space, lowest waste generation, and time period required for the WESF storage mission. The existing Ionpure system in B Plant is too old to be a viable alternative. The proposed location for the Culligan system is on the second floor of the 225-B AMU building following equipment removal and decontamination of storage areas.

3) Low Level Liquid Waste

Low level liquid waste generated at WESF is transferred from Tank 100 to B Plant for storage and eventual treatment before being transferred to Tank Farms. Deactivation of B Plant's LLW system will require WESF to install a system to transfer LLW directly to Tank Farms via an underground transfer line or by a tanker truck or rail car.

The recommended system is one of five options evaluated: a pipeline intertie to Project W-028, using the existing tanks in 221-BF for waste collection. This alternative requires that the project W-028 pipeline to Tank Farms be completed and that the modified 221-BF facility can meet current codes and requirements. WESF's LLLW will be piped from the lines feeding existing TK-100 into new tanks installed inside one of the existing large tanks at 221-BF. From 221-BF the LLLW will be pumped to the pipeline in project W-028. The pipeline for the transfer will be a double encased (pipe-in-pipe) transfer line.

WESF currently generates relatively low volumes of low level liquid waste (LLLW) in the decontamination of the facility and equipment such as the manipulators. An evaluation of LLLW volumes required to support the WESF mission should be performed to support this high cost system.

4) Liquid Effluents

The major WESF liquid effluent, pool cell cooling water, will be eliminated when Project W-252, Closed Loop Cooling, is implemented. WESF contributes to the B Plant Chemical Effluent Sewer (BCE) stream that is

currently treated at the 211-BA facility. 211-BA currently handles the combined B Plant/WESF BCE effluent, but is physically external to either facility.

The recommended system is continued operation of the 211-BA facility after WESF isolation from B Plant. An alternative to the recommended system was identified to determine which parts of the 211-BA neutralization facility are actually needed to be operational and controlled at WESF. Since the WESF effluent stream is not well characterized this option was not evaluated for this report.

The controls of 211-BA will be relocated or certain monitoring may be performed from a control room in WESF. Additional scope has been identified as follows:

1. The Engineering Work Station , including the Bailey /IBM bailey cad station and the serial interface CIU linking it to the new "WESF LOOP" WILL be needed, because it is assumed that the one in room 201 of 271B will go with the long term surveillance contractor-organization for so they can maintain the system either remotely or at 271B.

- Items needed are
- A. Bailey network 90 Engineering Work Station (EWS) and printer with serial computer interface unit (CIU01) and conduit and wiring to WESF LOOP.
 - B. An Engineering Station compatible with the Operator Interface Stations, either OIU , OIS or the newer P/C based 486-Bailey with windows, or Wonderware R .
 - C. Engineering office for above equipment located somewhere close to WESF (probably the WESF Office Trailer) with System (Cog) Engineer's personal office desk and computer station.

2. The 211-BA building will require: a) alternative electric power, not supplied from the 221-B electrical gallery, and b) a supply of process/sanitary water to operate the eduction jets for caustic and acid injection and supply the 151 sump pump seal water.
3. Alternative electric "emergency backup" power to the net 90 PCU and the environmental samplers in 211-BA.

It is has been concluded that the control loop operating 211-BA and other WESF instrumentation associated with Network 90 PCU's should be completely separate from the B Plant FPMCS to permit deactivation of B Plant.

5) Solid Waste

Currently, WESF hazardous, contact handled, radioactive and mixed waste is packaged in appropriate containers, transferred to B Plant, stored at 226-B waste pad, and shipped to final waste storage/disposal sites. Remote handled radioactive and mixed wastes are generated from WESF process cells, packaged in A cell, transferred to B Plant and stored in cell 4.

The recommended alternative system for remote handled radioactive waste generated in WESF hot cells includes the following features:

- 1) Use of approved containers, loaded in A cell. A major cleanup of A cell will precede the installation of the new system.
- 2) Contamination prevention by bagging the container to control surface contamination. Separate drum inner and outer liners will become part of the waste. The system will include a hood and a bag sealer and cutter.
- 3) 222-S laboratory analysis will characterize the ^{90}Sr and ^{137}Cs ratio of each waste item. A high purity Germanium (HPGe) gamma drum counter system will complete the characterization of each container in a drum counter located in the WESF canyon.
- 4) The characterized, externally clean, waste container is moved to an approved shielded cask container. The shielded container is transported directly to the burial ground by current solid waste disposal procedures.

8.0 REFERENCES

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WHC-SD-WM-ES-313, REV 0

Appendix A

WESF ISOLATION FROM B PLANT DEIONIZED WATER SUPPLY SYSTEM

Engineering Support Document

ENGINEERING SUPPORT DOCUMENT
FOR
WESF ISOLATION FROM B PLANT
DEIONIZED WATER SUPPLY SYSTEM

Prepared by

**ICF Kaiser Hanford
Richland, Washington**

for

Westinghouse Hanford Company

TABLE OF CONTENTS

INTRODUCTION	1
ASSUMPTIONS.....	1
ALTERNATIVE 1: NEW CULLIGAN SYSTEM.....	2
ALTERNATIVE 2: CDI SYSTEM.....	2
ALTERNATIVE 3: BACK-UP CULLIGAN SYSTEM.....	3
ALTERNATIVE 4: RELOCATE EXISTING B PLANT CDI SYSTEM.....	4
EVALUATION OF ALTERNATIVES.....	4
RECOMMENDED ALTERNATIVE.....	4
CONCLUSION	4

APPENDIX A: SKETCHES

- SKETCH 1: FLOW DIAGRAM FOR MULTI-TANK SYSTEM
- SKETCH 2: FLOW DIAGRAM FOR CDI SYSTEM
- SKETCH 3: FLOW DIAGRAM FOR BACK-UP MULTI-TANK SYSTEM
- SKETCH 4: DWSS IN BLDG 225-B

APPENDIX B: EQUIPMENT CUT-SHEETS/VENDER INFO

INTRODUCTION

Currently, WESF deionized water is supplied from by the B Plant deionized water system located on the third floor of building 271-B. The existing deionized water system consists of an Ionpure Continuous Deionization (CDI) unit and a series of pretreatment components. The CDI unit requires high quality feed water to prevent scaling or fouling within the unit. The system requires daily monitoring and periodic brine salt additions.

WESF uses deionized water for pool cell make-up water and also for chemical make-ups. Loss of pool cell water is primarily due to evaporation and recirculation pump seal leakage. High purity water is needed to prevent the corrosion of outer capsules.

The deionized water from B Plant enters WESF on the east side of the 225-B Aqueous Make-Up (AMU) building. The WESF distribution system feeds the pool cells, miscellaneous processing cells, the AMU, the K3 filter system, and tank TK-210.

Tank TK-210 is used for deionized water storage. TK-210 is a 1000 gallon fiberglass reinforced epoxy tank. Pump P-210 transfers deionized water from TK-210 directly to the distribution system. Pump P-210 is rated at 10 GPM at 136 ft of head.

The scope of this report is to develop sketches and describe the equipment to cover four alternatives for independant DI water for WESF when B plant is being shut down. The descriptions and sketches will be used for a preliminary cost estimate.

The four alternatives identified by WHC are:

1. Installation of a Culligan system
2. Installation of a small scale CDI system
3. Installation of redundant Culligan systems
4. Relocate existing B plant CDI system

ASSUMPTIONS:

Flow of DI water: 10 GPM

Conductivity of DI water: 4.5 μ Siemens/cm

Chlorine Concentration: less than 10 ppm

Conductivity of raw water: 200 μ Siemens/cm

The demand for DI water at a continuous flow rate is less than 0.5 GPM.

ALTERNATIVE 1: NEW CULLIGAN SYSTEM

The first alternative is a Culligan multi-tank system. The system consists of a two-bed system with an optional mixed-bed tank as a water polisher. The two-bed system includes a cation exchanger and an anion exchanger connected in series. The cation exchange unit removes positively charged ions from the water, including calcium, sodium, magnesium, iron, manganese and potassium. The anion exchange unit removes negatively charged ions including sulfates, chlorides carbonates, bicarbonates, nitrates, and silica.

An optional mixed-bed tank is recommended to insure the desired quality of deionized water is delivered by the system. The mixed-bed unit is made-up of both cation and anion resins combined and mixed in a single tank. The mixed-bed resin tank is connected downstream of the cation and anion tanks in series.

Sanitary water flows into the cation tank. The cation tank removes the positively charged particles. The water discharged from the cation tank enters the anion tank. The anion tank removes the negatively charged particles. The discharge from the anion tank is fed to the inlet of the mixed-bed resin tank. The mixed-bed resin tank polishes the discharge water by removing the remaining ions. The water discharged from the mixed-bed resin tank is stored "lag storage" for future use. The deionized water in the lag storage is discharged to the demineralized water distribution header.

A 10 GPM pump may be needed for proper flow through the cation/anion/polisher system. This pump will be installed at the beginning of the multi-tank system to provide proper discharge flow rates and pressures. The deionized water from the multi-tank system discharges to lag storage. A lag storage tank is added for sufficient storage capacity. See sketch 1 for the flow diagram for this proposed deionized water system.

The deionized water produced by this system is at the limit of the desired water quality. Therefore, it is recommended that the feed water be analyzed for exact feed conditions if this alternative is to be used. To ascertain that this alternative is workable, it is estimated with an optional water polisher consisting of a mixed-bed resin tank. This water polisher will also increase duration of resin between regenerations.

The maintenance of the Culligan system is done by the manufacturer. The Culligan company replaces regularly the resin tanks and regenerates the exhausted resin tanks in the factory.

The space required by the Culligan system with polisher is about 2 ft X 4 ft, plus the space for a 10 GPM circulation pump.

ALTERNATIVE 2: CDI SYSTEM

The second alternative is a continuous deionization (CDI) system from Ionpure Technologies. The CDI system consists of a pretreatment components and a CDI module. The pretreatment components include a carbon filter, water softener,

5 micron filter, reverse osmosis (R/O) unit and membranes.

The sanitary feed water first flows through the pretreatment components to remove particles, metals, and organics to prevent the CDI module from clogging, scaling, or fouling. Then the CDI module removes ions to provide high purity deionized water. The deionized water from the CDI system discharges to lag storage. See sketch 2 for the flow diagram for this proposed deionized water system.

The lag storage will consist of two tanks. The tanks are to be located on the second floor of the 225-B AMU building. One tank is the existing fiberglass reinforced epoxy tank, TK-210. Tank TK-210 has a 1000 gallon capacity. A second 1000 gallon tank must be procured. Deionized water from the two tanks is discharged to the demineralized water distribution header by the existing 10 GPM pump, P-210.

The CDI system was also evaluated at a minimum flow rate of 0.5 GPM in order to evaluate the system cost of a small CDI module at continuous operation.

The space required by a 10 GPM CDI system is about 4 ft X 18 ft.
The space required by a smaller 0.5 GPM CDI system is about 2 ft X 7 ft.

Maintenance of a CDI system requires replacement of filters cartridges (monthly), of activated carbon (yearly), of R/O membranes (every 3 years), of softening resins (every 5 years). Other maintenance items include backwashing of filters as necessary, regenerating of water softeners, and some descaling if necessary.

Typical life expectancy of the CDI system is about 10 years.

ALTERNATIVE 3: BACK-UP CULLIGAN SYSTEM

Another option for the Culligan tank system is to add a back-up set of resin tanks to insure deionized water supply at all times.

Bypass valving is used to direct the flow to and from the Culligan multi-tank systems. While one set of tanks is down due to maintenance or failure, the other set of tanks supplies deionized water. The added lag storage tank is eliminated. See sketch 3 for the flow diagram for this proposed deionized water system.

This alternative has the same mainenance and regeneration needs as in Alternative 1.

The space required by this alternative is about 4 ft X 8 ft (Roughly twice the space needed for one Culligan multi-tank system), plus the space for a 10 GPM circulation pump.

ALTERNATIVE 4: RELOCATE EXISTING B PLANT CDI SYSTEM

Since the life expectancy of a CDI system is about 10 years, it is not recommended to relocate the existing system at B Plant. Therefore, this alternative is considered unavailable.

EVALUATIONS OF ALTERNATIVES

The three available alternatives are evaluated on the basis of required maintenance, space requirements, reliability, and cost. The results of this evaluation are given in the table in the next page.

EVALUATING FACTORS	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	COMMENTS
Maintenance	Regular replacing of resin tanks by manufacturer	Brine additions, filter and resin replacement, resin regeneration, acid rinse.	Regular replacing of resin tanks by manufacturer	Alternatives 1 and 3 (Culligan) require less maintenance.
Space Required	About 2 x 4 feet Additional lag storage tank needed.	0.5 GPM: 2 x 7 feet 10 GPM: 4 x 18 feet Additional lag storage tank needed.	About 4 x 8 feet No additional lag storage tank needed.	Alternative 3 requires least space.
Reliability	Provided by lag storage.	Provided by lag storage.	Provided by back-up resin tanks.	Equal alternatives.
Cost	\$111,573	\$261,286	\$110,784	Alternatives 1 and 3 have approximately equal cost.

RECOMMENDED ALTERNATIVE:

The recommended system is a Culligan system. Alternative 1 and alternative 3 have similar advantages. The Culligan resin tank alternatives have lower maintenance requirements, need less space for installation, and do not generate waste in the plant. Alternatives 1 and 3 have roughly the same cost and are both less costly than alternative 2, the CDI unit system. Both Culligan systems are recommended over the CDI system. Both Culligan systems (alternative 1 and alternative 3) are equally satisfactory.

CONCLUSION

The best alternative for an independent deionized water supply system for WESF is a Culligan multi-tank system. The multi-tank system consists of a cation tank, anion tank, and mixed-bed resin tank. This system is capable of delivering the required quality and quantity of deionized water based on the given feed water characteristics. The Culligan multi-tank system is the best alternative based on lowest cost, lowest maintenance, least required space,

and lowest waste generation. Alternative 1 and alternative 3 are similar in cost, space requirement, and maintenance. Alternatives 1 and 3 are equally recommended.

The deionized water system is recommended to be located on the second floor of the 225-B AMU building following equipment removal and decontamination of storage areas.

APPENDIX A

SKETCHES

SKETCH 1: FLOW DIAGRAM MULTI-TANK SYSTEM

SKETCH 2: FLOW DIAGRAM CDI SYSTEM

SKETCH 3: FLOW DIAGRAM BACK-UP SYSTEM

SKETCH 4: DWSS IN BLDG 225-B

WESF BLDG 225-B, SECOND FLOOR

EXISTING CONDITIONS

PROPOSED LOCATION OF DWSS

CULLIGAN RESIN TANKS

**CULLIGAN WATER CONDITIONING OF THE TRI-
CITIES, INC.**

**CATION TANK
ANION TANK
MIXED-BED RESIN TANK**

SUBJECT: TELECON WITH GARY PUCKETT OF THE CULLIGAN WATER CONDITIONING OF
THE TRI-CITIES, INC.

DATE: 6/3/94

Given the estimated feed water supply and required discharge stream characteristics for the WESF deionized water, Culligan representative, Gary Puckett and ICF KH engineer Angel R. (Bob) Romero discussed possible deionization units capable of supplying adequate deionized water.

The following information was faxed to Gary Puckett:

Here are some general requirements for the deionization system.

Required Capacity: 10 gpm

Discharge from DI units:

Conductivity: 4.5 μ Siemens/cm

Chlorine Concentration: less than 10 ppm

Supply to DeIonization units

Conductivity: 200+ μ Siemens/cm

*The following lab analysis is of a sample of typical
sanitary water to be supplied to the deionization system:*

See Attached sheet for water sample analysis.

Response from the Culligan representative is as follows:

He suggested that a deionized water system consisting of one (1) cation tank and one (1) anion tank would probably be sufficient. However, the required quality of the discharged deionized water would be near the limits of the two tank system. He proposed that a mixed-bed resin tank be added as a water polisher to insure the quality of the discharge water meet our requirements.

The cost of the cation tank is approx. \$700.

The cost of the anion tank is approx. \$850.

The cost of the mixed-bed resin tank is approx. \$900.

Also, the cost of resin regeneration is approx. \$180 for the cation/anion tanks as a unit. The cost of resin regeneration is approx. \$180 for the mixed-bed resin alone. The total cost of resin regeneration is \$360 for the cation/anion/polisher system.

However, the addition of the water polisher (mixed-bed resin tank) extends the life of the cation/anion resin bed lives. The typical life of the cation/anion resin beds is approx. three months. Adding the water polisher typically extends the life of all the resins an additional three months. Therefore, typical regeneration for the

cation/anion system is three months. Typical regeneration for the cation/anion/polisher system is six months.

Regeneration of the resin beds is done by the Culligan company. Tanks having exhausted resins are replaced by the Culligan company with tanks having newly regenerated resins. The exhausted resin tanks are taken back to the Culligan facility to have their resins regenerated. Pick-ups and exchanges can be scheduled or phoned in. Phoned requests are usually serviced by the next work day.

The tanks are approx. 14" in diameter and 55" in height.

Initial observation of the feed water supplied to the deionized water system indicates no need for water softeners or filters.

CONTINUOUS DEIONIZATION UNIT

IONPURE TECHNOLOGIES CORP.

10 GPM SYSTEM

U.S. FILTER
UNITED STATES FILTER CORPORATION

JUNE 7, 1994

IONPURE

10700 JERSEY BLVD., SUITE 170
RANCHO CUCAMONGA, CA 91730
TEL: 909-987-0571
FAX: 909-987-3042

MR. BOB ROMERO
ICF KAISER HANFORD
FAX (509) 373-3343

BOB,

THE FOLLOWING IS A LIST OF PROPOSED TREATMENT BASED ON THE CONTENTS OF THE FEEDWATER AS LISTED ON THE WATER ANALYSIS PERFORMED BY IONPURE. HOPEFULLY, THIS WILL PROVIDE YOU WITH ENOUGH INFORMATION.

- 1) HARDNESS - A SOFTENER IS REQUIRED TO REMOVE THE HARDNESS FROM THE FEEDWATER TO PREVENT PRECIPITATION OF HARDNESS SCALE.
- 2) IRON - THE SOFTENER WILL BE EMPLOYED TO REDUCE THE IRON TO AN ACCEPTABLE LEVEL.
- 3) TOC - AN RO UNIT OR AN ORGANIC SCAVENGER IS REQUIRED TO REMOVE THE TOTAL ORGANIC CARBON FROM THE FEEDWATER TO PREVENT FOULING OF THE CDI MODULE.
- 4) CHLORINE - EVEN THOUGH THE WATER SAMPLE DOES NOT LIST CHLORINE, WE ARE CONCERNED ABOUT THE REQUEST FOR THE WATER EXITING THE CDI TO BE LESS THAN 10 PPM CHLORINE.

PLEASE PROVIDE THE FOLLOWING DATA:

EXACTLY WHERE DO YOU ANTICIPATE THE CHLORINE TO COME FROM?

IS THIS A CITY WATER SUPPLY OR A RETURN STREAM?

WHAT IS MEANT BY SANITARY WATER?

ATTACHED, PLEASE FIND THE EQUIPMENT LISTS FOR A 10 GPM AND A 1/2 GPM SYSTEM.

IONPURE

LANCY

LYCO

MEMBRALOX

PERMUTIT

RECOVERY
SERVICES

SuperBlue

10 GPM SYSTEM -
=====

QUANTITY	DESCRIPTION	PART NUMBER
(1)	24" DIAMETER CARBON FILTER	ZCS24XXXT
(1)	18" DIAMETER DUAL UNIT SOFTENER	ZSD18XXXW
(1)	304 SS FILTER HOUSING	ZHFF10520
(5)	5 MICRON CARTRIDGES	FCROF2005
(1)	REVERSE OSMOSIS UNIT	ZFRC40482
(12)	4" TFC RO MEMBRANES	CDRC4X40B
(1)	CDI MODULE	CDICRS060

BUDGET SELLING PRICE FOR THE COMPONENTS LISTED
ABOVE IS.....\$ 70,000.00
ESTIMATED INSTALLATION COSTS ARE.....\$ 11,000.00
ESTIMATED START UP COSTS ARE.....\$ 2,000.00
=====

0.5 GPM SYSTEM -
=====

QUANTITY	DESCRIPTION	PART NUMBER
(1)	12" DIAMETER CARBON FILTER	ZCS12XXXT
(1)	12" DIAMETER DUAL UNIT SOFTENER	ZSD12XXXW
(1)	PPL FILTER HOUSING	ZHAFD1001
(1)	5 MICRON CARTRIDGES	FCROF1005
(1)	REVERSE OSMOSIS UNIT	ZFRONC360
(3)	2 1/2 " TFC RO MEMBRANES	CDRC025S1
(3)	2 1/2" TFC RO MEMBRANES	CDRC025SH
(1)	CDI MODULE	CCDIS10X1

BUDGET SELLING PRICE FOR THE COMPONENTS LISTED
ABOVE IS.....\$ 25,000.00
ESTIMATED INSTALLATION COSTS ARE.....\$ 6,000.00
ESTIMATED START UP COSTS ARE.....\$ 1,500.00
=====

ALL APPLICABLE TAXES ARE FOR THE BUYER'S ACCOUNT. FREIGHT IS QUOTED F.O.B. POINTS OF ORIGIN.

TERMS OF PAYMENT ARE: 20% WITH ORDER
70% ON SHIPMENT
10% on START UP

TYPICAL LIFE OF THE EQUIPMENT IS 10 YEARS OR MORE NOT INCLUDING EXPENDABLES SUCH AS:

CHANGE OUT OF THE FILTER CARTRIDGES EVERY MONTH
CHANGE OUT OF THE ACTIVATED CARBON EVERY YEAR
CHANGE OUT OF THE RO MEMBRANES EVERY 3 YEARS
CHANGE OUT OF THE SOFTENING RESIN EVERY 5 YEARS

SCHEDULE MAINTENANCE SUCH AS:

WEEKLY BACKWASHING OF THE CARBON FILTER - TIME INITIATED
DAILY REGENERATION OF THE SOFTENERS - VOLUME INITIATED

TYPICAL FLOOR SIZE FOR THE 1/2 GPM SYSTEM IS 2 FEET BY 7 FEET INCLUDING THE WALL SPACE IMMEDIATELY BEHIND THE FLOOR SPACE.

TYPICAL FLOOR SIZE FOR THE 10 GPM SYSTEM IS 4 FEET BY 18 FEET

DESCRIPTIVE LITERATURE IS ATTACHED FOR INDIVIDUAL COMPONENT DATA.

BOB, AFTER YOU HAVE HAD A CHANCE TO REVIEW THE DATA, PLEASE CALL ME IF YOU HAVE ANY QUESTIONS.

IF EITHER OF THESE PROJECTS PROCEED FAVORABLY, WE WOULD PROCEED WITH PUTTING TOGETHER A PROCESS FLOW DIAGRAM (P&ID) FOR YOU USE AND INFORMATION.

ATTACHED, YOU WILL ALSO FIND A TYPICAL P&ID WHICH REFLECTS THE NORMAL INSTRUMENTATION AND VALVING REQUIRED FOR AN RO/CDI SYSTEM.

I MAY BE REACHED AT EITHER (909) 987-0571 OR (909) 396-5347.

REGARDS,

U.S. FILTER/IONPURE

Colin Taylor

COLIN TAYLOR
ACCOUNT MANAGER

WHC-SD-WM-ES-313, REV 0

Appendix B

WESF ISOLATION FROM B PLANT LOW LEVEL LIQUID WASTE SYSTEM

Engineering Support Document

PRELIMINARY ENGINEERING SUPPORT DOCUMENT

FOR

WESF ISOLATION FROM B PLANT

LOW LEVEL LIQUID WASTE SYSTEM

Prepared by

ICF Kaiser Hanford Company
Richland, Washington

for

Westinghouse Hanford Company

TABLE OF CONTENTS

OBJECTIVE	1
INTRODUCTION	1
LLLW TRANSFER DESIGN INPUT	1
ASSUMPTIONS	1
DESCRIPTION	3
ALTERNATIVE 1	3
ALTERNATIVE 2	4
ALTERNATIVE 3	4
ALTERNATIVE 4	5
ALTERNATIVE 5	5
DISCUSSION	5
GENERAL SYSTEM REQUIREMENTS	6
APPENDIX A SKETCHES	A-1

OBJECTIVE:

The Waste Encapsulation and Storage Facility (WESF) is to be isolated from B Plant to allow B Plant to be shut down. The Low Level Liquid Waste (LLLW) of WESF is currently processed in B Plant. This support document discusses alternative approaches to the processing of the WESF LLLW without B Plant support.

INTRODUCTION:

WESF is dependant on B Plant to perform its current function. This has become an unacceptable operating condition. This is due to the future shutdown of B Plant. This shut down cannot occur until all of the WESF processes that have interfaces with B Plant have been isolated from B Plant and can be operated independently of B Plant. This document only covers the isolation of the LLLW system. The other systems are covered in other documents.

The LLLW system of WESF is to be isolated from B Plant. To accomplish this, the following alternatives, as defined in the scope of work, are considered:

- 1) Pipeline intertie with Project W-028 using the existing tanks located at 221-BF.
- 2) Pipeline intertie with Project W-028 using new tanks in a new facility.
- 3) Tank Truck Loadout Facility using the existing tanks located at 221-BF.
- 4) Tank Truck Loadout Facility using new tanks in a new facility.

As a logical, implied alternative, a fifth alternative has been added for consideration.

- 5) Tank Truck Loadout Facility with new tanks included in the facility.

The above alternatives are researched for the purpose of defining items to support cost estimating. Any assumptions made or parameters defined in this study needs to be analyzed before it is used in a conceptual or definitive design.

LLLW TRANSFER DESIGN INPUT:

- 1) 5 000 gallons of LLLW is generated by WESF per year. This amount of waste is projected to remain constant.
- 2) Storage capacity required: two 1 500 gallon tanks.

ASSUMPTIONS:

- 1) The environmental and safety considerations of each alternative will

WESF/B Plant Isolation Study - Low Level Liquid Waste

need to be analyzed further.

- 2) Although there are different alternatives available that could be looked at for the isolation of the LLLW from WESF to B Plant, WHC has investigated them and determined that the alternatives discussed here are the only alternatives to consider.
- 3) Operating parameters not specified in the LOI were assumed.
- 4) Dimensions shown on sketches are approximate.
- 5) The design life of the system will be 20 years.
- 6) Catch tank CATCH TK-100 will not be used since it is a single shell tank. Therefore, this tank will be bypassed and new holding/storage tank system will be used.
- 7) The various requirements for the building, tanks, electrical, pumps, HVAC equipment, and piping are preliminary.
- 8) Only LLLW will be considered to be the transferred medium. High level liquid radioactive requirements and safety features are not considered or addressed. The systems will not be designed for solids or for high level radioactive liquid products.
- 9) No air conditioning or heating is needed for the building. Heat tracing will be used to prevent line freezing.
- 10) 30% of the soil for the length of the pipe trenches is assumed contaminated.
- 11) Pumps to discharge to the W-028 pipeline only. Once the water is in W-028 pipeline, it will flow by gravity.
- 12) Transfer pumps to handle 5 gpm or 1500 gallons per 5 hours of operation.
- 13) W-028 pipeline is assumed to be: pipe-in-pipe, 3" minimum nominal diameter of the inner pipe, 6" nominal diameter of the outer pipe, 3 miles long $\pm$, gravity draining.
- 14) Pumping arrangement is to provide tank to tank transfer of LLLW.
- 15) WHC has or will investigate to determine that transportation of liquid LLLW by truck is allowed by all regulatory agencies having jurisdiction.
- 16) It is assumed that a truck loading station will need a building to cover

WESF/B Plant Isolation Study - Low Level Liquid Waste

loading operations and provide secondary containment. The building will need to be maintained at negative pressure and exhaust through HEPA filters at least during and subsequent to loading operations.

- 17) The 221-BF facility is seismically qualified.
- 18) Assume that 221-BF vault is properly vented and heated for freeze protection.
- 19) Tanks to be instrumented for high level alarm and shutdown.
- 20) The tanks in 221-BF will be able to be decontaminated and, after the decontamination, will have a useful life of 20 years.
- 21) The W-028 pipeline is compatible with the LLLW to be transferred through it.
- 22) The LR-56 truck is assumed to come with it's own fixed dry chemical extinguishing system.
- 23) A dry fire sprinkler system is needed for the truck loadout facility.
- 24) The tie in point to W-028 pipeline is assumed at a location for the shortest transfer line.
- 25) The truck and all accessories mounted on the truck are not part of this estimate.

DESCRIPTION:

The LLLW currently gravity drains from WESF to CATCH TK-100 tank. From CATCH TK-100 the LLLW is then pumped into B Plant to be processed. To isolate WESF and B Plant this waste will be diverted, from going into B Plant for processing, to a new system for storage and processing.

All alternatives discussed here will need to be investigated further for total compliance with codes requirements, feasibility, etc...

ALTERNATIVE 1:

Pipeline intertie with Project W-028 using the existing tanks located at 221-BF and bring 221-BF up to current codes. This alternative requires that project W-028 pipeline to the tank farm be completed.

The WESF's LLLW will be piped from the lines feeding CATCH TK-100 into new tanks installed inside one of the existing tanks at 221-BF. From 221-BF the

WESF/B Plant Isolation Study - Low Level Liquid Waste

LLLW will be pumped to the pipeline in project W-028. The pipeline for the transfer will be a double encased (pipe-in-pipe) transfer line.

The 221-BF facility is not currently being used. The tanks in 221-BF currently have surface contamination. Cost of decontamination will be part of this cost estimate. One of the two 7 000 gallon tanks inside of 221-BF will have the top cut off and two 1 500 gallon tanks will be inserted inside of the 7 000 gallon tank. The environmental and safety considerations will need to be looked into to determine if this alternative will meet the current codes.

Alternative 1 is shown in sketch LLLW-SK1.

ALTERNATIVE 2:

Pipeline intertie with Project W-028 using new tanks. This alternative also requires that project W-028 pipeline to the tank farm be completed.

The new tanks need to be double shell type. They are to be located in a below ground facility. The configuration of these new tanks and the pumps and sampling facility will be similar to those currently in 221-BF.

This alternative is shown in sketches LLLW-SK2 and LLLW-SK6.

ALTERNATIVE 3:

A new Tank Truck Loadout Facility using new tanks installed inside one of the existing single shell tanks located in 221-BF and bring 221-BF up to current codes.

The WESF's LLLW will be piped from the lines feeding CATCH TK-100 into the new tanks of alternative 1 installed inside one of the existing tanks at 221-BF. From 221-BF the LLLW will be pumped to the truck load out facility. The pipeline for the transfer will be a double encased (pipe-in-pipe) transfer line.

As in alternative 1, the tanks in 221-BF currently have surface contamination which will need to be removed prior to construction. One of the two 7 000 gallon tanks inside of 221-BF will have the top cut off and two 1 500 gallon tanks will be inserted inside of the 7 000 gallon tank.

A truck load out facility has been looked at briefly in project 341-C. The sketches from this project show some of the required equipment for that project. Many of these same considerations will need to be addressed if this alternative is chosen.

Alternate 3 is covered in sketches LLLW-SK3 and LLLW-SK7.

WESF/B Plant Isolation Study - Low Level Liquid Waste

ALTERNATIVE 4:

This alternative consists in using the two new holding tanks discussed in alternative 2 in combination with the truck load out facility discussed in alternative 3.

The new tanks need to be the double shell type. They are to be located in a below ground facility. The configuration of these new tanks and the pumps and sampling facility will be similar to those currently in 221-BF.

This alternative is shown in sketches LLLW-SK4 and LLLW-SK7.

ALTERNATIVE 5:

This alternative consists in providing two new 1500 gallons tanks inside the truck load out building. This will eliminate the need for the decontamination and cutting of the 7,000 gallons tanks of alternate 1, or the need for the new underground vault of alternate 2. This facility will be an enlarged truck load out station. This is the alternative that is the most similar to the 341-C project. This alternative is shown in sketch LLLW-SK8.

LOAD OUT BUILDING:

The size of the load out building is estimating using assumed clearances as shown in sketch LLLW-SK7.

The building is assumed to provide secondary containment in case of a spill during transfer operations to the truck.

No contaminated waste will remain in the piping inside the building between load out operations. Typically, the lines will be drained back to the tank completely after each load out operation.

We assume that means to maintain negative pressure in the building through some HEPA filters will be required during truck loading.

We assume that an automatic fire protection system will be required. To eliminate heating of the building, a dry system will be used with the riser inside the mechanical room. Only the mechanical room will need heating for freezing.

DISCUSSION:

The above five alternatives have five segregations. They will be detailed separately to show how each portion of the alternatives affects the cost. The general system requirements are discussed first. The 221-BF facility is

WESF/B Plant Isolation Study - Low Level Liquid Waste

discussed next , followed by a new tank facility. The truck loadout facility is then discussed. The pipeline tie-in is discussed last. The flow diagram for the choices is shown below.

Figure 1: Flow diagram showing how alternatives interrelate.

GENERAL SYSTEM REQUIREMENTS:

All of the alternatives require tying into the pipelines feeding CATCH TK-100. There are numerous lines feeding this tank. Three of these lines are 2" drains from the stacks. One is a 2" vent feeding K-3 filter. One line is a 2" LLLW feed. There is a 2" line as a spare for the LLLW. One 4" line feeds the tank. One 8" drain line also feeds the tank.

These lines need to be isolated from CATCH TK-100 and routed to either the new

WESF/B Plant Isolation Study - Low Level Liquid Waste

tanks in 221-BF or the new tank facility. The 221-BF facility will need to be seismically qualified.

Two 1 500 gallon tanks are needed for storage of the LLLW before transfer to either the pipeline or the transfer truck.

Two 5 gallon per minute pumps are needed for the transfer of fluid from either tank to tank or transfer to either the pipeline or transfer truck. The existing pumps in 221-BF are of unknown condition. Therefore they will be planned for replacement. The pumps need to be able to transfer tank to tank. They also must be capable to transfer to either the pipeline W-028 or to the LR-56 LLLW transport truck. Either of these two options will require approximately the same horsepower due to distance versus height. The pumps will be similar to KONTR0 A-range seal/less pump model A22 with stainless steel wetted areas.

A chemical addition system is required to replace the function that is currently performed in B Plant, Cell 25. A small measuring tank (50 Gallons) and chemical drum unloading facility is also required.

Sampling is required by tank farms for characterization prior to direct transfer to double shell tanks. Remote (radioactive) sampling and capability is required to obtain 2 ml samples, similar to B Plant and Tank Farms, and shipment in sample pig or doorstep containers to 222-S with the existing sample truck.

The following sketches show a pictorial description of the alternatives.

WESF/B Plant Isolation Study - Low Level Liquid Waste

APPENDIX A

SKETCHES

ITEMS TO PROVIDE:

1. DECONTAMINATE EXISTING 7 000 GAL. TANK (TYP. 1)
2. PROVIDE 8" UNDERGROUND FEED LINE TO NEW 1 500 GAL. TANKS BYPASSING CATCH TK-100.
3. CUT ONE 7 000 GAL. TANK. TO USE AS A VAULT FOR TWO 1 500 GAL. TANKS.
4. PROVIDE TWO 1 500 GAL SINGLE SHELL WASTE STORAGE TANKS INSIDE THE 7 000 GAL TANK.
5. PROVIDE UNDERGROUND TRANSFER LINE FROM 1 500 GAL TANK TO W-028 PIPELINE.
6. PROVIDE 2 - 1 HP/5 GAL/MIN TRANSFER PUMPS. PUMPS TO BE ABLE TO TRANSFER ALSO FROM TK TO TK.
7. PROVIDE INSTRUMENTATION AND CONTROLS TO MONITOR TANKS FROM WESF BUILDING ABOUT 500 FEET AWAY.

NOTES:

1. INNER PIPE: 1 INCH STAINLESS STEEL, SCHEDULE 40
2. OUTER PIPE: 3" CARBON STEEL WITH COATING, SCHEDULE 40.
3. ASSUME 30% OF UNDERGROUND ROUTING THROUGH CONTAMINATED SOIL.

LLLW-SK-1

ITEMS TO PROVIDE.

1. PROVIDE NEW UNDERGROUND 1 500 GAL TANKS (TYP 2) INSIDE A CONCRETE VAULT. VAULT SIZE 20'X45'

LLLW-SK-2

ITEMS TO PROVIDE:

- 1 PROVIDE ITEMS 1,2,3,4,6, &7 OF ALTERNATIVE 1 (SEE SK-1)
- 2 PROVIDE TRANSFER LINE WITH TWO 5 GPM PUMPS TO TRUCK LOAD OUT FACILITY.
- 3 PROVIDE TRUCK LOADING BUILDING PER SKETCH SK-~~5~~

7.

LLLW-SK-3

ITEMS TO PROVIDE

1. PROVIDE NEW UNDERGROUND 1 500 GAL TANKS (TYP. 2) INSIDE A CONCRETE VAULT. VAULT SIZE 20' X 45'.
2. PROVIDE ITEMS 2, 5, 6, AND 7 OF ALTERNATIVE 1 SEE SK-1.

NOTES:

1. INNER PIPE: 8 INCH STAINLESS STEEL SCHEDULE 40.
2. OUTER PIPE: 10 INCH CARBON STEEL WITH COATING, SCHEDULE 40
- 3. ASSUME 30% OF UNDERGROUND ROUTING THROUGH CONTAMINATED SOIL..

LLLW-SK-4

ITEMS TO PROVIDE:

1. PROVIDE 8" UNDERGROUND FEED LINE TO NEW 1 500 GAL. TANKS LOCATED IN NEW TRUCK LOAD OUT FACILITY
2. PROVIDE ITEMS 4, 6, AND 7 OF ALTERNATIVE 1 SEE SK-1.
3. PROVIDE ITEM 2 OF ALTERNATIVE 3 SEE SK-3.
4. PROVIDE TRUCK LOADING BUILDING PER SKETCH SK-6.

NOTES:

1. INNER PIPE: 8 INCH STAINLESS STEEL, SCHEDULE 40
2. OUTER PIPE: 10 INCH CARBON STEEL WITH COATING, SCHEDULE 40.
3. ASSUME 30% OF UNDERGROUND ROUTING THROUGH CONTAMINATED SOIL.

LLLW-SK-5

GENERAL SYSTEM REQUIREMENTS

1,500 GALLON TANK (TYP. 2)

5 GALLON PER MINUTE PUMP (TYP. 2)
CAPABLE OF TANK TO TANK OR TRANSFER
TO EITHER THE W-028 PIPELINE OR
THE LR-56 TRANSFER TRUCK. SIMILAR
TO KONTRD A-RANGE SEAL/LESS PUMP
MODEL A22 WITH STAINLESS STEEL
WETTED AREAS

CHEMICAL ADDITION SYSTEM, MEASURING
TANK (50 GALLONS) AND CHEMICAL DRUM
UNLOADING FACILITY

REMOTE (RADIOACTIVE) SAMPLING
TO OBTAIN 2 ML SAMPLES.

ALL PUMPS SHALL BE FITTED W/TRIPLE-DUTY
DISCHARGE VALVES AND SUCTION DIFFUSERS.

NEW TANK FACILITY PLAN

SCALE: 1/8" = 1'-0"

NEW TANK FACILITY:

1,500 GALLON CAPACITY
DOUBLE SHELL TANK (TYP 2)

CONCRETE VAULT

SUMP

SUMP PUMP

APPROPRIATE INSTRUMENTATION
TO BE INCLUDED

STAIRS

MONITORING EQUIPMENT

SAMPLING EQUIPMENT

TRANSFER PUMP FOR TANK,
TO TANK AND EITHER TANK
TO PIPELINE OR TANK TO
TRUCK LOAD OUT FACILITY.

3" DBL WALL PIPELINE
(ALTERNATE #2)

PIPELINE TIE-IN:

W-028 PIPELINE TIE-IN

SOIL: ASSUMED 50% CONTAMINATED

PIPE: 4' OF COVER.

PIPE: STAINLESS STEEL, 316L, SCHEDULE 40.

INNER PIPE: 3"

OUTER PIPE: 6"

LLLW-SK6

ER5906SK2A
ALTERNATES #2 &
07-10-11

PIPELINE (BY OTHER W-028 PROJECT)

FOR INFORMATION ONLY

A SECTION
A13 1/8" = 1'-0"

(ALTERNATES #3 & #4)

LLLWSK7b

A-14

ALTERNATES #3
07-28-94 FR5906C

TRUCK LOAD OUT FACILITY:
LR-56 CASK SYSTEM TRANSFER TRUCK

BUILDING DIMENSIONS: LENGTH 70'
WIDTH 30', HEIGHT 22'

WALLS AND ROOF STRUCTURE
10' WIDE BY 2' DEEP PRECAST,
PRESTRESSED CONCRETE DOUBLE
TEE PANELS

FOUNDATION: 4' WIDE BY 1' THICK
CONTINUOUS WALL FOOTING, A
MINIMUM OF 2'-6" BELOW GRADE,
DIRECTLY SUPPORTING THE WALL PANELS.

FLOOR SLAB: 8" THICK, MIN.
REINFORCED CONCRETE FLOOR

CONCRETE, LINED TO CONTAIN
RADIOACTIVE, HAZARDOUS WASTE SPILLS.

PRE-ENGINEERED METAL LEAN-TOSHED
TYPE BUILDING (TYP 2) 15' X 15'
X 15' FOR STORAGE AND/OR MECHANICAL
ROOM PURPOSES WITH A 4" THICK FLOOR SLAB.

BUILDING PRESSURE: 01 INCH WG
NEGATIVE DURING OPERATION

AIR CHANGE RATE: 10 AIR CHANGES PER HOUR

FAN: 7,630 CFM AT 10" H2O SP
DRIVEN BY A 20 HORSEPOWER
TEFC 3-60-230-460 VOLT MOTOR
V/ VARIABLE FREQUENCY DRIVE
AND CONSTANT PITCH V-BELT
DRIVE AND WEATHER COVER/BELT
COVER ON UNITARY ISOLATION BASE.

HEPA FILTER: SIMILAR TO FLANDER'S
STANDARD HEPA FILTER SIZE 24" X 24"
X 11.5". CONFIGURED THREE ACROSS
AND THREE HIGH.

MOTORIZED LOUVER OR DAMPER

SUMP PUMP

TRUCK WASH OFF SYSTEM

ATMOSPHERE MONITOR

DOORS: WASHABLE

LIGHTING: 1.5 WATTS PER SQUARE FOOT.

CHEMICAL ADDITION SYSTEM

MEASURING TANK: 50 GALLONS

CHEMICAL DRUM UNLOADING FACILITY.

REMOTE RADIOACTIVE SAMPLING
IN 2 ML SAMPLES.

ALL PUMPS SHALL BE FITTED W/ TRIPLE-DUTY
DISCHARGE VALVES AND SUCTION DIFFUSERS

LLWSK7c

A-15

ALTERNATES #3
07-28-94 FR5906C

FOR INFORMATION ONLY

TRUCK LOAD OUT FACILITY:
LR-56 CASK SYSTEM TRANSFER TRUCK

VEHICLE DIMENSIONS: LENGTH 48'
HEIGHT 13.5'; WIDTH 8.5'

BUILDING DIMENSIONS: LENGTH 70'
WIDTH 30'; HEIGHT 22'

WALLS AND ROOF STRUCTURE:
10' WIDE BY 2' DEEP PRECAST,
PRESTRESSED CONCRETE DOUBLE
TEE PANELS

FOUNDATION: 4' WIDE BY 1' THICK
CONTINUOUS WALL FOOTING, A
MINIMUM OF 2'-6" BELOW GRADE,
DIRECTLY SUPPORTING THE WALL PANELS.

FLOOR SLAB: 8" THICK, MIN.
REINFORCED CONCRETE FLOOR.

CONCRETE: LINED TO CONTAIN
RADIOACTIVE, HAZARDOUS WASTE SPILLS.

PRE-ENGINEERED METAL LEAN-TO SHED
TYPE BUILDING (TYP. 2) 15' X 15'
X 15' FOR STORAGE AND/OR MECHANICAL
ROOM PURPOSES WITH A 4" THICK FLOOR SLAB

BUILDING PRESSURE: 0.1 INCH WG
NEGATIVE DURING OPERATION.

AIR CHANGE RATE: 10 AIR CHANGES PER HOUR.

FAN: 7,630 CFM AT 10" H2O SP
DRIVEN BY A 20 HORSEPOWER
TEFC 3-60-230-460 VOLT MOTOR
W/ VARIABLE FREQUENCY DRIVE
AND CONSTANT PITCH V-BELT
DRIVE AND WEATHER COVER/BELT
COVER ON UNITARY ISOLATION BASE.

HEPA FILTER: SIMILAR TO FLANDER'S
STANDARD HEPA FILTER SIZE 24" X 24"
X 11.5". CONFIGURED THREE ACROSS
AND THREE HIGH.

MOTORIZED LOUVER OR DAMPER

SUMP PUMP

TRUCK WASH OFF SYSTEM.

ATMOSPHERE MONITOR.

DOORS: WASHABLE

LIGHTING: 1.5 WATTS PER SQUARE FOOT.

CHEMICAL ADDITION SYSTEM

MEASURING TANK: 50 GALLONS

CHEMICAL DRUM UNLOADING FACILITY.

REMOTE RADIOACTIVE SAMPLING
IN 2 ML SAMPLES.

FOR INFORMATION ONLY

GENERAL SYSTEM REQUIREMENTS

500 GALLON TANK (TYP. 2)
5 GALLON PER MINUTE PUMP (TYP. 2)
CAPABLE OF TANK TO TANK OR TRANSFER
TO EITHER THE V-028 PIPELINE OR
THE LR-56 TRANSFER TRUCK. SIMILAR
TO KONTRD A-RANGE SEAL/LESS PUMP
MODEL A22 WITH STAINLESS STEEL
WETTED AREAS.

CHEMICAL ADDITION SYSTEM. MEASURING
TANK (50 GALLONS) AND CHEMICAL DRUM
UNLOADING FACILITY

REMOTE (RADIOACTIVE) SAMPLING
TO OBTAIN 2 ML SAMPLES.

ALL PUMPS SHALL BE FITTED W/ TRIPLE-DUTY
DISCHARGE VALVES AND SUCTION DIFFUSERS.

(B)
A13

SECTION

1/8" = 1'-0"
(ALTERNATE 5)

LLLWSK8c

A-18

ALTERNATE #5
07-28-94 ER59061

WHC-SD-WM-ES-313, REV 0

Appendix C

LIQUID EFFLUENTS CONTROL SYSTEM ALTERNATIVES

Engineering Support Document

LETTER REPORT

B-Plant / WESF Isolation Study Liquid Effluents - Control System

Project ER5906

prepared by

Patrick J. McGrath, P.E.

TABLE OF CONTENTS

Introduction	3
Summary Conclusions and Recommendations	5
Approach/Evaluation	7
Cost Data	8
Uncertainties and Recommendations	9
References	11
Appendix A - List of Abbreviations	13
Appendix B - Sketches	14

INTRODUCTION

Purpose

The purpose of this letter report is to describe the requirements, and provide a cost estimate for decoupling the Building 211-BA Process Control Unit (PCU) from the B Plant control system (1).

Background

The 211-BA facility does end of pipe treatment, which consists of neutralization and discharge, for aqueous B Plant chemical sewer waste effluents. The 211-BA facility is physically located on the North side of B Plant, in the 200 East Area of the Hanford Nuclear Reservation located in Southeastern Washington State (2,3). Building 211-BA treated effluents are discharged into the 211-BA sump, NS-02, and flow by gravity to the 207-B retention basins during normal operations (4). The Building 211-BA waste effluents will be routed to the 200 Area Treated Effluent Disposal Facility (TEDF) when the new effluent system comes on-line (5).

Building 211-BA process controls are supplied by a dedicated node of the B Plant distributed control system (DCS), a Bailey Network 90 (6). The B Plant Bailey Network 90 DCS consists of a redundant communication loop with 13 nodes (7,8). The primary control system communications loop is a pair of twinaxial RG22BU cables (9) in 1 in. sch. 40 conduit. Loop redundancy is provided by a second pair of twinaxial cables in a second 1 in. sch. 40 conduit. In each of the conduits, one twinaxial cable node termination handles node inputs, the other handles node outputs. Nodes consist of operator interface units (OIUs), operator interface stations (OISs) - which are upgraded OIUs, PCUs, computer interface units (CIUs), and engineering work stations (EWS). The B Plant control system nodes, including the 211-BA facility, consist of 5 PCUs, 4 OIUs, 2 CIUs, 1 OIS, and 1 EWS. The OIS is hardwired into the B Plant control system network (node #13), but is not yet running. The B Plant DCS is called B93A Facility Process Monitoring and Control System (FPMCS).

Work is currently underway on a project which will extend the B Plant FPMCS to incorporate the Waste Encapsulation and Storage Facility (WESF) (10). There are three stages to the project; creating a centralized control room in WESF, extending the FPMCS from B Plant to WESF, and upgrading the FPMCS to allow monitoring and control of selected WESF instruments and alarms. The Building 225-B shift office has been designated to serve as the WESF central control room. The FPMCS extension will be accomplished by physically moving node #6, one of the B Plant OIUs, to the WESF control room. Note that the B Plant control system architecture will remain the same, i.e. node #6 control network conduits will be moved with the node #6 OIU so that system interconnections will not change.

The B Plant DCS will be tied to the Project W-049 DCS, a MICON Open A/S system, when the 211-BA tie-in to TEDF is completed. Current plans are to link the Bailey system to the MICON through PCU #3, via a Bailey IMMFP01 Multi-Function Process Module Foreign Device Interface RS-232 serial port (modem transmission) (11). PCU #3 is physically located in the 221-B operating gallery.

Scope

Isolation of the B Plant control system from WESF requires that the 211-BA facility be physically disconnected from the B Plant control system network and set up as a new, independent loop. The proposed 211-BA control system network would consist of PCU #4 (existing), an EWS, and an operator station. The 211-BA control system operator station would be located in the WESF control room, the EWS could be located in the WESF control room or at a remote location. The primary activities required to isolate 211-BA controls from WESF are as follows; disconnect PCU #4 from B Plant, provide an operator station at the WESF control room¹, route Bailey Plant Loop Cable from 211-BA to the WESF control room, install an EWS, route Bailey Plant Loop Cable to the EWS (if remote), and connect the three control system nodes. Note that installation of all nodes includes providing for conditioned and uninterruptable power supplies (UPS) (except for EWS - UPS not required), system grounding, conduit runs, and physical and environmental device requirements (9). Additionally, the B Plant DCS network cable would have to be rerouted as required to accommodate for the disconnected node(s). Secondary activities associated with setting up an independent 211-BA network include downloading of system software, conducting acceptance test and/or operational test procedures, connecting PCU #4 (or one of the 211-BA system nodes) to TEDF, creating and/or revising drawings and/or system configuration documents, disconnection of PCU #3 from TEDF, decoupling B Plant controls from WESF, and coupling selected WESF controls to the 211-BA network.

¹An existing OIU will be moved to the WESF control room and connected to the B Plant DCS as part of the FMPCS Extension to WESF Project. During a B Plant/WESF Isolation Study Control Systems Meeting, Sept. 1, 1994, R. J. Townley said that if the B Plant Isolation Project were to proceed, the OIU installed at WESF would be disconnected from the B Plant DCS and utilized as an operator station for the 211-BA facility. As such, the procurement of a new operator station would not be required. The procurement and installation of a new operator station is considered in this report as an additional, optional activity.

SUMMARY CONCLUSIONS, AND RECOMMENDATIONS

Summary Conclusions

Building 211-BA process controls can be isolated from the B Plant DCS by disconnecting PCU #4 from the B Plant network. A 211-BA DCS, consisting of PCU #4, a Bailey operator station, and a Bailey EWS, can be configured with new and/or existing equipment so as to be completely independent of the B Plant system. The following describes the requirements for creating a new 211-BA process control network:

- 1) Installation of a B Plant independent UPS at 211-BA to supply PCU #4 (12,13).
(Building 211-BA normal and standby power is currently provided from Building 221-B MCCs 10 and 6A, respectively.)
- 2) Installation of a Bailey IMMFP01 Multi-Function Process Module (11) into PCU #4 for communication with the TEDF MICON Open A/S DCS. Note that the IMMFP01 may either be procured as new equipment, or scavenged from PCU #3.
- 3) Installation of a B Plant independent telecommunication drop at 211-BA for the TEDF communications link (12,13).
(Building 211-BA telecommunications are currently routed from B Plant.)
- 4) Installation of two 1 in. sch. 40 conduits, each routing 2 Bailey NKPL01 Plant Loop Cables (9) from 211-BA to the WESF control room.
- 5) Installation of a Bailey Small Field Enclosure IECFE11 (or IECFE12 for floor mount) at the WESF control room containing a Bailey IEPAS01 Power Supply and a Bailey INPCI02 Plant Loop to Computer Interface (CIU), for communication with the EWS (14,15,16). Note: an existing OIU is being installed in the WESF control room as part of the FMPCS extension to B-Plant (10), which would be disconnected from the B-Plant DCS and connected to the 211-BA network (see footnote, p. 4). If for some reason the WESF control room OIU were not available at the time of the 211-BA isolation project, two additional IEPAS01s, two additional INPCI02s, and an operator interface (computer and monitor) with LAN-90 Process Control View version 5.0 software (17) would also be required.
- 6) Installation of a PC based EWS with appropriate Bailey software (18) in the WESF control room.
- 7) Installation of a post-script laser printer in the WESF control room

The FMPCS Extension to WESF Project will be providing a B Plant independent UPS which will probably have enough capacity to support all the power requirements at WESF for the 211-BA isolation study (19).

Recommendations

It is a standard industrial practice that a distributed control system be provided with a dedicated EWS. It is recommended that a new PC based EWS, new EWS software, a new post-script laser printer, and new CIU hardware with cabinetry be purchased and installed in the WESF control room for the proposed 211-BA network. Bailey Controls must provide the control system software and CIU hardware with cabinetry. The EWS, printer, and Plant Loop cable can be supplied by Bailey or third party vendors.

The FMPCS Extension to WESF Project will provide for the installation of an existing OIU in the WESF control room. The plan (see footnote, p. 4) is to disconnect the WESF OIU from B Plant and connect it to the 211-BA network, if the 211-BA isolation project proceeds. The justification for this plan lies in the fact that the OIU is existing and will not have to be moved, the OIU has adequate capability to monitor the relatively low performance process activities at 211-BA, and rewiring the B Plant network to accommodate the removal of an OIU from WESF will be relatively inexpensive and relatively straightforward. Because the existing OIU which is planned for installation is several years (and generations) old, cost information for the installation of a new, PC based operator station is provided for consideration.

APPROACH/EVALUATION

Several 211-BA control system configuration options were considered in this study. Since the Bailey PCU #4 is already installed, operating, and has adequate functional capability, the option of procurement and installation of an entirely new system was quickly deemed to be not economically viable. It may be possible to recycle existing, or utilize spare OIUs and CIUs for the proposed 211-BA network. However, most of those existing and spare B Plant Bailey system components are antiquated (6). Furthermore, significant costs would be incurred in reconfiguring the B Plant DCS as a result of scavenging system components for re-deployment on the 211-BA system. With the possible exception of using an existing OIU, which will be installed in the WESF control room as part of the FMPCS extension, it is recommended that a new system components be procured and installed for the 211-BA control system network. The EWS can be physically located virtually anywhere, but long conduit runs from 211-BA or WESF to the EWS node, and additional CIU cabinets or racks will increase installation costs. Unless there is adequate justification to install the EWS as a remote node, it is recommended that the EWS be installed in or near the WESF control room.

COST DATA

Bailey System Related Equipment:

<u>P/N</u>	<u>QTY</u>	<u>Units</u>	<u>Description</u>	<u>Unit Price²</u>
1	1	ea.	Bailey IMMFP01 Multifunction Process Module (note: the purchase of a new IMMFP01 might be avoided if an existing unit were removed from PCU #3 and installed in PCU #4)	\$10,140.00
2	2000	ft.	Bailey NKPL01 Plant Loop Cable (or approved substitute)	\$40.00 + \$0.95/ft
3	1	ea.	Bailey IECFE11 Small Field Enclosure	\$5288.00
4	1 (2 opt)	ea.	Bailey IEFAS02 Power Supply Module	\$2140.00
5	1 (2 opt)	ea.	Bailey INPCI02-232H Computer Interface Unit with Terminal Modules	\$10,360.00
6	(1 opt)	ea.	Bailey LBPCV00002010W LAN-90 Process Control View version 5.0 software, 500 Tag	\$6560.00
7	(1 opt)	ea.	Bailey LSLOG10W LAN-90 Log/Report software	\$1200.00
8	(1 opt)	ea.	Operator Station - DECpc 466d2 LP+, 486dx2, 66MHz 340 MB hard drive, 20 MB RAM (or approved substitute), and 21" DEC FR-PCXAV-HA monitor (or approved substitute)	\$7090.00
9	1	ea.	Engineering Workstation - Bailey LTEWS0100010 (or approved substitute) with Standard Bailey Engineering Workstation software	\$10,800.00
10	1	ea.	HP Laserjet 4L	\$1125.00

Optional (opt) items indicate additional hardware requirements in the event that B Plant operations personnel decide to purchase a new operator station, in favor of utilizing existing used equipment.

Note that these costs are not all inclusive for the Building 211-BA control system component of the B Plant isolation study. Additional costs will be incurred in providing B Plant independent CSE utilities to 211-BA, routing conduit from 211-BA to 225-B, engineering design activities, and (re)configuring, procuring, installing, and starting up equipment.

²This information is provided for cost estimating purposes only.

UNCERTAINTIES AND RECOMMENDATIONS FOR FURTHER STUDY

The FPMCS extension to WESF project is contrary to the proposed B Plant isolation project. If the FPMCS extension project and the 211-BA isolation project proceed simultaneously, the logistics of both projects could become complicated and may result in conflicting activities.

During the course of researching this study, several activities out of the scope of the control systems engineering (CSE) discipline function, but within the scope of the isolation project were identified as overlooked items. If 211-BA is to be isolated from B Plant, utility issues like building power, telecommunications, and water should be studied further. CSE specific utility issues include providing a UPS independent of B Plant at Building 211-BA, and providing a telecommunications drop at 211-BA for the TEDF communication link.

WESF operations do not currently utilize a DCS. Whether WESF control system functions can and/or should be incorporated into the 211-BA control network is a topic which requires further study.

The 211-BA instrumentation drawings indicate that PCU #4 has been properly grounded (13). However, it may be worthwhile to test, and if need be calibrate, the impedance of the ground electrodes (9) during the isolation project control system reconfiguration.

A standard ICF KH design deliverable is Acceptance Test Procedures (ATPs). An ATP is a formal document which describes the steps to be followed and the data to be documented in demonstrating the acceptability of a new installation. It is intended to verify the response of indicators, instruments, and controllers to signals. If ICF KH were given the definitive design for the B Plant Isolation Project, the job would need to be staffed with at least two ICF KH CSE engineers (one for checking). In order to write ATPs, both would have to be trained on the Bailey system, to the degree that they were intimately familiar with the configuration and operation of the 211-BA network. There are currently few or no ICF KH engineers with adequate training to write Bailey System ATPs.

H-2- series essential drawings for the B Plant control system are in many cases incomplete and/or erroneous. The design software and hardware for the Bailey system installed at B Plant is several generations old. The old Bailey system design software is incompatible with AutoCAD, which makes creating and updating H-2- series essential drawings very cumbersome. The purchase of a new EWS with AutoCAD (not yet available, but being developed) compatible software will make H-2- series drawing management considerably easier. As such, an in-depth review of current B Plant control system configuration management is recommended for further study if the proposed B Plant isolation study is authorized to proceed. If the isolation project is authorized, the following H-2- series CSE Drawings are the minimum recommended design deliverables³:

H-2- series CSE Drawings: (new and/or revised)

<u>Drawing</u>	<u>Status</u>
Control System Block Diagram(s)	new
Building 211-BA P&ID(s)	revise
Building 211-BA Utility P&ID(s)	revise
211-BA Logic Drawing(s)	currently part of Bailey system configuration program, consider releasing as H-2- series
211-BA Instrument Index Drawing(s)	currently part of Bailey system configuration program, consider releasing as H-2- series
211-BA Instrument Site Plan Drawing(s)	revise
211-BA Instrument Cable Schedule Drawing(s)	new
System Interconnection Drawing(s)	revise
PCU #4 Wiring Diagram(s)	revise
(termination drawing)	

³Note that several other drawings from other engineering disciplines will also be required.

REFERENCES

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2. Drawing H-2-77728, "Sht. Index," Rev. 2, August 5, 1991.
3. Drawing H-2-77732, "Site Plan, 211-BA Building Diversion Pump Station," Rev. 2, August 5, 1991.
4. Drawing H-2-77735 3SH, "Composite Flow Diagram & System Description," Rev. 3, April 17, 1992.
5. Functional Design Criteria, "200 Area Treated Effluent Disposal Facility," Project W-049H, WHC-SD-W049-FDC-003, Rev. 0, May 1990.
6. Hanford Certified Vendor Information (CVI) No. 21,992.
7. Hafla, E. R., "B Plant Network 90 Configuration Document," WHC-SD-WM-TI-245, September 16, 1992.
8. Sidoway, L. G., "As Found Condition of FPMCS System Loop Connection Diagram," Engineering Change Notice to Drawing H-2-77704 SH7, ECN 607489 - draft, June 6, 1994.
9. Bailey Document E96-500, "Instruction - Site Planning and Preparation," 1991.
10. Townley, R. J., "FPMCS Extension to WESF," WHC-SD-CP-FRD-002, May 17, 1994.
11. Bailey infi 90, Specification E96-201, Multi-Function Processor Module, (1990)
12. Drawing H-2-77731 SH1, "Electrical Site Plan and Legend," Rev. 4, April 17, 1992.
13. Drawing H-2-77737 8SH, "Electrical Plan 211-BA" (individual sheets have been revised at different dates)
14. Bailey infi 90, Specification E96-513, Small Field Enclosures, (1990)
15. Bailey infi 90, Specification E96-506, Modular Power System, (1990)
16. Bailey infi 90, Specification E96-650, Plant Loop Communication System, (1990).

17. Bailey Controls Company Inter-Office Memo, Sales Release - Lan-90 version 5.0, July 1 1994.
18. Bailey infi 90, Specification E96-800, Engineering Work Station - LTEWS, (1993).
19. Siddoway, L. G., "Specification for Uniteruptable Power Supply for WESF Bailey DCS," WHC-S-0322, Rev. 0, August 23, 1994.

APPENDIX A - LIST OF ABBREVIATIONS

ATP	Acceptance Test Procedure
CIU	Computer Interface Unit
CSE	Control Systems Engineering
DCS	Distributed Control System
EWS	Engineering Work Station
FPMCS	Facility Process Monitoring and Control System
MCC	Motor Control Center
OIU	Operator Interface Unit
OIS	Operator Interface Station
PC	Personal Computer
PCU	Process Control Unit
P&ID	Piping & Instrumentation Drawing
TEDF	Treated Effluent Disposal Facility
UPS	Uninterruptable Power Supply
WESF	Waste Encapsulation and Storage Facility

FPMCS CONNECTION DIAGRAM
DEMOLITION SKETCH

B-PLANT/WEST ISOLATION STUDY
LIQUID EFFLUENTS-CONTROL SYSTEM
PROJECT IR5906
page 14

CADFILE: ER5806-1

WHC-SD-WM-ES-313, REV 0

Appendix D
SOLID WASTE REMOVAL ALTERNATIVES

Engineering Support Document

DRAFT

B-PLANT/WESF ISOLATION STUDY - SOLID WASTE REMOVAL

PROJECT: ER5906

FILENAME: Report.002 By Dave Farnsworth 09/08/94

INTRODUCTION

Solid waste is generated from the processing of used cesium and strontium capsules that are returned to the (WESF) Waste Encapsulation Storage Facility. With the proposed separation of B Plant and WESF, a new system for solid waste disposal is needed. This report provides descriptions and sketches of solid waste disposal systems to support a preliminary cost estimate. The Solid Waste Packaging and Loadout System will package the solid waste in approved containers, characterize its radionuclide content, obtain dose rate measurements, provide shielding, and will move it to a designated burial location.

SUMMARY CONCLUSIONS, AND RECOMMENDATIONS

The following methods for contamination prevention and/or decontamination of the solid waste container are identified: Bagging of the container, CO₂ blasting, ice pellet blasting. The following methods for drum radionuclide characterization are identified: 222-S Laboratory gamma/beta ratio analysis, gamma detector drum counter, calculation of radionuclide content. The most reasonable means of disposing of the solid waste from the WESF hot cells includes the use of approved containers, contamination prevention by bagging

of the container, 222-S laboratory analysis and an automatic HPGe gamma drum counter system.

APPROACH TO DECONTAMINATION

Drums loaded with solid waste in A cell collect surface contamination. This contamination must be removed before characterization and shipping of the drum takes place. In order to accurately characterize the contents of a drum for radionuclides and prevent the migration of loose contaminants in the WESF canyon, the exterior surface of the drum must be decontaminated before it is moved out of A cell.

The most reasonable approach to cleaning the surface of a drum is to prevent contamination from the beginning of a process. This can be done by using temporary bags over the drum till the drum is ready to be moved from the cell. See figure B. This method assumes that the bags maintain their integrity and that the contamination doesn't migrate past the bag to the exterior surface of the drum. Other methods looked at include CO₂ blasting and Ice Pellet blasting methods.

APPROACH TO CHARACTERIZATION

Solid waste is generated in G cell where the cesium and strontium capsules are processed. This solid waste is moved through the hot cells to A cell using robotic manipulator arms. This process of moving solid waste through intermediate cells generates additional waste. The majority of this additional solid waste is assumed to be manipulator boots.

It is assumed that the radionuclides existing in these hot cells are Cesium, Strontium and their daughter products. Both Cs-137 & Ba-137 exist in an equilibrium state as well as Sr-90 & Y-90. Since Ba-137 gives off strong gamma particles which penetrate through drums, the Cs-137 can be characterized from outside of a drum using a gamma detector. Sr-90 cannot be detected from outside of a drum because the β particle will not penetrate through the wall of the drum. If the ratio of Cs-137 to Sr-90 were known and stayed consistent, one could characterize the Sr-90 based on a measurement of the Cs-137. We assume however, that this ratio is not consistent. Therefore, the ratio of Cs-137 to Sr-90 needs to be characterized for each individual solid waste item.

To characterize Sr-90 for radionuclide content when it is in the presence of Cs-137 will require a working sample which will undergo a chemical separation process. This working sample must be obtained prior to the solid waste being put in the drum. It can be obtained by taking a smear of the solid waste with a mazalon cloth and sending the sample to the 222-S laboratory for analysis. Results from the laboratory will give the ratio of Cs-137 to Sr-90 and may take 2 or more weeks to process.

Using the radionuclide ratios of each of the waste samples and the amount of waste associated with each sample in a given drum, one can characterize a drum using a gamma detector. For a more accurate waste radionuclide characterization, it is advisable to separate wastes of different densities into separate drums.

PROCESS DESCRIPTION

WASTE SAMPLING

1. Take a smear of the waste to be put in drum using a mazalon cloth.
2. Put waste in drum. See figure A.
3. Open cover block. Lower bucket filled with course sand from the canyon to the cell, and put smear sample in it. Don't let bucket touch anything and return it to the Canyon level. Close cover block.
4. Prepare sample for shipment to 222-S laboratory.
5. 222-S Laboratory will characterize sample for ratio of Cs-137 to Sr-90.

DRUM DECONTAMINATION

1. Remove tape attaching drum inner liner to drum outer liner. See figure B. Seal drum inner liner.
2. Open cover block. With drum lid attached to canyon cable, lower lid on the drum. With manipulator arms, insert key strip into the lid. Spray lid opening for key strip with a fixative. Let dry.
3. Remove tape attaching drum outer liner to drum. Remove outer liner from drum. Lift drum out of cell. Close cover block. See figure C.
4. Stuff drum liners in the next available drum.

CHARACTERIZATION

1. Using canyon cable, move drum inside the greenhouse to the portable drum counter.
2. Calibrate drum counter. Run complete gamma survey on the drum.
3. Move drum to shielded cask container. See figure D.

4. From drum counter analysis, the radionuclide characterization and the dose rate can be calculated.

Figure A

Figure B

Figure C

Figure D

RECOMMENDATIONS FOR FURTHER STUDY

A cell was originally designed to radiologically separate the hood from the cell to keep the cell clean. This was accomplished through the use of bags in the drums, a bag sealer and cutter, and the hood. It is recommended that when the cell is cleaned up, the existing drum dolly be fixed to operate as was originally intended. This would help maintain the cleanliness of the cell which in turn would reduce costs.

To further reduce costs, a means of waste reduction should be looked at. It is assumed that most of the generated solid waste is from the plastic manipulator boots. These could be reduced in volume by mechanically chopping or crushing, chemical decomposition, radiation disintegration, et. cetera. This will minimize the number of drums to be processed.

REFERENCES

- DOE/EM-0142P March 1994, "Decommissioning Handbook"
- SD-WM-SAR-005 Rev 2 "Waste Encapsulation and Storage Facility Safety Analysis Report"
- Alpheus Cleaning Technologies Corp. 9119 Milliken Avenue, Rancho Cucamonga, CA 91730
- Canberra Industries, Inc., 800 Research Parkway, Meriden CT 06450
- Chemco Manufacturing Company, Inc, 3175 MacArthur Boulevard, Northbrook, Illinois 60062
- Ice Blast West, Inc., 1801 130th Ave NE, Bellevue, WA 98005
- Radiological & Chemical Technology, Inc., 1700 Wyatt Drive, Suite 16, Santa Clara, CA 95054

- Scientific Ecology Group, PO Box 2530, 1560 Bear Creek Road, Oak Ridge,
TN 37830

APPENDIX A

DECONTAMINATION METHODS

GENERAL DESCRIPTION

There are many approaches to cleaning radiological contamination from the surface of a drum. The "Decommissioning Handbook", DOE/EM-0142P March 1994, table 9.2 gives a list of techniques that have potential for our application. These methods are listed in Table A-1. By eliminating techniques that remove surfaces and can't be done remotely, the choices are narrowed to a few options: Flushing with Water, Vacuuming, Fixative Stabilizer Coating, Steam Cleaning, Sponge Blasting, CO₂ Blasting, Wet Ice Blasting and Wet Abrasive Cleaning.

Vacuuming may increase the spread of contamination. Fixatives don't remove the contaminants, but are used to control spreading. Flushing with water generates significant amounts of liquid waste to be processed. Sponge Blasting and Wet Abrasive cleaning both create liquid and solid waste in small amounts. Techniques that generate even smaller amounts of waste include Wet Ice blasting, CO₂ blasting, and bagging of the container. These three methods are investigated.

WET ICE BLASTING PROCESS

PROCESS DESCRIPTION

This system directs a high-velocity stream of fine particles of ice onto the drum surface to remove contamination. It employs low-pressure air and wet ice for cleaning. Typical air requirements range between 60 and 250 psig at 280 cfm. The contaminated water that is generated by the melting ice particles is the controlling medium for the displaced contamination and may generate up

DECONTAMINATION TECHNOLOGY

LEGEND			ADVANTAGES																DISADVANTAGES															
APPLICATIONS			Marginally Advantageous == > o																Disadvantageous == x															
Marginally Effective == > o			Marginally Advantageous == > o																Disadvantageous == x															
Highly Effective == > O			Highly Advantageous == > O																Highly Disadvantageous == > X															
			Etching with Water	Dusting/Wiping/Scrubbing	Vacuuming	Fixative Stabilizer Coating	Turbulator	Metal-Based Paint Removal	Stripable Coatings	Steam Cleaning	Sponge Blasting	CO2 Blasting	Wet Ice Blasting	Hydro Blasting	Ultra High Pressure Water	Shot Blasting	Wet Abrasive Cleaning	Gritblasting	Grinding	Scarifying	Milling	Drill and Spall	Paving Breaker / Chipping Hammer	Expansive Grout	Electropolishing	Ultrasonic Cleaning	Vibratory Finishing	Light Ablation	Microwave Scabbling	Flaming	Flame Scarifying	Plasma Torch	Electrical Resistance	Microbial Degradation
Surface Cleaning (C) or Surface Removal (R)	C	C	C	C	C	C	C	C	C	C	C	C	C	R	R	R	C	R	R	R	R	I	R	R	C	C	C	C	R	C	I	C	R	C
Batch(B) or In-Situ	I	I	I	I	B	I	I	I	I	I	I	I	I	I	I	I	B	I	I	I	B/I	I	I	I	B	B	B	I	I	I		I	I	I/B
Loose Particulate Contamination	o	O	O	o	O	o	O	O	O	O	O	O	o	o	o	o	O	o	o	o	o	o	o	o	O	O	O	O						
Bare and Painted Concrete	o	o	o	o	o	o	o	o	o	O	O	O	O	O	O	o	O	O	O	O	O	O	O	O		O	O	O				O	O	
Metal Surfaces	o	o	o	o	o	O	o	o	o	O	O	O	O	O	O	o	O	O		O	O				O	O	O							
Components Of All Sizes	o	o	o	o		o	o	O	O	O	O	O	O	O	O		O	O		o					o									
Pipe and Tank Internals	O	o	o	o										O	O			O							o									
Embedded Material and Some Oxide Surfaces		o	o			o	o							O	O			O	o	o	o	O	O	O	O									
Small Hand Tools	o	o			O												O								O	O	O							
Special Equipment (e.g. Motors)				O	o					O	O		o				o								o	o								
Soil, Groundwater and Oily Wastewater																																		O
Easy to Apply	O	O	O	O	o		O	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o						
Readily Available	O	O	O	o		o	O	o	o	o	o	o	o	o	o			O		O			O		o	O								
Easy Waste Handling / Disposal	o	o	O	O		O	o												o	o	o	o	o	o	o	o								
Little or No Surface Damage	O	O	O	O	O	o	O	O	O	O	o	o														o	O	O						
Easy to Train Operators	O	O	O	O	o	O	O	O	O	O	O	O	o	o	o	o	o	o	o	o	o	o	o	O	o	o	o	o						
Remote Operation Possible or Available	O		o	o					O	O	O	O	O	O	O	O	o	O	O	O				o	o									
Can Penetrate Cavities				o		o	o							O	O									O	o	o	o							
Can Be Applied Wet Or Dry		O	O								O							O																
Difficult To Remove Contamination From Crevice	x	X					X	x																										
Cross Contamination Potential	x			x			x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x										
Personnel Exposure Could Be High	x	x	x				x	x																x										
Labor Intensive	x	X	x	x		XX	X	x	x	x	x												x	x	x									
Solvents and Detergents Could Complicate Waste	x	x				x	x	x						x	x		x									x	x	x						
Could Produce Increased Volumes of Wastes Unl	X					x					x			x	x				x							x	x	x						
Possibility of Excessive Erosion or Surface Rough														x	x	x			x	x	x	x	x	x	x	x								
Contamination Not Removed					X																													

Table A-1

to 10 gal/hr of water that will be disposed of down existing sump in A cell.

At the same time the wet ice is being shot at the drum, air movement will be directed downward to aid in controlling airborne contamination.

Decontamination efficiency depends on the design of the applicator translation speed, cleaning head distance from the substrate, operating pressure, and geometric complexities of the drum. After the drum has been shot with the wet ice, air is used to dry the drum. A fixative is sprayed on the drum and given time to dry. The drum is removed. A flushing fluid is then run through the fixative lines to prevent them from being plugged.

EQUIPMENT DESCRIPTION

A specially designed Decontamination Container fitted with a motor driven drum turntable, contaminated water drainage to the sump and nozzles for wet ice, air and fixatives. A small crane would lift the drum into the decon container. Support equipment for the container would include piping and valves for control of fluids to the container, motor speed controller, ice pellet making equipment, air compressors, fixative supply containers and flushing fluids. The decon container would be designed to fit in the cell. Rental options for portable ice pellet/air compressor system is available. Equipment may be up to a maximum of 300 ft from the point of application.

WET ICE BLASTING DECON EQUIPMENT

Figure A-2

PLAN VIEW

ELEVATION VIEW

07/31/94

CO2 BLASTING PROCESS

Small dry-ice pellets are accelerated through a nozzle using compressed air at 50 to 250 psig shattering when they impact the surface of the drum. The resulting kinetic energy has a lifting force that releases the contaminant from the base material. Removed debris falls to the ground, and the CO₂ (now gas) returns to the atmosphere uncontaminated. Design considerations include noise, ventilation and static electricity.

EQUIPMENT DESCRIPTION

A specially designed Decontamination Container fitted with a motor driven turntable, overspray panels and nozzles for CO₂, vacuum and fixatives. See figure A-2. A small crane would lift the drum into the decon container. Support equipment for the container would include piping and valves for control of all fluids to the container, motor controls, a CO₂ pelletizer (converts liquid CO₂ into dry-ice snow), cleaning station (from which the pellets are stored and blasted), CO₂ storage, air compressors, vacuum system and fixative supply containers. The decon container would be designed to fit in A cell.

C02 BLASTING DECON EQUIPMENT

PLAN VIEW

ELEVATION VIEW

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BAGGING OF CONTAINER

PROCESS DESCRIPTION

This approach uses prevention to keep contaminants from collecting on the surface of the drum from the start of the process. Before a drum enters a cell, it could be wrapped in 2 plastic bags as shown in figure B of the main report. It is assumed that these bags would be tough enough not to rip and have a surface that contaminants will stick to. The bags stay on the drum till the drum is ready to be moved from the cell. By careful use of the manipulator arms, the plastic can be removed and dumped into another drum in the cell.

EQUIPMENT DESCRIPTION

None.