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7. Abstract		

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**B PLANT MISSION ANALYSIS
REPORT**

April 1995

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1.0 INTRODUCTION

1.1 PURPOSE

This report further develops the mission for B Plant originally defined in WHC-EP-0722, "System Engineering Functions and Requirements for the Hanford Cleanup Mission: First Issue." The B Plant mission analysis will be the basis for a functional analysis that breaks down the B Plant mission statement into the necessary activities to accomplish the mission. These activities are the product of the functional analysis and will then be used in subsequent steps of the systems engineering process, such as identifying requirements and allocating those requirements to B Plant functions. The information in this mission analysis and the functional and requirements analysis are a part of the B Plant technical baseline.

1.2 SCOPE

The scope of the B Plant mission is to deactivate the facility for turn over to decontamination and decommissioning (D&D) activities. Basically, the existing B Plant facility and program will be transformed into a deactivated facility that is completely compliant with laws, regulations, and policy and is supportive of the Hanford Sitewide Cleanup Mission. B Plant currently supplies some critical services necessary to support continuing operations at the Waste Encapsulation and Storage Facility (WESF). Therefore the B Plant mission does include providing some necessary WESF support services, but it does not include the storage of Cs and Sr currently in WESF. The target completion time for the B Plant mission is five years from authorization, but the expected time from this completed mission to the initiation of D&D may be years even decades. The facility will be maintained in a condition that requires minimal surveillance, and B Plant's total annual operating cost will be substantially less than the current operations. The final conditions of the B Plant mission will be replaced support services for WESF and a deactivated facility which has the minimum surveillance needed to contain the contamination from past practices and which complies with federal, state and local regulations to the satisfaction of the Stakeholders.

1.3 BACKGROUND

The B Plant facility is located in the 200-E area at the U.S. Department of Energy's (DOE) Hanford Site. The plant was constructed between 1943 and 1945 and was used to process spent nuclear fuels in support of the Manhattan Project. Following extensive modifications conducted in 1961 through 1967, the plant changed processes and separated Strontium (Sr) and Cesium (Cs) from the fission product waste stream from the Plutonium Uranium Extraction Plant (PUREX) between 1968 and 1985. The recovered, purified, and concentrated Sr and Cs solutions were then transferred to the Waste Encapsulation and Storage Facility (WESF) where they were converted into solid compounds, encapsulated and stored. Because of the expected difficulty of updating the, now, 49 year old plant to meet current environmental standards, DOE eliminated B Plant from any future processing missions in May 1991. Since that time, B Plant has continued to supply facility services to WESF and to ensure safe management of the substantial radioactive contamination and residual inventory of materials remaining in B Plant from past operations.

1.4 PROBLEM STATEMENT

Overall, the B Plant complex is currently in a surveillance and maintenance state since the completion of its previous processing mission of separating and concentrating Cs and Sr solutions. Portions of B Plant remain active to support WESF operations, the remainder of the plant is inactive. Past activities have left behind radioactive and hazardous materials, highly contaminated systems, subsystems, structures and equipment, and also contaminated soil around the plant. The continuing operations of ensuring the safe storage of the legacy material inventory and contaminants and of maintaining the facility are expensive. The aging facility and infrastructure (steam, water, ventilation) are deteriorating and require significant upgrades in the near future to continue supporting the WESF facility which will store Cs and Sr materials. At the present time, no future mission for the B Plant facility has been identified. Therefore, B Plant must be placed in a condition that requires minimal surveillance and maintenance until decontamination and decommissioning (D&D) activities are performed. Present environmental, safety, and health (ESH) risks are acceptable when current standards for intact, enclosed structures are applied. These risks must be reevaluated prior to any D&D activities that might change any present containment barriers, especially those providing radiological containment.

2.0 MISSION ANALYSIS

2.1 MISSION STATEMENT

The B Plant mission is to safely and cost effectively transition the facility to a "shut down" status (i.e., a safe, minimal surveillance configuration awaiting D&D) within five years of project authorization. Currently available technologies will be applied in innovative ways to support the B Plant mission. Freed-up intellectual and physical resources will be applied to other Hanford Site mission objectives. Figure 1 is the B Plant Mission Context Diagram and pictorially defines the Deactivate B Plant Mission.

2.2 MISSION OBJECTIVES

The objectives for the Deactivate B Plant Mission are the following:

- To successfully transfer the deactivated B Plant facility to the D&D contractor.
- To provide sufficient surveillance and maintenance program for B Plant that minimizes total operating costs following the deactivation, and while waiting for D&D to begin.
- To provide replacement operating systems and services for WESF that eliminate WESF dependence on B Plant.

2.3 INITIAL CONDITIONS

The initial conditions for the B Plant complex are shown in Table 1. The initial conditions establish the current programmatic and physical states of the system on which the mission is to be performed. They are described in terms of the system attributes that will be transformed by performing the mission. Initial conditions enter from the left as illustrated in Figure 1. References are provided in the table where further information may be found.

Control & Constraints

Direction & Control

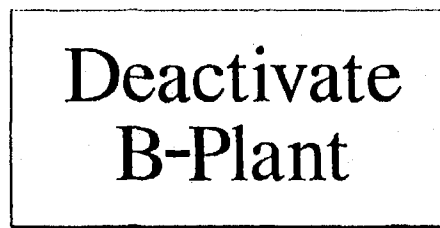
- DOE Orders
- Stakeholder Values
- DNFSB Constraints
- ESH Compliance Criteria
- Self Imposed Time Limit (5 yr)
- Known Waste Acceptance Criteria
- Air Discharge Permit Criteria

Mission Requirements

- Laws
- Regulatory
- Tri-Party Agreement
- Waste Acceptance Criteria
Solid, Liquid, Air

Boundaries & Interfaces

D&D Contractor
 Security, Fire, Emergency Services
 Other Hanford Programs & Projects
 WESF relies on B-Plant for Critical
 Utilities and Services



Resources

Allocated Funding
 Mission Essential Capabilities:
 Skilled People
 Current Technology
 Physical Structures and Equipment

Initial Conditions

Contaminated Buildings: Inactive and active
 Utilities and Services: Inactive and active
 Radioactive and/or Chemically
 Hazardous Substances
 Contaminated Equipment: Inactive and active
 Trained Operational Staff
 Existing Information/Documentation

Final Conditions

Deactivated Facilities Transferred
 to D&D
 Stabilized Materials (in place
 or removed as waste)
 Transitioned, Re-usable Resources
 Accepted Turnover Data Package
 Functional Utilities for Remaining
 Operational Facilities (WESF)

2-2

Figure 1. B Plant Mission Context Diagram

Table 1. B Plant Initial State Conditions		
Topics	Initial Condition	References*
Physical Systems		
Buildings	Contaminated buildings, both active and inactive Five major buildings and a chemical storage tank farm.	[2], [7], [8]
Equipment	Jumpers (>2000; 99% mixed waste) Process vessels (>100); Centrifuges, ion exchange columns, concentrators, pulse columns, tanks, failed equipment cells Process equipment (pumps, agitators, jets) "Cold" equipment (may have salvage value) Piping (fixed and embedded) Electrical instrumentation and equipment Structural steel Contaminated crane truck	[2]
Materials	Radioactive (Cs and Sr, liquid heels, other trace radioactive, non-transuranic materials) Hazardous (friable and non friable asbestos, bulk chemicals, sodium hydroxide, sulfuric acid, nitric acid, miscellaneous chemicals) Mixed radioactive and/or hazardous materials 5000 gal liquid organics 550 KCuries Cs & Sr (291-B filters) Organic ion exchange resin Cell 4 inventory (solid waste & transformers) Lead contamination (solids & paint) Potentially contaminated liquid mercury Stainless steel encapsulated lead Chemical contamination on floors Contaminated asbestos gaskets	
Utilities & Services	B Plant infrastructure, utilities, operating structure, maintenance needed for deactivation. WESF operations rely on B Plant utilities and services including: demineralized water, low level waste handling, solid waste handling, and effluent systems.	[6]
Soil	Large volume contaminated, radioactive rain water runoff Radioactive dirt	[7]
Programmatic Systems		
Operational & Support Personnel	Trained and certified operations staff. Shared technical staff.	
Information/ Documentation	Indicates the plant configuration and present condition.	

* The references numbers correspond to those in section 3.0 References.

2.4 FINAL CONDITIONS

Final conditions for the B Plant complex are shown in Table 2. The final conditions establish the programmatic and physical end state to be achieved by execution of the mission. The final conditions are described in terms of major topics. These major topics identify significant system characteristics produced by performing the mission. Final conditions are shown exiting the right side of the mission as illustrated in Figure 1.

2.5 MISSION BOUNDARIES AND EXTERNAL INTERFACES

2.5.1 Mission Boundaries

The physical boundary of the B Plant facility is described in Table 3 as a list of the buildings that are included in B Plant. The WESF is not part of B Plant. However, B Plant currently operates critical systems for direct support to WESF operations. In addition to the WESF, the following are not part of B Plant: RCRA past practice sites (cribs, retention basins, B-Ponds), TWRS feed lines, 224-B (ventilation and piping interfaces), 222-B, and Mobile Offices. Since the TWRS feed lines, 224-B ventilation and 224-B piping are continuous from B Plant to TWRS and 224-B, a specific physical location for the boundaries between the two needs to be identified and the interface must be defined and accepted by the involved programs.

Table 2. B Plant Final State Conditions.	
Topic	Final Condition
Deactivated Facilities	Transferred to D&D contractor
Stabilized Materials	Materials are stabilized and are either safely stored and maintained in place or removed as waste.
Transitioned, Reusable Resources	Materials are in a state acceptable for reuse, and workforce is redeployed.
Accepted Turnover Data Package	The documentation is adequate (includes physical facility configuration, known personnel and environmental hazards, and any unknowns requiring further investigation) and is acceptable to the D&D contractor, DOE, EPA, Washington State, and stakeholders.
Functional Utilities	Replacement operating systems are in place supporting WESF operations including demineralized water, low level liquid waste, radioactive solid waste, and effluent monitoring. The required utilities and infrastructure are minimized.

Table 3. B Plant Structures (two pages)	
<u>Number</u>	<u>Name/Function</u>
211B	Chemical Tank Farm
211BA	Chemical Sewer Neutralization Building
212B	Cask Station
217B	Demineralized Water Building
221B	Process Treatment Canyon Building
221BA	High Risk Cooling Water Monitor
221BB	BCS (steam condensate) Monitor Building
221BC	SWP Change House
221BD	Laundry Storage
221BE	Fork Lift Storage
271B	B Plant Service and Office Support
272B	Electric and Maintenance Shop
272BA	Material Storage Shed
272BB	Insulation Storage Building
276B	Organic Storage
282B	Emergency Pump House
282BA	Emergency Pump House
291B (291B1)	Sand Filter and Stack
291BA	Steam Turbine Building - Ventilation Exhaust
291BB	A & B Filter/Instrument House
291BC	Turbine Control Instrument House
291BD	C Filter/Instrument House
291BF	D Filter/Instrument House
291BG	E Filter/Instrument House
292B	291B Stack Monitor Building

Table 3. B Plant Structures (two pages)	
<u>Number</u>	<u>Name/Function</u>
2711B	Breathing Air Compressor Building
291-B-1	Main Stack
C8577	291-B Substation
C8549	221-B Substation
2715 B	Material Storage
2716 B	RR Cut Change Room/Laundry Storage
211BB	Switchgear for Tank Farm
207BA	Liquid Effluent Sampling Station

2.5.2 External Interfaces

Interfaces occur where information and resources are exchanged in the process of accomplishing the deactivation mission. The B Plant interfaces with the following programs and projects:

- DOE Headquarters and Field Office
- D&D and Environmental Restoration (ER) Contractor
- Security, Fire & Emergency Services
- Other Hanford Projects and Programs
 - WESF
 - TWRS
 - Owners of 222-B & 224-B
 - Other Transition Project (PUREX, FFTF, etc.)
 - Site Infrastructure
- Federal Agencies
- State and Local Governments
- Confederated Tribes
- Stakeholders

2.6 MISSION RESOURCES

Mission resources, also called mission essential capabilities, can be divided into the following categories:

- Allocated funding
- Certified and qualified, intellectual and physical resources
- Available Technology
- Physical structures and equipment
 - Electrical power, steam, raw water
 - Site services and infrastructure

2.7 MEASURES OF EFFECTIVENESS AND SUCCESS CRITERIA

Measures of effectiveness (MOE) and success criteria are used to determine the progress towards completion of the B Plant mission. The following is a list of categories of MOE's applicable to B Plant, and the following table further defines the MOE's including the success criteria when available. The success criteria and threshold values have not been fully

developed at this time, but were discussed when the MOE's were developed to build understanding of MOE's and their purpose. Threshold values, also called Pass/Fail values will be determined later and are subject to negotiation between B Plant and the D&D contractor.

Deactivated Facilities

- Cost to deactivate is within projected budget
- Building occupancy level
- Surveillance and maintenance operating costs are minimized and within estimates

Stabilized Materials

- Radiation levels meet negotiated values
- Contamination levels meet negotiated values
- Percentage of contamination that has been removed
- Risk (to public, workers & environment) is within regulatory constraints
- Potential mobility of remaining material is low and within acceptable level

Transitioned, Reusable Resources

- Number of workers reassigned
- Minimize residual economic value of system, subsystems and structures
- Net value is such that it costs less to remove than to keep

Accepted Turnover Data Package

- The documentation content is acceptable, and includes physical facility configuration, known personnel and environmental hazards, and any unknowns requiring further investigation.
- The documentation is acceptable to the D&D contractor, DOE, EPA, Washington State, and Stakeholders.

Functional Utilities

- HVAC, electrical & other utilities available for remaining operations

Other

- Schedule meets published milestones
- Quantity of systems, subsystems and structures ready for turn over to D&D
- Improvement in public involvement and public perceptions

2.8 MISSION RISKS

The B Plant mission, as defined, is feasible. Both possible and probable alternative solutions, which can accomplish the B Plant mission, are expected to exist. To the extent the mission is defined here, the technology exists and the operational resources are available to accomplish the mission. As the Functional Requirements Analysis is performed and the mission is further defined, mission feasibility will be explored in more depth. Following the requirements identification and their allocation to system functions; detailed structural, physical, and organizational configurations of alternative solutions will be fully developed, evaluated for feasibility, and the preferred alternative selected. The mission risks have been identified as:

- Public and Worker Health and Safety
Public concern will remain high until distrust of DOE Hanford Operations is substantially reduced or eliminated. Characterization and mitigation of all ESH issues may eventually result in more public trust of DOE Hanford.
- Programmatic
Inadequate funding could jeopardize the timely completion of B Plant deactivation activities.

Lack of clear, detailed guidance on acceptable end states for Hanford Site facilities presents a significant risk to the development of a sound technical baseline.

Table 4. B Plant Mission Measures of Effectiveness	
Measures of Effectiveness	Candidate Success Criteria
Deactivated Facilities	
Cost	Expenditures (\$), minimized
Surveillance period	Time (days), maximized
ALARA	Exposure level and risk of exposure to workers, minimized
Stabilized Materials	
Radiation levels	TBD
Contamination levels	TBD
Public values	TBD
Potential mobility	TBD
Containment	TBD
Environmental, safety & health risk	TBD
Transitioned, Reusable Resources	
Number of people employed?	Count by position skill level, minimized
Net value of items on deactivation list	Estimated net value (\$), positive
Acceptable Turn Over Data Package	
Documentation content and acceptance	Content meets requirements Accepted by all Stakeholders
Functional Utilities	
TBD	TBD

2.9 ISSUES

- B Plant needs to be provided the time duration between deactivation completion and start of D&D. If this period is long enough, renovation to the facilities may be needed to maintain the ES&H envelope.
- B Plant can not complete deactivation until the critical WESF support systems are replaced and the systems in the two facilities are physically isolated from each other. Therefore, providing the critical support systems to WESF is included in the B Plant deactivation scope of work.
- Minimal decontamination is currently planned for the highly radioactive structure, process equipment, and existing canyon filter system. Therefore, an active ventilation system is required to ensure containment. If a passive ventilation system is desired, the highly radioactive structure must be decontaminated.
- The acceptance criterion for transfer of B Plant to the D&D contractor have not been completely defined. The determination of responsibilities, the end-point criteria, and the activities to be performed and the interfaces are not clear.

3.0 REFERENCES

[1] WHC-EP-0722, Rev. 0; January 1994; "System Engineering Functions and Requirements for the Hanford Cleanup Mission: First Issue"; Westinghouse Hanford Company.

[2] WHC-SD-WM-PHA-008, Rev. 0; August 1993; "B Plant Preliminary Hazards Analysis"; Westinghouse Hanford Company.

[3] 9453650 ATTACHMENT Draft, May 25, 1994, "Hanford Site Systems Engineering Manual"; Westinghouse Hanford Company.

[4] WHC-SD-WM-ZBB-001, Rev 0; March 1, 1994; " B Plant Complex Zero Based Budget"; Westinghouse Hanford Company.

[5] EM-40, Draft; Decontamination and Decommissioning Guidance Document; USDOE.

[6] SD-WM-SAR-005, Rev. 11A; Sept. 22, 1993; "Waste Encapsulation and Storage Facility Safety and Analysis Report"; Rockwell International, Hanford Operations.

[7] WHC-SD-WM-PRS-011, Rev 0; Oct. 20, 1993; "B Plant Cleanout and Stabilization Program Update FY 1993"; Westinghouse Hanford Company.

[8] WHC-SD-WM-AP-023, Rev. 0; Jan. 15, 1993; " B Plant Cleanout and Stabilization Program Plan"; Westinghouse Hanford Company.

[9] WHC-SD-HT-RPT-001, Rev. 0; Westinghouse Hanford Company.

4.0 GLOSSARY

This section contains the definition of some words and phrases found in this document.

active	This term describes the operational status of a process or facility. When a facility is active, it is currently operating for scheduled for operation.
deactivation	The transition of facilities to a state where the buildings, chemical processing systems and infrastructure are placed in a long-term, low cost, minimum surveillance and maintenance, safe condition and are ready for D&D. A facility enters deactivation when the need for a facility to fulfill its current mission does not exist.
D&D	D&D is decontamination and decommissioning and is performed when no other missions are identified. The objective of D&D is to place the site in a long-term radiologically safe condition. Dismantling and decontamination, mothball for later dismantlement and entombment are all D&D options.
ER	ER is Environmental Restoration. It is an activity contracted to the ER Contractor. They will perform D&D of facilities.
infrastructure	<p>Facility are the physical portions of the facility that are implicit to the function of the activities in the structure, such as the heating ventilation, electricity etc.</p> <p>Includes all utility, support and other service systems that interfere with a particular facility complex. Within a facility complex ancillary facilities and structures provide infrastructure support to the main facility.</p>
resources	Buildings, equipment, people, materials and chemicals.
shut down	Shut down is a safe, minimal cost surveillance state awaiting D&D where materials are either safely stored and maintained in place, removed as waste or transferred for beneficial use.

stabilize	The action of chemically treating the material, physically repackaging the material or adequately containing it by sealing or removing the contamination making it less hazardous.
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