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   Distribution

3. From: (Originating Organization)  
   WESF Capsule Management Team

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   WESF Decoupling Project

   Engr.: K.A. Jennings-Mills/M.L. Johnson/L.D. Brist

7. Purchase Order No.:  
   N/A

8. Originator Remarks:  
   This document describes the functions and requirements for  
   design and construction of the WESF liquid effluent  
   monitoring system.

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   N/A

10. System/Bldg./Facility:  
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    1/10/97

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   (see WHC-CM-3-5, Sec.12.7)

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18. Signature of EDT Originator  
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19. Authorized Rep. Date for Receiving Organization  
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Functions and Requirements
Document B Plant/WESF Decoupling
Project Liquid Effluent Control System

Mark L. Johnson
Fluor Daniel Northwest, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

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Abstract: This document gives the functions and requirements to perform design and construction of the new B Plant Chemical Sewer effluent monitoring system.
FUNCTIONS AND REQUIREMENTS DOCUMENT
B PLANT/WESF DECOUPLING PROJECT
LIQUID EFFLUENT CONTROL SYSTEM

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Date
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GLOSSARY

ALARA as low as reasonably achievable
BAT/AKART best available technology/all known, available, and reasonable methods of prevention, control and treatment
BCE B-Plant Chemical Sewer
DCS Distributed Control System
DOE U.S. Department of Energy
Ecology Washington State Department of Ecology
EPA U.S. Environmental Protection Agency
FPMCS Facility Process Monitoring Control System
FDNW Fluor Daniel Northwest
HVAC Heating, ventilation, and air conditioning
QA quality assurance
QAPP Quality Assurance Program Plan
RL U.S. Department of Energy, Richland Field Office
TEDF Treated Effluent Disposal Facility
WESF Waste Encapsulation Storage Facility
WHC Westinghouse Hanford Company
WPMCS WESF Process Monitoring Control System
1.0 INTRODUCTION

This document provides the functions and requirements to design an effluent monitoring system for the B Plant Chemical Sewer (BCE). This function is currently being accomplished by instrumentation in the 211-BA facility and a distributive control system in 271-B. These two facilities are scheduled to be deactivated by the end of fiscal year 1998, therefore a new instrumentation and monitoring system is required to support the continuing mission of the 225-B Waste Encapsulation Storage Facility (WESF).

1.1 BACKGROUND

The WESF Decoupling Project provides replacement systems for services currently provided by B Plant, allowing WESF to operate independently of B Plant. B Plant is scheduled to be deactivated by the end of Fiscal Year 1998, beyond which WESF has a continued mission for storage of cesium and strontium capsules. Because of this continuing mission there will be effluent streams from this facility. These streams flow into the BCE and eventually into the Treated Effluent Disposal Facility (TEDF).

Currently the 211-BA facility provides pH monitoring, flow measurement, and proportional flow composite sampling for the BCE. These process values are electronically transmitted to the B Plant Distributive Control System and the Effluent Treatment Facility (ETF) control room. The 211-BA facility is scheduled to be deactivated by the end of Fiscal Year 1998, however, WESF will require these BCE monitoring functions after deactivation.

The purpose of this project is to replace and relocate the effluent monitoring equipment from 211-BA to another location. The function of the 211-BA BCE monitoring control system will be moved from the B Plant Facility Process Monitoring Control System (FPMCS) (Bailey Net 90) to the WESF Process Monitoring Control System (WPMCS) (Bailey Infi 90). Electrical power, currently supplied from B Plant, will be provided from another source.

1.2 SITE, FACILITY, AND SYSTEM DESCRIPTION

The B Plant complex consists of several facilities (see Figure 1). Of interest for this project are the 225-B WESF and the 211-BA facility.

The 225-B WESF was completed in 1974 and is attached to the west end of the 221-B canyon building. This facility was constructed to encapsulate and store cesium and strontium obtained from B Plant processing. The encapsulation mission was completed in 1985. Currently the WESF facility is used to store cesium and strontium capsules under water in pool cells. Liquid waste streams generated at the facility, with a low risk of radioactive contamination, flow to the BCE (see figure 2) and then to 211-BA.
Figure 1. B Plant/WESF Facility Site Plan
Figure 2. Chemical Sewer Flow Diagram (H-2-82967)
The 211-BA Facility provides pH monitoring, total flow measurement, and flow sampling for the BCE. The system consists of a pump station (211-BA-151), which intercepts the BCE flow downstream of manhole 14 and pumps the effluent to the 211-BA Facility where the stream flows into four parallel neutralization units (see Figure 3). The effluent then flows through the system to TEDF via pump station 2. The process monitoring signals generated in 211-BA are transmitted to the B Plant FPMCS and from there process information such as flow rate and pH are sent to the TEDF DCS via a modem connection.

The 200 Area TEDF is composed of the piping system, along with supporting structures, components, and instrumentation which begins at the generating facility/200 Area TEDF interface (manhole F-1 for WESF) and ends at the 200 Area TEDF disposal ponds. Because the 200 Area TEDF does not have any treatment or retention capacity, strict control of all effluent sources at the generating facility interface is essential to operate the 200 Area TEDF.

1.3 PURPOSE AND NEED

The purpose of this document is to provide the baseline scope, design requirements, codes and standards, administrative requirements, and regulatory requirements for this project. The object of this project is to provide the necessary changes to the effluent monitoring system to allow WESF to operate once B Plant is deactivated. This document will address the requirements in such a manner as to allow a technical baseline to be incorporated into a definitive design.

1.4 SCOPE

The scope of this project includes the following items. A detailed description of the design basis for these items is provided in Section 2.0 of this document. The modifications to the effluent monitoring system include:

- Installation or relocation of a flow totalizer, pH monitor, and a proportional flow composite sampler to monitor the BCE.
- Install a method of communication between the process monitoring equipment and the WPMCS (Bailey Infi 90).
- Installation of weather enclosure to house the instrumentation and communication equipment.
- Install a means of communication between the WPMCS and the TEDF Distributive Control System (Micon Open A/S).
- Relocation of service power as required to support the new installation.
Figure 3. 211-BA Facility Layout
Modification of Pool Cell 9 and 10 discharge piping to allow sampling and recirculation.

In addition to the above, this project also includes installation of support equipment and systems to provide the functions necessary to ensure that compliance with applicable codes and standards listed in Section 6.0

1.5 ASSUMPTIONS

Effluent will flow directly through the pump station and bypass the 211-BA facility.

The 211-BA facility is being deactivated and will not be available for this project.

All B Plant sources to the BCE will be isolated and deactivated as part of B Plant deactivation.

2.0 FUNCTIONAL CRITERIA

This project shall provide the necessary systems, components, facility modifications and buildings to meet the requirements of TEDF to monitor the BCE. The project shall incorporate commercially available equipment and technologies, wherever practical. The use of technologies which are not currently used by private industries shall be minimized. The project will be designed to meet the applicable 99 sections and Division 13 of DOE Order 6430.1A (DOE 1989b).

2.1 SITE LOCATIONS

The upgrades will be performed at the B Plant/WESF facility in the 200 East Area of the Hanford Site. Modifications and additions required for design and construction of this project will be near the 211-BA-151 pump station, manhole 14 and the WESF pool cell area in 225-B.

2.2 DESIGN BASIS

Requirements established by the TEDF "Interface Control Document (Project W-049H)", WHC-SD-W049H-ICD-001, Rev. 3, require the BCE monitoring functions to include, flow totalization, pH monitoring, and proportional flow composite sampling. Pool Cells 9 and 10 require beta/gamma sampling and analysis prior to discharge because of their potential for radioactive contamination.

The new effluent monitoring system will be designed to monitor the waste streams from WESF identified in Table 1. These streams accumulate and flow into manhole 14 and 211-BA-151 pump station. Effluent will then gravity flow through the 211-BA-151 pump station to TEDF. Instrumentation sensors and flow measurement equipment should be
installed at or near this location. Associated cables and sample tubes shall be routed to the weather enclosure where the instrumentation equipment is located.

Output from these instruments shall communicate to the WPMCS. The WPMCS shall be reconfigured to communicate with the TEDF DCS without the use of the B Plant FPMCS.

A new electrical power source to the weather enclosure and instruments will be provided by existing overhead lines that are to remain in service after B Plant deactivation.

2.3 OPERATING CONDITIONS

The effluent stream will have a specific gravity of approximately 1 with a temperature range of 4.0 °C to 50 °C. The flow rate will vary between 0 and 200 gpm.
### Table 1 Description of Effluent Sources to BCE

<table>
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<th>EXISTING SOURCE/DESCRIPTION</th>
<th>ESTIMATED FLOW</th>
<th>SOURCE DESCRIPTION</th>
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<td>WESF Compressors cooling water</td>
<td>8-16 gpm for aftercooler</td>
<td>after-cooler operation is needed during summer months</td>
</tr>
<tr>
<td>Storm Drains - 4 total</td>
<td>Up to 200 gpm</td>
<td>storm water and snow melt</td>
</tr>
<tr>
<td>WESF Chiller Cooling and waste heat loops</td>
<td>water is drained and replaced every couple of years</td>
<td>propylene glycol and water mixture on two closed loops.</td>
</tr>
<tr>
<td>WESF Fluid Cooler</td>
<td>2 - 4 gpm blowdown stream</td>
<td>fluid cooler blowdown stream during cooling season, currently stream has no chemical treatment</td>
</tr>
<tr>
<td>WESF Pool Cells 9 and 10</td>
<td>280,000-300,000 gallons per year. Approx. pumping rate is 30 gpm</td>
<td>this source is composed of steam condensate and leaks from pool cell circulation pumps</td>
</tr>
<tr>
<td>WESF Tank 210 Deionized Water Storage Tank</td>
<td>50 gpm</td>
<td>tank is drained occasionally for cleaning.</td>
</tr>
<tr>
<td>WESF Deionized Water System Back flush Drain</td>
<td>10 - 20 gallons per week</td>
<td>weekly 10 minute sanitary water backflush of the Prefilter for the deionizer.</td>
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2.4 PROJECT INTERFACES

Any necessary design and construction required for this effort shall be coordinated and integrated with WESF and the 200 Area TEDF. Instrumentation design needs to interface with the WPMCS (Bailey Infi 90) and the TEDF Distributive Control System (Micon Open A/S). Project W-452 installed the Bailey Infi 90 DCS at WESF. The configuration of this DCS needs to be modified so the system will transmit the 225-BG signals (Project W-252) and the new effluent signals to the TEDF DCS. Software changes to the WPMCS will be coordinated with the Bailey Systems Engineer.

2.5 DESIGN AND OPERATING LIFE

This project shall have a useful operating life of at least 20 years. Where a 20 year design life cannot be reasonably expected, readily replaceable components shall be used.

3.0 PROCESS DESIGN CRITERIA

3.1 PIPING

Piping systems shall be provided to meet the functional requirements of this project. System piping shall be constructed in accordance with applicable regulatory requirements and codes specified during detailed design. Piping system materials of construction shall be compatible with waste stream characteristics and intended service.

All piping shall be designed to drain freely with features incorporated for repair of failures. Pipe systems will use gravity flow, whenever practical, and be designed to minimize accidental accumulation of contaminants.

3.2 INSTRUMENTATION AND CONTROLS

Instrumentation shall be provided to meet the functional requirements of this project. The following instruments are required for monitoring of the BCE effluent streams prior to their tie-in to the TEDF system.

- pH Monitoring
- Proportional Flow Composite Sampling
- Total Flow Monitoring

The instrument signals shall be transmitted from the instrument enclosure to the WPMCS.

Surplus instruments located at the 211-BA facility should be considered
for this activity if possible. If surplus instruments are used then they shall be removed in a workmanship like manor.

3.3 TELECOMMUNICATIONS AND DCS CONFIGURATION

The current Micon driver that enables the B Plant FPMCS to communicate with the Micon DCS at TEDF will be moved to the WPMCS. The existing modem at B Plant will be abandoned and a new modem will be utilized at WESF (see Figure 3).

Due to the addition of the new process signals, new analog and discrete cards for the WPMCS are required as part of this project.

Programming and configuration of the B Plant Net 90 and the WESF Bailey Infi 90 are also part of this project.

4.0 FACILITY DESIGN CRITERIA

4.1 CIVIL/STRUCTURAL

4.1.1 Civil/Structural Design Requirements

The auxiliary equipment, instrumentation monitoring equipment, and components shall be housed in buildings, structures, enclosures, or otherwise designed to withstand the Hanford Site environment. These structures shall be designed and constructed to withstand the loads as defined in Fluor Daniel Northwest Architecture/Civil Standard GC-Load-01 Rev. 3.0, “Design Loads for Facilities”.

4.2 HEATING, VENTILATION, AND AIR CONDITIONING

The addition or modification of an HVAC system, if required shall comply with the appropriate requirements of DOE Order 6430.1A, Section 1550 (DOE 1989b). The HVAC system shall be designed such that the process equipment/instrumentation operates within the manufacturers’ environmental constraints and so the proportional flow composite sample does not freeze.

4.3 UTILITIES

The project shall take full advantage of existing utilities and site services wherever practical.

4.4 LIGHTING

Lighting shall be provided at equipment locations where operations and maintenance activities are required.
Figure 4. Control Signal Block Diagram
4.5 ELECTRICAL

Due to the future deactivation of B Plant, a new electrical power source for the Liquid Effluent Control System shall be provided. The electrical design shall comply with DOE Order 6430.1A and the National Electrical Code (NFPA 70-1996).

4.6 MAINTENANCE

Ease of maintenance will be a design goal. Access will be provided for all process and ancillary equipment, and piping for regular maintenance, repair, and replacement. Replacement of equipment or piping will occur with minimal relocation or removal of other equipment and piping. Regular maintenance, repair, and replacement will be completed in a manner to minimize cost of disassembly and interruption of service.

4.7 FIRE PROTECTION

Fire protection, if required by this project, shall be designed and constructed to the applicable requirements of the National Fire Protection Association, DOE Orders 5480.7A and 6430.1A, and RL Implementing Procedure 5480.7 (RLIP 1990).

5.0 GENERAL REQUIREMENTS

5.1 SAFETY

5.1.1 Safety Classification

Structures, systems, and components (SSCs) for this project are designated as General Service per WHC-CM-4-46, Safety Analysis Manual. Design shall meet the requirements of this designation. All new instruments must be reviewed by WESF for inclusion into the Safety Equipment List (WHC-SD-WM-SEL-008).

5.1.2 Safety Criteria

The project design shall ensure that no single credible component failure shall result in unacceptable safety consequences. Unacceptable safety consequences are:

- Fire or explosion
- Rapid loss of pool cell water

5.1.3 Operation Risks

All electrical, mechanical, and instrument systems shall be designed to
ensure a prompt and safe shutdown in the event of a failure. Alarms shall be provided on systems or components to prevent operation in a manner that may affect safety or be detrimental to the equipment. Systems required for environmental control, safety, and/or critical processes (where recovery of operations would be expensive and/or hazardous) shall be provided with redundant or backup systems. Human factors engineering shall be used throughout the design to minimize the chance of operator error.

5.1.4 Construction Risks

Risks associated with construction activities are to be considered by the design; all applicable standards and regulations shall be complied with during construction. Safety precautions shall be provided for, but not limited to, the following items:

- Construction hazards may be created during the construction of new systems. Field operations shall be conducted in conformance with required safety rules and regulations, applicable DOE and RL Orders, and industry accepted practices to ensure a safe working environment.

- Where construction is to be performed within existing facilities, or on existing systems, pre-job safety plans shall be prepared to ensure that any potential hazards have been identified and appropriated precautions taken to minimize personnel exposure or risk.

5.2 SAFEGUARDS AND SECURITY

The Liquid Effluent Control System project will be in the 200 Area of the Hanford Site. Design and construction activities will comply with the requirements of DOE Order 6430.1A (DOE 1989b), Fluor Daniel Hanford security procedures, and an approved security plan. Existing safeguards and security measures will not be impacted by this project. No new measures beyond the current practices for entry into the B Plant/WESF area will be required.

5.3 NATURAL FORCES

The facility structures shall comply with the criteria defined in Fluor Daniel Northwest Architecture/Civil Standard GC-Load-01 Rev. 30, "Design Loads for Facilities".

5.4 QUALITY ASSURANCE

Quality assurance (QA) activities for all contractors involved in the design, construction, testing, and inspection of the proposed project shall be formulated and executed through the use of a project-specific Quality Assurance Program Plan (QAPP). The QAPP shall establish QA program requirements used for verification, inspection, and testing
activities. The QAPP shall provide the means to ensure the facility complies with program requirements; the project plans and specifications are adequate; and tests and inspections are sufficient to confirm the adequacy of design and the quality of construction and manufactured components. The quality assurance program requirements will be in accordance with DOE Order 6430.1A, 140, “Quality Assurance;” DOE Order 5700.6C, Quality Assurance (DOE 1991b); and WHC-CM-4-2, Quality Assurance Manual.

5.5 CONFIGURATION CONTROL

As-Built drawings for the Liquid Effluent Control System, including modifications to the affected facilities, shall be provided by this project. Existing drawings, ECNs to existing drawings, and project drawings shall be consolidated to the extent practical to enhance facility configuration. New project drawings shall be created only if an existing drawing does not exist. Drawings provided shall be verified after completion of construction as “as-built”.

6.0 CODES AND STANDARDS

Design criteria for the Liquid Effluent Control System are to be based upon the applicable provisions of DOE Order 6430.1A and DOE Order 5400.1.

The following list identifies the appropriate codes, standards, regulations, guidelines, orders, etc., which are not defined within DOE Order 6430.1A. Revisions to codes and standards during the project shall be administered by the project with assessments prepared to identify the impact of these revisions. Impacts shall be managed in accordance with DOE, contractor, and project-specific requirements and procedures.

- DOE Order 5480.7A, Fire Protection (DOE 1993)
- HNF-CM-5-6, B Plant Administration Manual
- HNF-IP-1182, B Plant/WESF Conduct of Operations
7.0 REFERENCES


Note: WHC designator may be changed to HNF in the future.