ADVANCED CONCEPTUAL DESIGN REPORT
PHASE II LIQUID EFFLUENT TREATMENT
AND DISPOSAL
PROJECT W-252

January 31, 1995

Work Performed Under Contract No. DACW68-94-D-002
Delivery Order 10

Prepared for
U.S. Department of Energy
Richland Operations Office
Richland, Washington

Prepared by
DEPARTMENT OF THE ARMY
Walla Walla District, Corps of Engineers
Walla Walla, Washington 99362-9265

MONTGOMERY WATSON
Richland, Washington

STONE AND WEBSTER ENGINEERING CORP.
Richland, Washington

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7. Abstract

This Advanced Conceptual Design Report (ACDR) provides a documented review and analysis of the Conceptual Design Report (CDR), WHC-SD-W252-CDR-001, June 30, 1993. The ACDR provides further design evaluation of the major design approaches and uncertainties identified in the original CDR. The ACDR will provide a firmer basis for the both the design approach and the associated planning for the performance of the Definitive Design phase of the project.

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ADVANCED CONCEPTUAL DESIGN REPORT

FOR

PHASE II LIQUID EFFLUENT
TREATMENT AND DISPOSAL

PROJECT W-252

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TABLE OF CONTENTS

	Page No.
ACRONYMS	iv
I. INTRODUCTION	1
II. SUMMARY	3
III. JUSTIFICATION	7
IV. DESCRIPTION OF PROJECT SCOPE	8
A. 242-A Evaporator	8
B. 244-AR Vault	13
C. 241-A Tank Farm	15
D. B-Plant/WESF	17
E. 284-E Powerhouse	23
F. 282-E Raw Water Reservoir	28
G. 283-E Water Treatment Facility	29
V. METHODS OF PERFORMANCE	42
A. Off-Site Architect/Engineer Work	42
B. On-Site Architect/Engineer Work	42
C. Procurement	42
D. Construction Work by On Site Contractor	42
E. Construction Work by Off Site Contractor	42
F. Work by Operating Contractor	42
VI. REQUIREMENTS AND ASSESSMENTS	43
VII. IDENTIFICATION AND ANALYSIS OF UNCERTAINTIES	44
A. 242-A Evaporator	45
B. 244-AR Vault	45
C. 241-A Tank Farm	45
D. B-Plant WESF	47
E. 284-E Powerhouse	48
F. 283-E Water Treatment Facility	49
OUTSTANDING ITEMS TO BE RESOLVED DURING DEFINITIVE DESIGN	49
VIII. REFERENCES	54

LIST OF TABLES

Table 1	Design Criteria	31
Table 2	200 East Area PTECS Projected Flow Rate	46

LIST OF APPENDICES

Appendix A	W-252 Wet Surface Fluid Cooler Freeze Protection Measures, Location and Orientation
Appendix B	W-252 Resolution of 242-A Open Items
Appendix C	W-252 Resolution of B-Plant/WESF Open Items
Appendix D	W-252 Alternate Fluid Cooler Location - 242-A Evaporator
Appendix E	W-252 Alternative Cooling Water System Design - 284-E Powerhouse
Appendix F	W-252 Monitoring Instrumentation Review
Appendix G	B-Plant and 242-A Evaporator Liquid Effluent Radiation Monitoring Equipment
Appendix H	W-252 Value Engineering Study
Appendix I	W-252 Resolution of Miscellaneous Open Items
Appendix J	W-252 Evaluation of Procurement of Long Lead Items
Appendix K	Contract Administration
Appendix L	Draft Specifications
Appendix M	Cost Estimate
Appendix N	Construction Schedule
Appendix O	Drawings

ACRONYMS

ACD	Advanced Conceptual Design
AKART	all known, available, and reasonable methods of prevention, control, and treatment
ALARA	as low as reasonably achievable
BAT	best available technology
CaCO ₃	calcium carbonate
CDR	conceptual design report
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
Ecology	State of Washington Department of Ecology
EPA	U.S. Environmental Protection Agency
ES	engineering sketch
FDC	functional design criteria
ft	feet
gal	gallons
gpd	gallons per day
gph	gallons per hour
GPLI	general purpose LAN interface
gpm	gallons per minute
hp	horsepower
HPS	Hanford Plant Standards
HVAC	heating, ventilating, and air-conditioning
KEH	Kaiser Engineers Hanford Company
LAN	Local Area Network
lbs	pounds
LCU	local control unit
LOI	local operator interface
MCC	motor control center
MCS	Monitoring Control System
mg/l	milligrams per liter
mm	millimeters

NEMA	National Electrical Manufacturers Association
NFS	Nuclear Fuel Systems, Inc.
NTU	nephelometric turbidity units
OI	Open Items
P&ID	Process and Instrumentation Diagrams
psig	pounds per square inch gauge
PTC	Project Time and Cost, Inc.
PTECS	Phase II Effluent Collection System
PVC	polyvinyl chloride
QAPP	Quality Assurance Program Plan
RL	U.S. Department of Energy, Richland Operations Office
RLIP	RL Implementing Procedure
SOW	Statement of Work, USACE Delivery Order No. 10, dated 18 July 1994
sq ft	square feet
SWEC	Stone and Webster Engineering Corporation
TEDF	Treated Effluent Disposal Facility
TI	Texas Instruments
TPA	Tri-Party Agreement
WAC	Washington Administrative Code
WBS	Work Breakdown Structure
WESF	Waste Encapsulation and Storage Facility
WHC	Westinghouse Hanford Company
WSFC	Wet Surface Fluid Cooler
WTF	Water Treatment Facility

I. INTRODUCTION

This introduction is the same as included in the Conceptual Design Report (CDR) and is repeated herein as a reference. Changes from the CDR text are shown in italics.

"Hanford Site liquid wastes from the 100 and 200 Areas, including cooling water, steam condensate, raw water, and sanitary wastewater, have historically been discharged directly to the soil column as a method of treatment or retention. It is the current policy of the U.S. Department of Energy (DOE) to discontinue this practice at the earliest practical time and to treat, minimize, or eliminate the existing waste streams. This includes ensuring that discharges of radioactive and nonradioactive materials to the environment meet applicable regulatory requirements and that these discharges are as low as reasonably achievable (ALARA).

"In support of this policy, DOE entered into an interagency agreement with the Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA). This accord is known as the "Hanford Federal Facility Agreement and Consent Order" and is commonly referred to as the Tri-Party Agreement (TPA) (Ref 1). The DOE published a plan and schedule (Ref 2) to discontinue the disposal of contaminated effluent into the soil column at Hanford. The plan and schedule document contains a strategy for implementing alternative treatment and disposal systems for each of the major waste streams discharged to the soil column. The plan ranks the waste streams into two priorities, Phases I and II, based on four criteria: radionuclide concentration, hazardous waste characteristics, reportable quantity of listed waste, and disposal facility life. Project W-252 will manage Phase II waste streams to partially satisfy TPA Milestone M-17-00B, "Complete Liquid Effluent Treatment/Facilities Upgrades for all Phase II Streams by October 1997". The balance of the work to satisfy the TPA milestone for the Phase II streams will be accomplished by other projects. Phase I streams are the higher priority and are also being managed under other projects.

"A key element of the plan to implement the waste treatment and minimization policy of DOE was to identify the waste streams and determine the best available technology (BAT)/all known, available, and reasonable methods of prevention, control, and treatment (AKART) for each stream. The technical guidance for implementation of BAT/AKART for the waste streams affected by project W-252 are identified in an engineering report (Ref 3). Functional criteria for implementation of BAT/AKART are described in the project functional design criteria (FDC) (Ref 4). The facilities affected by project W-252 are as follows:

- 200-East Area
 - 242-A Evaporator.
 - 241-A Tank Farm.
 - 244-AR Vault.

- B-Plant including the Waste Encapsulation and Storage Facility (WESF).
- 284-E Powerhouse.
- 282-E Reservoir
- 283-E Water Treatment Facility (WTF).
- 183-D Water Treatment Facility (WTF) (*deleted from project*).

“Implementation of BAT/AKART requires the following:

- Design and installation of closed-loop cooling systems to eliminate discharges from once-through cooling systems.
- Installation of level instrumentation and controls to eliminate overflow from tanks.
- Installation of new treatment processes to clean water for the filter backwash systems so the water can be reused.

“Project W-252 will provide a 200-East Area Phase II Effluent Collection System (PTECS) for the waste water effluents remaining after BAT/AKART implementation and will connect to the project W-049H Treated Effluent Disposal Facility (TEDF) for final disposal. The BAT/AKART requirements will be implemented before the generating facilities will be allowed to discharge effluents into the 200-Area TEDF to ensure that no effluents above the TEDF acceptance criteria are released to that facility.”

II. SUMMARY

The first 1.5 pages of this summary are basically the same summary as included in the CDR and are repeated as a reference. Changes from the CDR are shown in italics.

"Modifications to the 242-A Evaporator, 244-AR Vault, 241-A Tank Farm, B-Plant/Waste Encapsulation and Storage Facility (WESF), 284-E Powerhouse, 282-E *Reservoir*, and 283-E Water Treatment Facility (WTF) are necessary to complete implementation of best available technology (BAT) all known, available, and reasonable methods of prevention, control, and treatment (AKART).

"Installation of enhanced monitoring and sampling systems is necessary to ensure that all remaining wastewater effluents are acceptable to discharge to the Treated Effluent Disposal Facility (TEDF). Instrumentation measuring the quality and flow rate of effluent from each facility to the TEDF is required for proper operation of the TEDF piping network.

"A description of the facility upgrades to be completed under project W-252 follows:

- **242-A Evaporator**

Waste streams will be controlled at the 242-A Evaporator by installing a closed-loop cooling system which will recirculate the cooling water from the evaporator condensers and use *some or all of* the steam condensate as makeup water for the cooling towers. Additionally, there will be a separate cooling system installed for the facility air compressors. The remaining waste stream will be routed through a new drain line to the TEDF for disposal.

- **244-AR Vault**

A new electrical vessel vent heater will be installed at the 244-AR Vault replacing the existing steam heater. Additionally, *the facility air compressors will be repiped to share a common cooling system.* The minor waste streams for the heating, ventilating, and air-conditioning system, an eyewash station, and backflow preventors will be collected and routed to TEDF for disposal. *(Note: The majority of this facility may be descope from the definitive design; the connection to TEDF will be the only item constructed.)*

- **241-A Tank Farm**

The BAT/AKART for the 241-AY and AZ Tank Farms cooling water will be implemented through project W-030. Drainage from the *existing* cooling towers will be the only remaining waste stream from the 241-A Tank Farm. Project W-252 will provide all equipment necessary to sample, monitor, and discharge the cooling tower waste stream to the TEDF.

- **B-Plant/WESF**

The waste streams at B-Plant/WESF will be controlled by installing a closed-loop cooling system that will recirculate cooling water from the WESF storage pools and process cells heat exchangers. Water from the WESF pool flush system will be collected and pumped to

the *wet surface fluid coolers* for makeup water. The *overflow from the wet surface fluid coolers* will be routed through a new drain line to the TEDF for disposal.

- **284-E Powerhouse**

The wastewater from the 284-E Powerhouse will be controlled by installing a closed-loop cooling system that will recirculate the cooling water for specific pieces of equipment in the powerhouse. Additionally, new surge tanks will be installed to collect the blowdown from the boilers and the ion exchange columns. The overflow from the *wet surface fluid coolers* and the boiler blowdown will be routed to the TEDF through a system of new and existing pipes.

- **283-E Water Treatment Facility (WTF)**

The backwash waste and waste from the settling basins at the 283-E WTF will be collected and pumped through a new system. This system will be designed to remove solids which will be dried in new drying beds and disposed of according to regulations. The supernatant will be returned to the 283-E WTF. The waste streams from overflow of the 282-E Reservoir and the 283-E Clearwell will be eliminated by installing level control equipment. All *major* waste streams will be eliminated; *a connection to the TEDF will be provided for minor waste stream such as sink and floor drains.*

- **183-E Water Treatment Facility**

This facility was removed from the project.

“Project W-252 is a fiscal year 1995 Line item.”

The 90% ACD Report includes 11 Engineering Reports and updated specifications and drawings from the CDR. The engineering reports and drawings are included in the Appendices. The following is a brief description of the contents of each Appendix:

- Appendix A includes the report entitled “W-252 Wet Surface Fluid Cooler Freeze Protection Measures, Location and Orientation”. This report is prepared in accordance with Statement of Work (SOW) item 10.2.3.1 and Open Items (OI) List item 3. This Report summarizes the preliminary evaluations as to type of cooler, freeze protection measures, suggested locations and orientations of cooler at each location.
- Appendix B includes the report entitled “W-252 Resolution of 242-A Open Items”. This report was prepared in accordance with SOW item 10.2.3.2 and OI 5, 8, 9, 16, 18, 21, 23, 24, 25, and 29. This report responds to all the OI items for the 242-A Evaporator.
- Appendix C includes the report entitled “W-252 Resolution of B-Plant/WESF Open Items”. This report was prepared in accordance with SOW item 10.2.3.3 and OI 15, 19, and 22. This report responds to all the OI items for the B-Plant/ WESF.

- Appendix D includes the report entitled "W-252 Alternate Fluid Cooler Location - 242-A Evaporator". This report was prepared in accordance with SOW item 4.2.3.a in response to suggestions from the 242-A Evaporator personnel.
- Appendix E includes the report entitled "W-252 Alternative Cooling Water System Design - 284-E Powerhouse", this report was prepared in accordance with SOW item 4.2.3.a in response to suggestions developed at the Criteria Review Committee meeting on use of the 282-E Reservoir for cooling of the powerhouse water.
- Appendix F includes the first of two Instrumentation Reports and is entitled "W-252 Monitoring Instrumentation Review". This report was prepared to meet the requirements of SOW item 10.2.3.4.a, b, c, and e and OI 2, 6, 7, 10, 11, 12, and 20. This report summarizes the meetings of the Montgomery Watson instrumentation with interested WHC employees to discuss the Process and Instrumentation Diagrams (P&IDs) and the OI issues.
- Appendix G includes the second of two Instrumentation Reports and is "B-Plant and 242-A Evaporator Liquid Effluent Radiation Monitoring Equipment". This report was prepared to meet the requirements of SOW item 10.2.3.4.d and OI 13 and 14.
- Appendix H includes the report entitled "W-252 Value Engineering Study". This report was prepared to meet the requirements of SOW 4.1.d and 4.2.1.d. This report provides the results of the Value Engineering Study and makes a number of recommendations for further study. All the recommendations have been accepted by WHC and included in the ACD evaluations.
- Appendix I includes the report entitled "W-252 Resolution of Miscellaneous Open Items". This report was prepared to respond to the Open Items that were not discussed in other reports. These include OI 1, 4, 17, 26, 27, and 28.
- Appendix J includes the report entitled "W-252 Evaluation of Procurement of Long Lead Items". This report was prepared to respond to SOW item 4.2.d and summarizes the evaluation of items which need to be procured outside the General Construction contract.
- Appendix K includes the report entitled "Contract Administration". This report was prepared in accordance with SOW item 4.2.g and summarizes the evaluation regarding contract administration and sole source procurement for this project.
- Appendix L includes draft specifications. For ease of review, these specifications were prepared by hand correcting the version of the specification that were contained in the CDR.
- Appendix M includes the Cost Estimate

- Appendix N includes the overall Construction Schedule.
- Appendix O includes 43 drawings that show the design concept included in the 90% ACD submittal.”

III. JUSTIFICATION

This justification is the same as that included in the CDR and is repeated here as a reference.

"Liquid effluents from various 100 and 200-Area process facilities are currently discharged to the Hanford soil column for retention of suspended solids and dissolved radionuclides. Current environmental statutes and policies dictate that this practice be discontinued at the earliest possible date and be replaced with systems for source control, recycling, waste minimization, and treatment.

"The U.S. Department of Energy, Richland Operations Office (RL) published a plan and schedule in 1987 outlining a strategy for implementing alternate waste treatment and disposal systems for the waste streams currently discharged to the soil column at the Hanford Site. These waste streams have been prioritized into either Phase I or II categories. Project W-252 will implement BAT/AKART for some of the Phase II streams including treatment, minimization, or elimination of the waste streams and will route the remaining effluents to the TEDF for disposal. Project W-252 is part of the plan and schedule to satisfy this milestone of the TPA enacted between RL, Ecology, and the EPA for Hanford wastes.

"It is the policy of DOE to conduct operations in a safe, cost-effective, and environmentally sound manner. This includes ensuring that discharges of radioactive and nonradioactive wastes to the environment meet applicable regulatory requirements and that discharges are ALARA. Project W-252 will ensure adherence to this policy and compliance to applicable Federal and State regulations."

IV. DESCRIPTION OF PROJECT SCOPE

The facility upgrades designed and constructed under project W-252 will support implementation of BAT/AKART for wastewater discharges from the following facilities: 242-A Evaporator, 244-AR Vault, 241-A Tank Farm, B-Plant/WESF, 284-E Powerhouse, and 283-E WTF (including the 282-E Reservoir). This project will provide a 200-East Area PTECS for the wastewater effluent remaining after BAT/AKART implementation and will connect to the project W-049H TEDF for disposal. The BAT/AKART requirements will be implemented before the generating facilities will be allowed to discharge effluents into the 200 Area TEDF to ensure that effluents above the TEDF acceptance criteria are not released.

The remainder of the Description of Project Scope section of this advanced conceptual design report (ACD) is structured by facility.

A. 242-A EVAPORATOR

The basic approach to waste stream reduction contained in the ACD is consistent with the CDR in most respects, but some significant changes are being made. The heat sink equipment used on the closed-loop cooling system should be referred to as wet surface fluid cooler(s) rather than cooling tower(s). The 242-A system will use the steam condensate as the primary source of makeup water. Other waste streams to the TEDF will be minimized or eliminated. The normal raw water discharge from the air compressor/air dryer cooling water will be eliminated by installing a separate cooling system.

1. Improvements to Land

Site Work

Demolition or relocation of existing structures is not required at this facility. The CDR references to demolition or relocation in this section should be disregarded. No other changes to the CDR description of site work are needed.

2. Buildings

Local Control Unit/Support/Sampling Building

An insulated, pre-engineered 36 by 40 foot building will be provided. This building will serve multiple purposes. One room of the building will enclose the local control unit (LCU) and the electrical motor control center (MCC). It will also provide a fluid cooler chemical addition storage room. The third room will provide an enclosure for the fluid cooler piping equipment, including the pumps, expansion tank, and sampling equipment (see Engineering Sketch ES-252-ACD-42 in Appendix O).

- **Heating, Ventilating, and Air Conditioning**

The heating, ventilating, and air conditioning (HVAC) system will be designed to meet operating requirements during normal mode of operation. There will be a separate HVAC system for each side of the building. The HVAC systems will be designed for energy efficiency in accordance with the requirements of DOE Order 6430.1A. The design parameters are as shown in the CDR.

The ventilation for the pump room will be sized for the high heat load of the pumps.

Fabrication Shop Replacement Building

The Kaiser Engineers Hanford Company (KEH) Fabrication Shop Replacement Building will not be needed because the fluid coolers will not be located where the shop is located. Therefore, the CDR references pertaining to this structure should be disregarded.

3. Other Structures

One 600-gallon fuel storage tank is specified in the CDR. The requirement for this tank has been deleted.

4. Special Equipment and Processes

Fluid Coolers (Replaces CDR Section on Cooling Tower)

The fluid to be cooled will be circulated inside the tubes of the heat exchanger. The heat will flow from the process fluid through the coil tubes to the water outside which cascades downward over the tubes. Air is forced upward through the coil, evaporating a small percentage of the water. Sensible heat and the latent heat of vaporization are discharged to the atmosphere.

The remaining water will fall to the sump to be recirculated by the spray pump while water entrained in the air stream will be reclaimed and returned to the sump by mist eliminators at the fluid cooler air discharge. The CDR references in the Cooling Tower section to the surface coil, spray water pump operations, and sensible cooling via forced air are not relevant to the fluid coolers.

Pumps

The closed-loop cooling circulating pumps will be horizontal, single-stage pumps with mechanical seals, dynamically balanced impellers, and replaceable impeller and casing wear rings. The double-suction pumps will be of carbon steel construction.

Pumps will be powered by a National Electrical Manufacturer's Association (NEMA) electric motor designed for indoor operation.

Air Cooler (Replaces CDR Section on Chillers)

The process/instrument air compressors and after-cooler will be cooled using a separate closed-loop cooling water system. The primary heat sink for this system will be a small, dry surface air cooler designed to transfer heat from the cooling fluid to the air. The fluid to be cooled will be circulated inside the cooler tubes. Air will be forced upward through the cooler to dissipate heat to the atmosphere by sensible cooling.

A backup raw water heat exchanger will be installed for use when the outdoor dry bulb temperature is too high to provide acceptable cooling water temperatures to the air compressors.

Mechanical System Description

- **Evaporator Condenser Closed Loop Cooling System**

The E-C-1, E-C-2, and E-C-3 condenser cooling water effluent will be eliminated by modifying the existing once-through cooling system to a closed-loop cooling system. The proposed cooling water system will use a fluid cooler to remove waste heat from the evaporator condenser cooling water (see Engineering Sketch ES-252-ACD-10 through 14). Surge capacity will be provided by a surge/expansion tank. A separate chemical addition tank will be provided for addition of corrosion inhibitors to the closed-loop system. The design heat load of the cooling water system will be 30×10^6 Btu/hr.

Cooling water will be circulated using a 150-hp vertical in-line pump (the CDR showed it as 200 hp). A redundant pump will be installed to provide operating and backup capability. The pumps will be operated alternately. Each pump is capable of delivering 3,650 gallons per minute (gpm) at 100 feet of total head. Both pumps will be electrically powered.

The spray water of the proposed fluid cooler system will be sized to permit operation at two cycles of concentration. At two cycles of concentration, the fluid coolers will produce a maximum blowdown flow of approximately 87 gpm during the summer. The maximum amount of spray water evaporated will also be approximately 87 gpm during the summer. Based on summer operation, a maximum of 174 gpm of makeup water will be required for fluid cooler operation. However, during the winter the minimum makeup requirement to the coolers will be approximately 61 gpm. During the winter, the condensate production could exceed the makeup

requirement, requiring that the excess condensate be routed directly to the TEDF.

The required makeup water will be supplied to the fluid cooler from steam condensate collected in the 207-A basins. Makeup water will be supplied to the fluid coolers by the existing 207-A Transfer Pumps. A new 3-inch line will be installed from the discharge of the pumps to the fluid coolers and to the TEDF system.

If the required makeup water is not available from the 207-A basins, raw water will provide the required makeup water volume.

The fluid coolers, pumps, and tanks will be located as shown on Engineering Sketches ES-252-ACD-04 through 09. Freeze protection will be provided for the fluid cooler and piping system.

- **Air Compressor Closed-Loop Cooling System**

A new closed-loop cooling system will be installed for the compressors supplying process and instrument air to the 242-A Evaporator. The new system will supply cooling water to the CP-E-1 and CP-E-2 compressors and E-E-6 aftercooler. The primary heat sink for this system will be a small dry surface air cooler designed to transfer heat from the cooling fluid to the air (see Engineering Sketch ES-252-ACD-15).

In addition, a small water-to-water heat exchanger will be provided to supplement the air coolers with raw water when required to avoid exceeding the maximum allowable cooling water temperature. The supplemental heat exchanger will only be required when the ambient dry bulb temperature is extremely high, above approximately 105°F. When the heat exchanger is used, the raw water discharge of approximately 5 gpm will be routed to TEDF. The air cooler will be located outside the air compressor room. The circulating pumps, auxiliary equipment, and electrical starters will be located in a small building adjacent to the cooler.

To prevent overcooling of the air compressors, the need for a 3-way mixing valve will be evaluated during definitive design.

- **242-A Evaporator Cooling Water/Steam Condensate Collection System**

The ACD requires no changes for this section, except that the cooling water for the R-C-1 sampler/monitor will be changed to the closed-loop cooling water system, eliminating the raw water discharge.

- **HVAC Room Drain System**

The ACD does not change the recommendations of the CDR.

- **Turbine Building Steam System**

The ACD does not change the recommendations of the CDR.

Instrumentation System Description

The general features listed in the CDR for the instrumentation systems are correct, except that local monitoring and control will not be available through a local operator interface (LOI). At the request of the site personnel, LOI will not be installed at this location.

- **Instrumentation Systems**

The ACD does not change the recommendations of the CDR.

- **Instrumentation System Configuration**

LOI will not be required at this location. All controls will be programmed into the existing Texas Instruments, Inc. (TI) system. Interconnection of the field instrumentation sensors and LCU to the TEDF Monitoring Control System (MCS) is shown in Engineering Sketch ES-252-ACD-43. Engineering Sketches ES-252-ACD-10 through 16 show various instrumentation loops and interlocks. Otherwise, no changes to this section of the CDR are required for the ACD.

Standby Electrical Generator

The standby generator specified in the CDR for the 242-A Evaporator LCU building will not be provided.

Motor Control Center (MCC)

There will be a MCC located in the LCU/Support/Sampling Building (see Engineering Sketch ES-252-ACD-42). The MCC will be a free standing structure consisting of five vertical sections which contain combination motor controllers for the 150 hp circulation pumps, combination motor controllers for the fluid cooler sump pumps, a feeder circuit breaker for each of the fluid coolers, and a transformer and panelboard for the LCU/Storage Building.

The CDR Engineering Sketch ES-252-N1 shows the starters for the air compressor chiller, two circulation pumps, and a future steam condensation basin pump located

in MCC-2. This MCC has space for only one starter and one breaker. The future steam condensation basin pump will be moved to the new MCC in the LCU/Support/Sampling Building. A small MCC will be provided in the mechanical room for the air compressor chiller to power the chiller and the two circulation pumps. This MCC will be fed from a breaker installed in MCC-2.

Electrical System Description

Changes to the CDR include deletion of the requirement for the additional 1200 kW standby generator and associated automatic transfer switch (Zone E8 on CDR Engineering Sketch ES-252-N1). The four pan heaters shown being fed from MCC-2 will be relocated to the new MCC in the LCU/Support/Sampling Building. Also, all references to a cooling tower should be changed to fluid coolers.

Telecommunication System Description

This section will remain subject to modification in the Definitive Design phase. The nature of the telecommunication system will not be clearly defined until detailed technical specifications are developed during Definitive Design.

PTECS Description

No changes to the CDR are required for the ACD.

5. Demolition

The KEH fabrication shop will not be replaced and hence will not require the demolition described in the CDR.

B. 244-AR VAULT

The general description of the 244-AR Vault is unchanged from the CDR. Because no mission has been assigned to this facility, BAT/AKART may be descoped from this project. Existing waste stream discharge from the 244-AR Vault and the 241-A Tank Farm areas will be combined in a new 6 inch pipeline for discharge to a TEDF transfer line. The combined waste streams will be sampled and monitored at a single sample station with the LCU building just downstream of the junction of the waste streams.

1. Improvements to Land

The ACD does not change the recommendations of the CDR.

2. Other Structures

The ACD does not change the recommendations of the CDR.

3. **Special Equipment/Process Systems**

Vessel Vent Heater

The ACD does not change the recommendations of the CDR.

Heat Exchanger

The ACD does not change the recommendations of the CDR.

Pump

The ACD does not change the recommendations of the CDR.

Air Compressor Chiller

Instead of providing a new chiller for the second air compressor, both air compressors will be piped to use the existing air compressor chiller.

Metering Manhole

The flume used for measuring the flow rate will be installed in a manhole downstream of the junction of the waste streams from 241-A Tank Farm and the 244-AR Vault. Otherwise, the metering manhole will be as described in the CDR.

Mechanical System Description

The ACD does not change the recommendations of the CDR.

Miscellaneous Waste Streams

Existing waste streams from this facility will continue to discharge to the in-place collection piping. This will be intercepted at a manhole and routed in a new PTECS line to a sampling station (see Engineering Sketch ES-252-ACD-24). The remaining discussion in this section of the CDR is not changed.

Electrical

The existing electrical starters will be modified so that both air compressors cannot operate simultaneously.

Instrumentation System Description

Instrumentation systems at the 244-AR Vault will be limited to waste stream monitoring for the W-252 Project. The general features of the instrumentation systems are correct as specified in the CDR.

- **Instrumentation Systems**

Instrumentation systems to be provided are appropriate as described in the CDR, except that level monitoring and pressure monitoring will not be required.

- **Instrumentation System Configuration**

CDR Engineering Sketch ES-252-Y1 is being replaced by Engineering Sketch ES-252-ACD-43. CDR Engineering Sketches ES-252-Y8 and M7, sheet 1 and 2 are being replaced by Engineering Sketches ES-252-ACD-26, 27, and 28. Otherwise, the CDR configuration description is unchanged but applies only to parameters monitored at the sampling station and LCU Building.

A LOI will be provided at this location.

- **Compressor Closed-Loop Cooling**

The CDR recommended separate chillers on each of the two air compressors. The ACD changed that to combining the discharge of the two compressors to run through the existing chiller.

Telecommunication System Description

The CDR description of the telecommunication system is unchanged for the ACD.

PTECS Description

The CDR description of the PTECS system is unchanged for the ACD.

4. Demolition

No demolition will be required.

C. 241-A TANK FARM

The CDR description of the basic components of the Project W-252 modifications requires no changes.

1. **Improvements to Land**

Site Work

The CDR description of site work activities is unchanged.

2. **Buildings**

Local Control Unit Building

An insulated, pre-engineered, 16 by 16-foot building is required. This building will provide an enclosure for the LCU to serve both the 241-A Tank Farms and the 244-AR Vaults (see Engineering Sketch ES-252-ACD-41.)

The ACD will follow the LCU Building design parameters shown in the CDR including general structural requirements, HVAC, fire protection, and electrical.

3. **Utilities**

Electrical

No changes to the CDR are required in the ACD.

4. **Special Equipment/Process Systems**

Metering Manhole

The flume used to measure the combined flow rate of the 241-A Tank Farm and the 244-AR Vault areas will be installed in a manhole. The manhole and flume will be a packaged unit constructed of fiberglass reinforced plastic. The unit will be equipped with hatch cover and access ladder.

Standby Electrical Generator and Automatic Transfer Switch

The CDR discussion of the standby electrical generator is unchanged.

Instrumentation System Description

The description of instrumentation systems provided in the CDR remains essentially unchanged for the ACD. CDR Engineering Sketch ES-252-Y1 is replaced in the ACD by Engineering Sketch ES-252-ACD-43.

Telecommunication System Description

The telecommunication description in the CDR is unchanged in the ACD.

PTECS System Description

The PTECS system description in the CDR is unchanged in the ACD.

D. B-PLANT/WESF

The basic approach to waste stream reduction contained in the ACD is consistent with the CDR in most respects, but three significant changes are being made. The heat sink equipment used on the closed-loop cooling system should be referred to as wet surface fluid cooler(s) rather than cooling tower(s). The backup emergency well system will be disconnected. The backup emergency well system is not required because the design provides adequate capacity for a cooling system failure. The Stairwell #1 HVAC drainage will be routed to tank TK-10-1 instead of to the closed-loop cooling system.

1. Improvements to Land

Site Work

The fluid coolers will be located northwest instead of south of WESF. No changes to the CDR Site Work description are proposed in the ACD.

2. Buildings

LCU/Storage/Support Building

An insulated, pre-engineered 36 by 40 foot building will be provided. This building will serve multiple purposes. One room of the building will provide an enclosure for LCU, MCC, and electrical transfer switch. Another room will provide an enclosure for the fluid cooler chemical addition equipment and a storage area. The third room will provide an enclosure for the fluid cooler system equipment, including the pumps, expansion tank, and sampling equipment (see Engineering Sketch ES-252-ACD-41).

Design criteria for safety codes and equipment will be consistent with those shown on the CDR.

- **Heating, Ventilating, and Air Conditioning**

The heating, ventilating, and air conditioning (HVAC) system will be designed to meet operating requirements during normal mode of operation. There will be a separate HVAC system for each side of the building. The HVAC systems will be designed for energy

efficiency in accordance with the requirements of DOE Order 6430.1A. The design parameters are as shown in the CDR.

- **Fire Protection**

Fire protection criteria will be as specified in the CDR.

- **Electrical**

The discussion of electrical power in the CDR remains unchanged.

3. **Other Structures**

No changes to the CDR are required in the ACD.

4. **Utilities**

Electrical

No changes to the CDR are required in the ACD.

5. **Special Equipment and Process Systems**

Fluid Coolers (Replaces CDR Cooling Tower Section)

The fluid to be cooled will be circulated inside the tubes of the heat exchanger. The heat will flow from the process fluid through the coil tubes to the water outside which cascades downward over the tubes. Air is forced upward through the coil evaporating a small percentage of the water. Sensible heat and the latent heat of vaporization are discharged to the atmosphere.

The remaining water will fall to the sump to be recirculated by the spray pump while water entrained in the air stream will be reclaimed and returned to the sump by mist eliminators at the fluid coolers air discharge.

Pumps

The closed-loop cooling circulating pumps will be horizontal, single-stage pumps with mechanical seals, dynamically balanced impellers, and replaceable impeller and casing wear rings. The double-suction pumps will be of carbon steel construction. Pumps will be powered by a NEMA electric motor designed for indoor operation.

Standby Electrical Generator

No changes to the CDR are required for the ACD.

Mechanical System Description

- **WESF Pool and Process Cell Cooling Water System**

The WESF pool and process cell once-through cooling water system will be modified to provide a closed-loop cooling system to the heat exchangers as described in the CDR. The closed-loop cooling system will incorporate a fluid cooler as the final heat sink (see Engineering Sketches ES-252-ACD-19 through 23). Surge capacity will be provided by a surge/expansion tank. A separate chemical addition tank will be provided for addition of corrosion inhibitors to the closed-loop system. The design heat loads of the cooling water system will be 3.26 million Btu/hr.

The proposed fluid cooler spray water system will be sized to permit operation at two cycles of concentration. At two cycles of concentration, the fluid cooler will produce a maximum blowdown of approximately 14 gpm. The maximum amount of spray water evaporated will also be approximately 14 gpm. A maximum of 28 gpm of makeup water will be required for fluid cooler operation.

The closed-loop cooling water will be circulated by a 25 hp horizontal pump. A redundant circulating water pump will be installed to provide operating and backup capability. The pump will be operated alternately. Each pump will be capable of delivering 600 gpm of flow at 100 feet of total head. Both pumps will be electrically powered and supplied with backup power.

The primary source of makeup water for the fluid coolers will be the raw water system. The WESF pool cell flush system will be used to provide makeup water when available. The B Plant sanitary water system will provide the backup source of makeup water. Raw water will be provided for once through cooling if the closed-loop cooling water system becomes unavailable due to failure.

The proposed locations for the pumps, tanks, and fluid coolers are shown on Engineering Sketches ES-252-ACD-16 through 18. The piping system and fluid cooler will be provided with freeze protection.

- **WESF Pool Cell Flush System**

The current WESF pool cell flush system is a batch operation which releases 5,000 gallons per batch to B-Pond. Project W-252 will provide a 5,000 gallon holding tank to collect the effluent from the pool cell flush system and will replace the jet ejector pumps with new 25 gpm electric pumps. The collected effluent will be pumped at 2.5 gpm to the fluid coolers for makeup water.

- **282-B and 282-BA Emergency Well Water System**

The 282-B and 282-BA emergency well water system will be eliminated as a backup water supply. This is a change to the CDR.

- **Stairwell #1 Heating, Venting, and Air Conditioning**

The CDR (Ref 8), Section VII.D, states that, with regard to the waste stream flow in the HVAC system in the B-Plant/WESF Stairwell #1, "...an evaluation will be performed during subsequent design phases to determine if this stream can be administratively controlled."

The FDC (Ref 4), Section 3.3.5, states that all waste streams remaining after BAT/AKART implementation should be monitored and discharged to the PTECS for disposal. Appendix G of the FDC indicates that steam condensate from Stairwell #1 HVAC system should be used as makeup water for the B-Plant fluid coolers.

An April 18, 1994 KEH Letter Report, Waste Stream Removal at B-Plant Facility, Project W-252 (Ref 9), states that most of the waste stream is contaminated with radiation and should not be used as makeup water. This report also states that an estimated total of 3 gallons per day (gpd) flow is generated from the HVAC Stairwell #1.

Three floors of piping network are located in the stairwell. On each floor is a room adjacent to the stairway in which plumbing and other features are located. Two floor drain lines converge in the middle floor room (the first floor, located at ground level). These lines drain the "C" and "O" HVAC units. The C line drain is known to be contaminated with radiation; the O line is considered to be contaminated by association. Also at this level is a steam line which supplies steam to a heater in the room. The low flow generated by the condensate from the steam line makes routing a special line to the fluid cooler makeup system impractical.

A separate 2-inch line drains a decontamination area on the second (top) floor. This drain line enters the laundry storage room and is anchored to the ceiling near the north wall of the laundry storage room, passing near the 10-inch penetration between the restroom and the laundry storage room. This line drains westward to TK-10-1 via the Canyon area.

The steam condensate flow will be combined with the contaminated waste stream for discharge to TK-10-1, located in the B-Plant Canyon area. The "C" and "O" HVAC unit drains will be disconnected from the main drain and combined with the steam condensate just below the water supply line in the first floor stairwell restroom. The three lines will be combined into a new single 2-inch ductile iron drain line. An air gap will be required for the steam condensate line before combining with the contaminated drain line flows. A backflow prevention device will be included if required.

A concrete wall penetration currently allows existing piping to exit the stairwell southward into the adjacent laundry room. From there, other piping extends out into the Canyon where tank TK-10-1 is located. The new combined drain line should be routed out of the restroom through the 10-inch square wall penetration into the laundry storage room for Stairwell #1. The drain line should pass through the wall penetration below and offset from the water supply line. After passing through the wall penetration into the laundry storage area, the line should tee into the 2-inch drain line which drains to TK-10-1. Less than 10 feet of 2-inch pipe should be required to make the connection from the junction of the C, O, and steam condensate lines in the restroom to the drain line in the laundry storage room.

The steam line will be terminated just below the ceiling of the restroom on the first floor room. This will necessitate elimination of the steam heater in the first floor restroom in order to avoid accumulation of steam condensate below the point of diversion. The steam heater will be replaced with a wall-mounted electric heater.

Instrumentation System Description

A LOI will be provided, along with a fully functional Programmable Logic Controller (PLC), both located in the LCU cabinet. The PLC will be programmed to control all local operations and to transmit monitoring signals back to the B-Plant's Bailey Distributive Control System (DCS). The DCS will be equipped with a interface card that

can accept signals sent from the PLC via a PLC vendor data highway link. The DCS at present sends signals to the TEDF via a multiplexer device, this will also be utilized for the new signals. No other changes are required to the CDR general instrumentation system description.

- **Instrumentation Systems**

Instrumentation systems will remain unchanged in the CDR. The control for the fluid coolers will be programmed into the new PLC located at the LCU.

- **Instrumentation System Configuration**

The instrumentation system will remain consistent with the CDR. A LOI will be provided in the LCU cabinet. Engineering Sketch ES-252-Y1 in the CDR is replaced by Engineering Sketch ES-252-ACD-43 in the ACD. Engineering sketch ES-252-M12, sheets 1-4 in the CDR are modified and replaced by Engineering Sketches ES-252-ACD-19 through 23 in the ACD.

- **Electrical System Description**

No changes to the CDR are required for the ACD, except that references to the cooling tower should be replaced by fluid coolers.

An uninterruptible power supply system will be provided for the LCU.

Motor Control Center

The MCC description in the CDR is unchanged in the ACD.

PTECS Description

The CDR indicates that the existing process sewer line be considered for use for PTECS collection of waste streams and discharge to TEDF Lift Station No. 2.

B-Plant engineers have indicated that the existing process sewer line, which collects parking lot stormwater runoff at B-Plant/WESF, has been observed to surcharge and back up during or after a significant storm event. Control of storm drainage will be part of a future project. Because of this, the existing process sewer is not a good candidate for PTECS discharge of B-Plant/WESF waste streams. PTECS Line E, installed as part of the

W-049H project, will be used as the PTECS discharge line for B-Plant/WESF waste streams (see Engineering Sketch ES-252-ACD-16).

References in the CDR to the cooling tower should be replaced with fluid coolers. Engineering Sketch ES-252-M13 in the CDR is replaced with Engineering Sketch ES-252-ACD-17.

Telecommunication System Description

The suitability of the CDR section on the telecommunication system cannot be determined until detailed specifications have been prepared. This will be performed during Definitive Design.

6. Demolition

The ACD requires no changes from the CDR for demolition.

E. 284-E POWERHOUSE

The basic approach to waste stream reduction contained in the ACD is consistent with the CDR in most respects, but one significant change is being made. The heat sink equipment used on the closed-loop cooling system should be referred to as wet surface fluid cooler(s) rather than cooling tower(s).

1. Improvements to Land

Site Work

No changes are anticipated in the ACD from the scope for site work in the CDR.

2. Buildings

LCU/Support/Sampling Building

An insulated, pre-engineered 36 by 40 foot building will be provided. This building will serve a dual purpose. One room of the building will provide an enclosure for the LCU and MCC. A second room will provide an enclosure for the wet surface fluid cooler chemical additional equipment and a storage area. The third room will provide an enclosure for the wet surface fluid cooler system equipment, including the pumps, expansion tank, and sampling equipment.

Design criteria for safety codes will be consistent with those shown in the CDR.

- **Heating, Ventilating, and Air Conditioning**

The heating, ventilating, and air conditioning (HVAC) system will be designed to meet operating requirements during normal mode of operation. There will be a separate HVAC system for each side of the building. The HVAC systems will be designed for energy efficiency in accordance with the requirements of DOE Order 6430.1A. The design parameters are as shown in the CDR.

- **Fire Protection**

Fire protection criteria will be as described in the CDR.

- **Electrical**

The discussion of electrical power in the CDR remains unchanged.

3. **Special Equipment/Process Systems**

Wet Surface Fluid Coolers (Replaces CDR Cooling Tower Section)

The fluid to be cooled is circulated inside the tubes of the heat exchanger. Heat flows from the process fluid through the coil tubes to the water outside which is cascading downward over the tubes. Air is forced upward through the coil, evaporating a small percentage of the water. Sensible heat and the latent heat of vaporization are discharged to the atmosphere.

The remaining water falls to the sump to be recirculated by the spray pump while water entrained in the air stream is reclaimed and returned to the sump by mist eliminators at the wet surface fluid coolers air discharge. Associated references in the CDR to the spray water pumps and heat dissipation by sensible cooling are not relevant to the fluid coolers.

Pumps

The closed-loop cooling circulating pumps, blowdown transfer pumps, and TEDF transfer pumps will be horizontal, single-stage pumps with mechanical seals, dynamically balanced impellers, and replaceable impeller and casing wear rings. The pumps will be of carbon steel construction. Pumps will be powered by a NEMA electric motor designed for indoor operation.

Heat Exchanger

The exchanger will have a heat transfer surface area of 590 square feet with a removable tube bundle. The size of the heat exchanger is based on a conservative blowdown system heat load and flow rate. This load is currently being re-evaluated. The heat exchanger will be constructed with a carbon steel shell and stainless steel tubes.

Mechanical System Description

- **284-E Powerhouse Cooling Water System Modification**

The list in the CDR of equipment connected to the closed-loop cooling system should include the following:

- Boiler blowdown heat exchanger.

The heat sink for the 284-E Powerhouse closed-loop cooling system will be wet surface fluid coolers. The design heat load of the cooling water system will be 7.18 million Btu/hr.

The proposed wet surface fluid coolers will be sized to permit operation at two cycles of concentration. At two cycles of concentration, the wet surface fluid cooler will produce a maximum blowdown flow of approximately 14.7 gpm. The maximum amount of spray water evaporated will also be approximately 14.7 gpm. A maximum of 29.4 gpm of makeup water will be required for wet surface fluid cooler operation.

The only source of makeup water for the wet surface fluid coolers closed loop system will be the softened water system. Raw water will be used for the wet surface fluid cooler basins.

The closed-loop cooling water will be circulated by a 25 hp horizontal pump. A redundant pump will be installed to provide operating and backup capability. The pumps will be operated alternately. Each pump is capable of delivering 400 gpm at 150 feet of total head. Both pumps will be electrically powered. Standby power will not be provided.

The brine tank size will be the same as shown in CDR but will be located southeast instead of east of the powerhouse.

The softener regenerate will be discharged to the TEDF by a 1-1/2 hp horizontal pump. A redundant pump will be installed to provide

operating and backup capability. Each pump will be capable of delivering 125 gpm of 25 feet of total head.

The condensate from the boiler blowdown will be cooled by a shell and tube heat exchanger until the condensate reaches 120°F, rather than the 88° F stated in the CDR. To resolve the temperature concerns, the blowdown will be cooled to less than 120°F prior to being transferred to the TEDF system. The blowdown heat exchanger will be located in the discharge line from the existing blowdown tank to the TEDF transfer pumps.

The continuous boiler blowdown will be routed to the existing blowdown tank and will be continuously cooled by the blowdown heat exchanger and transferred to the TEDF system. The maximum continuous blowdown flow will be approximately 100 gpm, based on four boilers operating. The batch boiler blowdown will be routed to the new 5,000 gallon blowdown tank. The capacity of the new blowdown tank is based either on a batch blowdown of four boilers, on four batch blowdowns of one boiler during startup, or blowdown of one boiler that has been overfilled. The size of the tank is based on a conservative blowdown flow rate and duration. It is anticipated that a tank size of 5,000 gallons will be adequate based on re-evaluation of the blowdown flows. The contents of the new tank will be gradually transferred to the existing blowdown tank and mixed with the continuous blowdown prior to being cooled and transferred to the TEDF system. The blowdown transfer pump will be a 3/4 horsepower horizontal pump capable of delivering 20 gpm at approximately 40 feet of total head. A redundant electric pump will be installed. Backup electrical power will be provided from the existing MCC-1 which currently has both normal and standby power. One of these pumps will be capable of transferring the 5,000 gallon tank capacity in approximately 4.2 hours. The continuous blowdown transfer to the TEDF system will increase to a maximum of approximately 120 gpm when a blowdown transfer pump is operating.

Due to the size of the new boiler blowdown tank, it cannot be located adjacent to the existing tank. Increasing the length of piping to the tank will potentially cause flashing in the line. Methods of preventing flashing are currently being evaluated.

Instrumentation System Description

The ACD is consistent with the CDR for instrumentation systems.

- **Instrumentation System Configuration**

An LOI will be provided in the LCU building. The system configuration in the ACD is unchanged from the CDR. Engineering Sketch ES-252-Y1 in the CDR is replaced with Engineering Sketch ES-252-ACD-43 in the ACD, and Engineering Sketches ES-252-M18, sheet 1-5 in the CDR are replaced with Engineering Sketches ES-252-ACD-31 through 36 in the ACD.

Electrical System Description

No changes from the CDR are required for the ACD except that references to the cooling towers should be replaced by wet surface fluid coolers.

PTECS Description

The TEDF transfer pump(s) and fluid cooler overflow pump(s) (if required) will transfer the effluent through a new 2-inch drain line to a new manhole. The flow from the 282-E and 283-E will also discharge into this manhole. From this manhole, a new 6-inch PVC line will carry the effluent to the TEDF. The waste stream will pass through a sampling and monitoring station and a metering manhole enroute to the TEDF. The routing of the TEDF will be essentially the same as the existing 42-inch concrete pipe (see Engineering Sketch ES-252-ACD-29). The new drain piping will be installed underground for freeze protection. The new 6-inch line will be graded for gravity flow.

Consideration was given to using the existing 42-inch concrete pipe as a PTECS line. In order to accommodate the design flow of 33 gpm (FDC Appendix A, Table A-1) at a self-cleaning velocity of 2 feet per second, with an estimated Manning roughness coefficient of 0.013 for concrete pipe, over the distance of about 3600 feet from the powerhouse to the proposed TEDF transfer line junction with an estimated slope of 0.0062, a full-flowing pipe of 3-inch diameter would be required. A larger concrete pipe would have a velocity less than 2 feet per second. Thus, the 42-inch concrete pipe would be too large to maintain a self-cleaning velocity of flow.

A more direct re-routing of the PTECS line to connect with the TEDF transfer line directly north of the facility will be considered during Definitive Design, after KEH develops the data necessary to evaluate this option.

Telecommunication System Description

No changes are needed to the CDR for the ACD.

4. Demolition

No changes are needed to the CDR for the ACD.

F. 282-E Raw Water Reservoir

Reservoir Level Control. The level in the 282-E Raw Water Reservoir will be controlled in order to minimize overflows from the reservoir (see Engineering Sketch ES-252-ACD-37).

The level will be controlled in a manner identical to the level control in the 282-W Raw Water Reservoir. An ultrasonic level transducer will measure the reservoir level and transmit the level to a level controller. This controller will control an inlet control valve which will modulate the flow into the reservoir in order to maintain a constant level in the reservoir.

At the 282-E Raw Water Reservoir there are two inlet houses, the 282-EA and the 282-EB Weir Houses. Presently the inlet pipes to these two inlets are not interconnected near the reservoir, however, an intertie will be installed immediately adjacent to the reservoir. There is an existing 8-inch bypass pipe located immediately adjacent to the 282-EA Weir House which will also be connected to the intertie between the two weir houses. The inlet control valve will be installed on this bypass pipe.

The inlet control valve will consist of an 8-inch motor-operated V-port ball valve. Flows in the range of 0 to 3,000 gpm will flow through this pipe. A manual 8-inch gate on the bypass pipe upstream of the V-port ball valve will be manually adjusted to reduce the pressure on the inlet flow to approximately 55 psig. The remaining pressure drop will occur across the motor-operated V-port ball valve to control the flow.

Flows greater than 3,000 gpm will flow through an orifice plate installed in the position of the existing 12-inch cone valve in the 282-EB Weir House. This orifice plate will pass up to 2,000 gpm. (Therefore, maximum flow into the reservoir would be 5,000 gpm). If it is necessary to provide flows greater than 3,000 gpm, an operator would have to open a manual gate valve to allow the flow to pass through this pipe (the remainder of the flow would come through the 8-inch bypass pipe and V-port ball valve). If the reservoir water level becomes too high when the pipeline in the 282-EB Weir House with the orifice plate is operating, a high level switch will automatically close a knife gate valve installed on this line. Then the flow would come entirely through the 8-inch bypass pipe.

The piping inside the 282-EA Weir House will be abandoned in place.

Drainage Modifications. Other modifications will be similar to the 282-W Reservoir. A new pipe will be installed in the 282-E Reservoir overflow to carry any overflow to the new PTECS pipeline. Also a sump pump will be installed in the 282-E Reservoir Pump House to pump floor drainage in the pump house to the new PTECS pipeline.

G. 283-E Water Treatment Facility

The 283-E WTF supplies sanitary water for the 200-East Area. Presently, the 283-E WTF includes flash mix, four combined flocculation and sedimentation basins, four dual media filters, and two clearwell reservoirs. Raw water from the 282-E Raw Water Reservoir is treated at the WTF where solids are removed in the sedimentation basins and filters. Periodically, the sedimentation basins and the filters are cleaned. Each of the four sedimentation basins is cleaned about four times per year using approximately 40,000 gallons of water for each basin for each cleaning. Each of the four filters is cleaned about once per week using approximately 70,000 gallons of water for each filter for each cleaning. Currently, the wastewater produced during cleaning is routed to B-Pond for disposal. In addition to the wastewater, the overflow from the 282-E Raw Water Reservoir, the 283-E WTF Clearwells, and the 283-E WTF Building floor drains are routed to B-Pond for disposal.

In order to eliminate the filter waste washwater and sedimentation basin sludge flows, these flows will be treated and recycled.

Also, to reduce the amount of wastewater flows that need to be recycled, the 283-E WTF will be upgraded to operate reliably in a direct filtration mode. Modifications similar to those made to the 283-W WTF will be made to the 283-E WTF.

Process Description.

Direct Filtration

Direct filtration is a common treatment process that utilizes coagulation, flocculation and filtration. Sedimentation is not utilized in the direct filtration process. The direct filtration mode requires an operations/chemical addition scheme that creates a small, light pin floc which will not readily settle in the sedimentation basin, rather than a large, heavy sweep floc that is desired in a conventional treatment plant.

By operating in the direct filtration mode, two objectives concerning waste reduction will be met:

1. Waste flows will be significantly reduced. The sedimentation basins will only need to be drained once a year instead of four times or more per year.
2. The dosage requirements of coagulant chemical (in this case alum) will be substantially reduced, which will significantly reduce the amount of solids in the waste flows.

By using a small amount of coagulant aid (polymer), the required alum dose for the direct filtration process will likely be in the range of 6 to 10 milligrams per liter (mg/l). This is significantly less than the present alum dose of 20 to 40 mg/l.

Water Quality Criteria

The source of supply for the 283-E WTF is the Columbia River. Water quality for the Columbia River above the Yakima River is quite good, with turbidities consistently running at less than 10 nephelometric turbidity units (NTU). In general, when water quality is this good with turbidity levels consistently less than 15 NTU, a direct filtration process can be used (Ref 5, 6).

The water is also low to moderately hard and contains low alkalinity. The hardness ranges from approximately 60 to 75 mg/l calcium carbonate (CaCO_3), and the alkalinity ranges from 50 to 70 mg/l CaCO_3 .

Design Criteria

In order to operate effectively in a direct filtration mode, the unit processes must be optimized. The new design criteria for the unit processes at the 283-E WTF are presented in Table 1.

The evaluation and recommended modifications for each unit process are discussed in more detail in the following sections.

Hydraulic Profile

The hydraulic profile through the 283-E WTF is quite flat and is barely adequate. The headloss from the flash mix basin to the clearwells is only about 13 feet. Normally the minimum headloss through a conventional treatment plant should be 16 feet.

The headloss from the flash mix basin to the filters is only about 1 foot, which is quite low. It is not feasible to raise the structures to increase the available head across the plant.

Process Modifications

See Engineering Sketch ES-252-ACD-38 for the WTF schematic.

WTF Raw Water Influent

The raw water supply for the 283W WTF comes from the Hanford Export Water System. The water comes into the plant via a 12 inch pipeline. As the raw water enters the plant, it is measured by an existing ultrasonic flow meter. The flow rate is controlled by the raw water inlet valve. The existing control valve will be replaced with an automatically controlled, motor-operated 8-inch V-port ball valve.

TABLE 1
DESIGN CRITERIA

Description	Units	Criteria
Design Capacity Flow Rate	mgd gpm	4.6 3200
Flash Mix		
Type: Basin Injection		
Number	—	1
Mixing Energy	sec ⁻¹	750-1000
Flocculation Basins		
Type: Mechanical, Horizontal Paddle, Variable Speed		
Number of Basins	—	4
Dimensions, length by width (LxW)	ft x ft	29.0 x 17.0
Side Water Depth	ft	9.25
Volume	gal	34,100
Detention Time	min	42
Number of Stages/Basin	—	3
Dimensions/Stage (L x W)	ft x ft	9.7 x 17.0
Mixing Energy, G		
• Stage 1	sec ⁻¹	40-60
• Stage 2	sec ⁻¹	20-40
• Stage 3	sec ⁻¹	5-20
Motor Size (1 per basin)	hp	3/4
Sedimentation Basins		
Number	—	4
Dimensions, each, L x W	ft x ft	78 x 17.0
Side Water Depth	ft	12.0
Volume, each	gal	120,000
Filters		
Type: Gravity, Dual Granular Media		
Number	—	4
Media Area per Filter	sq ft	224
Total Area	sq ft	896
Nominal Filtration Rate	gpm/sq ft	3.6
Maximum Filtration Rate	gpm/sq ft	4.8

TABLE 1
DESIGN CRITERIA
(continued)

Description	Units	Criteria
Filter Media		
• Anthracite		
Depth	inches	20
Effective Size	mm	0.90-1.00
Uniformity Coefficient	—	<1.4
• Sand		
Depth	inches	10
Effective Size (millimeters)	mm	0.45-0.55
Uniformity Coefficient	—	<1.5
• Torpedo Sand		
Depth	inches	4
Effective Size	mm	0.9-1.2
Uniformity Coefficient	—	1.7
Backwash Rate	gpm/sq ft	19.0
Surface Wash Rate	gpm/sq ft	0.7
Washwater Volume per backwash		
• Drawdown (2.5 ft)	gal	4,200
• Surface Wash (3 minutes)	gal	480
• Backwash (8 minutes)	gal	33,600
• Filter to Waste	gal	8,000
• Total Volume	gal	46,280
Filter Waste Washwater Equalization Basin and Pump Station		
Type: Circular, Reinforced Concrete		
Number	—	1
Diameter	ft	40
Sidewater Depth	ft	10
Volume	gal	94,000
Number of Pumps	—	3
Capacity, each	gpm	125
Total Dynamic Head, each	ft	25
Motor Size, each	hp	5
Filter Waste Washwater Treatment		
Type: Solids Contact Clarifier, Circular Reinforced Concrete Basin		
Number	—	1
Design Capacity	gpm	250
Diameter	ft	19
Side Water Depth	ft	10.25
Surface Loading Rate	gpm/sq ft	0.96

TABLE 1
DESIGN CRITERIA
(continued)

Description	Units	Criteria
Washwater Recycle Pump Station		
Type: Rectangular, Reinforced Concrete		
Dimensions	ft x ft	7 x 12
Water Depth, max.	ft	5
Volume	gal	3,100
Number of Pumps	—	3
Capacity, each	gpm	125
Total Dynamic Head, each	ft	349
Motor Size, each	hp	20
Sludge Lagoons		
Type: Trapezoidal, Concrete Lined with Decant Structures		
Number	—	3
Bottom Dimensions (L x W)	ft x ft	66 x 21
Top Dimensions (3 ft approx. depth) (L x W)	ft x ft	96 x 33
Annual Dried Sludge Production	lbs/yr	54,000
Drying Capacity, Each Lagoon	lbs/yr	18,000
Drying Capacity, Each Lagoon (4% solids)	gal/yr	50,000

The purpose of the raw water inlet valve is to provide the desired flow rate through the WTF and also reduce the raw water inlet pressure from approximately 150 pounds per square inch gauge (psig) to the pressure required for operation of the treatment facility, which is approximately 2 psig. This large reduction in pressure will be accomplished by the use of the V-port ball valve, which will reduce the pressure from 150 psig to about 55 psig, followed by a manual butterfly valve which will be manually adjusted to reduce the pressure to the required value.

The raw water inlet valve will be operated by level control from the water level in the clearwell reservoirs. Clearwell level will be input to the level controller from one of the ultrasonic level controllers in each of the two clearwells. An emergency alarm will be initiated by either high clearwell level or high level in the filter influent flume.

Flash Mixing

The purpose of flash mixing is to quickly and uniformly disperse water treatment chemicals throughout the incoming process water so coagulation will occur (Ref 5).

At present, flash mixing of coagulant chemicals occurs in the flash mix basin by mechanical mixing. The mixer is mounted on top of the flash mix basin, which is immediately downstream of the raw water control valving. Mechanical mixing is not as effective at chemical coagulation as pumped diffusion mixing, which is the method of flash mixing at the 283-W WTF. Pumped diffusion mixing is accomplished by diffusing a jet of water at high pressure directly into the incoming raw water flow stream while alum is simultaneously fed into this influent flow stream immediately in front of the water jet. Pump diffusion mixing will be accomplished at the 283-E WTF in a method similar to the 283-W WTF by installing a small (3-inch diameter) pipe off the raw water influent pipe just downstream of the control valve. The pressure in this water jet diffusion pipe would then be about 55 psig. The water jet diffusion pipe will be brought up through the floor to the top of the flash mix basin and down into the basin. Once the raw water flows into the flash mix basin, the flow is no longer uniform and mixing cannot be controlled well enough to ensure uniform mixing and dispersion of the coagulant. Therefore, the water jet pipe will be directed into the incoming 12 inch raw water pipe to ensure complete and uniform mixing. A nozzle will be provided on the end of the water jet pipe in order to direct the water jet at an adequate angle of coverage to provide uniform and complete mixing and at a sufficient pressure and velocity to provide a mixing energy value of about 1000 sec^{-1} . The mixing energy, or G value, should be in the range of 750 to 1000 sec^{-1} for optimum dispersion of chemicals to occur.

Alum will be added through new diffusers directly into the path of the water jet, so complete dispersion of the alum will occur in the incoming raw water flow.

A flowmeter, pressure gauge, and pressure regulating valve will be installed on the water jet pipe to allow proper control of flow and pressure to provide the desired mixing energy.

Flocculation

The purpose of flocculation is to accelerate the rate of particle collision to form settleable and filterable sizes of particles (Ref 5). In the case of direct filtration, the purpose is to form particles of filterable size since the settling process is eliminated.

The existing flocculators at the 283W WTF are horizontal shaft, paddle flocculators. The existing four flocculation basins are designed for a detention time of 42 minutes at maximum design flow (3200 gpm). This detention time is within accepted design criteria for flocculation. Presently, each basin is divided into two stages by wooden baffle walls with two horizontal paddle flocculators in each stage. The flocculators turn perpendicular to the flow. The two flocculator shafts pass through the end wall of the basin. Each flocculator shaft drives a paddle wheel assembly in each of the two flocculation stages. The flocculator drives, chains, and sprockets for each basin are located outside the end wall of each basin. A single variable speed drive drives two flocculator shafts in each basin at the same speed. The variation of the velocity gradient in each stage is accomplished by the number of paddles in each stage.

The criteria for mixing energy for each stage will be as follows:

Mixing Energy (G) Range, Sec⁻¹

• Stage 1	40 to 60
• Stage 2	20 to 40
• Stage 3	5 to 20

During the definitive design, the existing equipment will be evaluated to determine if it can be modified to provide three stages of flocculation with the above mixing energy criteria. At a minimum, new paddle wheel assemblies and baffle walls will have to be added to provide three flocculation stages.

Filtration

The filters are the heart of a water treatment plant, especially in the direct filtration process, where the filters remove all the solids.

Filter Improvements. The filter media and the existing underdrains in each filter will be replaced, as is being done at the 283-W WTF. This will improve the solids removal capabilities of the media and also provide more available headloss in the filter. At present the filter only has about 40 inches of available headloss. This is quite low, as a filter should have a minimum available headloss of about 6 feet (72 inches) (Ref 7). By using a cast-in-place strainer nozzle underdrain floor, the 12-inch gravel layer can be replaced with 4-inches of torpedo sand. This lowers the media by 8-inches and adds that amount to the available head.

Since the media is being lowered, the surface wash rotary arm will have to be lowered to be effective. Because of the age of this system, it is not possible to merely add piping to the end of the present surface wash piping. Therefore, the surface wash rotary arms will be replaced and the associated piping will be replaced completely to the point of entry into the filter box. The filter washwater troughs will also be replaced. These troughs are in poor condition. The troughs will be replaced with fiberglass troughs.

A more detailed evaluation of the existing filter media and the underdrains will be conducted during definitive design.

Filter Flow Control. Presently the flow through the filters is controlled by the level in the clearwell. A float controlled valve on the filter effluent pipe opens and closes based on the level of the clearwell. Filter flow should be either relatively constant or decline gradually as headloss in the filter media increases (filters designed to have the flow rate gradually decline are known as declining rate filters - the filters at 283-E WTF are not designed to be declining rate filters). Controlling the filter flow rate from the clearwell level, with no consideration of filter conditions, could cause turbidity breakthrough if the flow rate through the filters is increased by a lowering of the clearwell toward the end of a filter run (when solids have built up significantly).

There are several methods to keep the filter flow rate constant. The two methods feasible for this project are as follows:

- Constant level filtration - the flow is split evenly to each filter using inlet flow splitting weirs. A level sensor in the filter box modulates the filter effluent valve to keep the level in the filter constant.
- Constant rate filtration - the flow is controlled by a flowmeter on the filter effluent which modulates the filter effluent valve. A level sensor in the common filter influent channel keeps the flow constant to all the filters by modulating all on-line filter effluent valves to keep the filter influent level constant.

Constant level filtration would require the addition of flow splitting weirs, which would increase the headloss across the plant. Because the plant does not have any available head for flow splitting weirs, it is recommended that the filter flow rate be kept constant by using constant rate flow control. The level in the common filter influent channel and the flow through each filter as measured by a flowmeter on each filter effluent pipe would modulate a filter effluent valve on each filter. As head builds in the filter media and the flow rate through the filter slows so the filter water surface increases, the effluent valve would modulate open to compensate for the increased head and the result would be constant flow.

The 283-W WTF filters are utilizing constant rate filtration.

Filter Backwashing. The backwash rate will be increased to the maximum capacity of the existing backwash pump. At present a weighted lever operated backwash control valve

limits the amount of backwash flow. It is recommended that this valve be removed to allow maximum backwash flow. In order to minimize any potential media disturbance by the high velocity of 4,200 gpm of backwash flow entering the filter plenum, it is also recommended that a distribution conduit be installed in the filter plenum attached to the 14-inch diameter filter effluent pipe. This conduit would extend across the bottom of the plenum with openings located along its length to evenly distribute the backwash water over the entire filter bottom. This would effectively eliminate the initial high velocity entering the media at the front end of the filter.

The filters are backwashed manually. The current backwash procedure is as follows:

1. Start backwash pump.
2. Close the filter effluent valve.
3. Close the filter influent valve.
4. Run surface wash for 5 minutes.
5. Open filter waste valve.
6. Slowly open backwash valve.
7. Backwash at low flow for about 3 minutes.
8. Stop surface wash (surface wash and backwash are concurrent for 3 minutes, so surface wash runs alone for about 2 minutes).
9. Backwash at full flow for a minimum of 10 minutes until the water flowing into the troughs is clear.
10. Start surface wash and operate until either water is clear again or a minimum of 3 minutes.
11. Close filter waste valve.
12. Refill filter to just above the washwater troughs.
13. Close backwash valve.
14. Open filter influent valve and fill filter to normal operating level.
15. Open filter-to-waste (rewash) valve and filter to waste for 5 minutes.
16. Close filter-to-waste valve and open filter effluent valve.

With this procedure, the filter is backwashed a minimum of 13 minutes and the surface washed a minimum of 8 minutes. It also requires that the operator backwash the filters until the water is clear.

However, a filter should not be backwashed until it is completely clean, but there should be a residual turbidity of 10 to 15 NTU in the backwash waste water, which leaves a well ripened media. The current length of backwash and surface wash are excessive. The surface wash should be operated at the beginning of the backwash cycle for a total of about 3 minutes, including an overlap with the backwash of about 1 minute. Operational experience indicates it takes the surface wash about 2 minutes to loosen the clogged top layer of media. The overlap should be limited to one minute because after this the media grains kicked up by the surface wash get carried out of the filter by the upward flow of the backwash flow. It is also recommended that the backwash should be operated for a total of only 6 to 8 minutes. Backwash would be operated alone for about 5 to 7 minutes.

Solids Handling

It has been determined that the filter waste washwater flows should be eliminated from the TEDF waste stream and that these flows be recycled. In order to recycle these flows, the flow will be treated to remove the solids (see Engineering Sketch ES-252-ACD-39).

FWW Equalization Basin. An equalization basin will be included in the filter waste washwater treatment process so the volume requirements of subsequent treatment units can be reduced. The equalization basin will be sized to hold two filter waste washwater (FWW) flow volumes.

The total expected FWW volume from one filter backwash is approximately 46,000 to 47,000 gallons (see Table 1). Therefore, the equalization basin should have a nominal volume of about 94,000 gallons. A concrete reinforced circular basin with a 40 foot diameter and 10 foot side water depth will be constructed (volume = 94,000 gallons). The basin will be designed to allow gravity flow of the FWW from the filters into the basin.

The FWW will be pumped from the equalization basin to the FWW treatment unit. The pumping rate was determined such that a waste backwash volume would be pumped out of the basin prior to the addition of another waste volume, so that no more than two waste volumes would be in the equalization basin at one time. Assuming a minimum filter run of 24 hours and four filters on line, the worst case would be a filter backwashed every 6 hours. It is recommended that the pump station be sized to pump 45,000 gallons out of the equalization basin in 3 to 6 hours (125 to 250 gpm). It is recommended that three pumps be provided, each with a capacity of 125 gpm. The pumps would operate on water level in the basin, with 2 pumps (flow rate = 250 gpm) operating at a high level and 1 pump (125 gpm) operating at lower levels. The third pump would be standby. Hand/Off/Automatic switches would be provided for each pump in a local control panel. In the automatic mode, the pumps will be operated by water level in the basin.

FWW Treatment. The treatment of the FWW will be accomplished with a solids contact clarifier. This process will accomplish flocculation and settling of the solids in one unit. According to Kawamura (Ref 5), design criteria for a solids contact unit should be as follows:

Criteria

Surface Loading Rate	0.8 - 2.5 gpm/sq. ft.
Flocculation Time	20 minutes
Settling Time	30 to 120 minutes

Table 1 includes the design criteria for the recommended solids contact clarifier.

Effluent from the solids contact clarifier will flow by gravity to a Recycle Pump Station. The effluent will be pumped from the Recycle Pump Station into the raw water piping feeding the 283-E WTF. The pumps will operate exactly the same as the FWW Equalization Basin Pumps. Because the incoming raw water is operating at a head of approximately 150 psig, the Recycle pumps will require a high total dynamic head (see Table 1).

Only one solids contact clarifier would be provided. Rather than providing redundant units, the FWW piping will be designed so that FWW could be routed to an empty sludge lagoon if the solids contact clarifier was down. The sludge lagoon will provide ample settling time and the overflow will be routed from the sludge lagoon decant structure back to the FWW Equalization Basin. The discharge piping from the FWW Equalization Basin allows the solids contact clarifier to be bypassed and flows pumped directly to the Recycle Pump Station. This bypass will only be utilized when FWW flows are treated in the sludge lagoons.

Sludge Lagoons. The sludge lagoons are sized to handle and dewater the filter waste washwater solids expected to be generated under the direct filtration mode of operation.

Three lagoons will be constructed, each with a capacity of about 120 days. Each lagoon will have a decant structure. The operators will fill a lagoon to a thin sludge depth (approximately one to two feet), at which time the lagoon will be taken off line to allow the sludge to dewater and thicken. After a short thickening time (one to three weeks), excess water on top of the sludge is decanted off and the remaining sludge will be allowed to thicken and dry further. As soon as consolidation of the sludge layer takes place, the lagoon will be returned to service with the sludge building up over time in a layering effect. Eventually the lagoon will be taken off line to thicken and dry for about three months. Decanting will continue to be performed during this period. Overall, a more concentrated, settled sludge is achieved using this approach, since excess water is removed as quickly as possible, and the sludge is exposed in thin layers to natural processes which promote dewatering.

Each lagoon will have a sludge capacity of 50,000 gallons, which is the same capacity as the sludge lagoons at the 283-W WTF. This is based on an average solids concentration of 4 percent with a maximum three feet of depth.

In order to promote dewatering, the ability to add polymer to the solids contact clarifier sludge discharge will be provided. Polymer could also be added to the FWW Bypass if the solids contact unit was out of operation.

Chemical Feed Systems

There will be no modifications made to the alum feed system. However, four polymer systems will be added. The following table shows the functions of the polymers that would be used, the type of polymer [cationic (positive charge), anionic (negative charge), and nonionic (neutral)], dosage range, and polymer feed rate in gallons per hour (gph).

Function	Polymer Type	Dosage Range (mg/l)	Feed Rate (gph)
Coagulant Aid	Cationic	0.5 - 2.0	0.005 - 4.0
Filter Aid	Nonionic	0.01 - 0.05	0.001 - 0.01
Flocculant Aid in Solids	Anionic	0.01 - 0.25	0.0007 - 0.0037
Contact Clarifier			
Sludge Settling Aid	Anionic	0.2 - 1.0	0.001 - 0.25

The polymer feed rate is for "neat" polymer (i.e., non-diluted polymer). The polymer feed units that will be used for the 283-E WTF dilute, mix and feed the polymer in one unit. Each unit consists primarily of a metering pump to pump the neat polymer into the dilution water, a wetting unit, and an in-line static mixer to thoroughly mix the polymer. These units can feed either liquid or emulsion polymers. Many of the anionic and nonionic polymers are high viscosity emulsions that must be activated by "inverting" the polymer molecules. One of the most effective ways to activate the emulsions is by a static mixer, which is included in these units. Although there are dry anionic and nonionic polymers on the market, many effective liquid/emulsion polymers are available and it is recommended that a dry polymer feed unit not be provided.

283-E Building Drainage Modifications

A new 10-inch drain pipe will be provided to convey the floor drainage from the 283-E WTF to the TEDF sewer. The pipe will be routed to a new manhole located east of the 283-E WTF. A sump pump will be installed in the sump in the 283-E Pump Room to pump drainage in this room to the new 10-inch drain. The existing drain out of the sump would be plugged.

The overflow from one clearwell will be plugged and the overflow from the second clearwell will be routed to the new PTECS pipe. An adequately sized air gap (2 pipe diameters) will be provided on this connection.

The drains for the sedimentation basins will be connected directly to the FWW Bypass pipe to the sludge lagoons. A portable pump will also be provided to convey most of the contents of a sedimentation basin into the adjacent basin. The last one to two feet of liquid would then be drained to a sludge lagoon. This will substantially reduce the volume of water drained into the sludge lagoon.

Instrumentation System Design

The instrumentation design will not require the use of a master LCU. All instrumentation will either be self-contained or will be controlled through local panels (which may include small specific use LCUs). This will be similar to the system used at 282-W and 283-W.

Electrical System Description

A new MCC will be provided. All the electrical modifications will be similar to the system used at 282-W and 283-W.

PTECS Description

A new PTECS pipeline will be installed to collect 282-E Reservoir overflow and 283-E floor and sink drains and clearwell overflow. This pipe will be routed to the new manhole northwest of the Powerhouse and will be combined with the powerhouse flow prior to flow metering and sampling.

V. METHODS OF PERFORMANCE

The methods of performance complies with the work breakdown structure (WBS) contained in the CDR. The WBS indicates the major phases of work to be accomplished, i.e., engineering, procurement, construction, project management, and other project activities.

A. OFF-SITE ARCHITECT/ENGINEER WORK (WBS 1.1 and WBS 1.2.1)

An off-site architect/engineer will provide the definitive design and engineering services during construction for this project.

B. ON-SITE ARCHITECT/ENGINEER WORK (WBS 1.2.2)

The engineer/constructor contractor will provide acceptance inspection services for this project.

C. PROCUREMENT (WBS 2.1 and WBS 2.2)

The engineer/constructor contractor will procure the following owner-furnished material for supply to the fixed-price construction contractor:

- monitoring/control systems (TI, LCU to connect to Bailey-Net 90, Micon LCUs)
- telephone modems
- communications control systems (General Purpose LAN Interface)

See Appendix J for an evaluation of procurement of long lead items.

D. CONSTRUCTION WORK BY ON SITE CONTRACTOR (WBS 3.1)

The engineer/constructor contractor will perform construction work on all underground piping in radiation or contaminated zones and provide the internal piping work for B-Plant, 242-A Evaporator, and 244-AR Vault.

E. CONSTRUCTION WORK BY OFF SITE CONTRACTOR (WBS 3.2)

Construction work will be performed under a single fixed-price contract managed and administered by the engineer/constructor contractor. Fixed-price work will include all construction except for that noted under WBS 3.1. (See Appendix K for a discussion on Contract Administration.)

F. WORK BY OPERATING CONTRACTOR (WBS 4.0 and WBS 5.0)

The integrated management team concept will be utilized for this project. The project integrator function will be performed by the operating contractor. Roles and responsibilities for the integrated management team will be defined in a project management plan. The operating contractor will be responsible for other project costs, (e.g., safety documentation).

VI. REQUIREMENTS AND ASSESSMENTS

There are no changes to the information contained in the CDR.

VII. IDENTIFICATION AND ANALYSIS OF UNCERTAINTIES

The following is a revised version of the same section in the CDR.

In-line sampling and monitoring will be provided to determine effluent quality. In accordance with the CDR, provisions have not been made in either the design or estimate to retain or divert the waste streams from TEDF during an upset condition at the generating facilities.

The requirements to obtain a permit for effluent (industrial wastewater) discharges to the soil are stated in Washington Administrative Code (WAC) 173-216 and 173-240. The limits for acceptable discharges and the methods of treatment to be contained in the State waste discharge permit are yet to be agreed upon by the operating contractor and Ecology. For compliance with WAC 173-216, the operating contractor selected the BAT/AKART. Montgomery Watson does not accept the risk that the BAT/AKART chosen will meet the requirements for the discharge limits or permit conditions. No funds are provided in the estimate for a change in the BAT/AKART specified.

The FDC indicates that applicable DOE Order 6430.1A, Division 13, "Special Facilities" criteria are to be invoked. Based on the safety assessment prepared for the CDR, no items were identified which require special design consideration because of site selection, process selection, or safe shutdown requirements. Therefore, design and construction costs have not been estimated to implement DOE 6430.1A, Division 13 criteria.

By omission from the FDC, it is assumed that none of the facilities are designed "critical" (vital importance) as defined in DOE Order 6430.1A. Therefore, design and construction costs have not been estimated to implement DOE Order 6430.1A criteria for critical facilities.

Continuous monitoring and control of alpha radioactivity in the effluent is not possible. Continuous monitoring of beta radioactivity is not possible at the required levels. If required at each facility, it would be necessary to monitor these parameters by sample and laboratory analysis.

The design of the closed-loop cooling systems does not include provisions to detect or monitor radiation within the loop.

Fire protection applied to project W-252 structures and equipment will comply with the requirements of DOE Orders 5480.4, 5480.7A, 6430.1A, and RL Implementing Procedure (RLIP), RLIP 5480.7 to achieve the "improved risk" level of fire protection described in the orders. These criteria will be applied, if required, as the design develops and requirements become more clear.

Exact locations of the telephone pedestals are unknown. The estimate provides an allowance for determining the locations.

Radiological and chemical contamination may exist at work areas affected by project W-252. An allowance has been made in the estimate to account for some disposal of contaminated materials. This cost is subject to change based on actual field conditions.

Montgomery Watson has been directed to not utilize the metric system in the design.

As part of the ACD, the effluent flows from each facility have been calculated and summarized in Table 2. These flows are significantly different from the flows included in the FDC (also shown in Table 2). The impacts of these increased flows on the definitive design are unknown.

A. 242-A EVAPORATOR

The number of cycles of concentration for all fluid coolers is uncertain. Based on two cycles of concentration, the fluid cooler blowdown effluents will exceed the discharge target values specified by the project W-049H FDC. Fluid cooler cycles of concentration will be set by the allowable release limit criteria for the generating facilities. The allowable release limit criteria will be determined by the permitting process. Therefore, until the permit limitations have been established, the number of fluid cooler cycles of concentration cannot be determined but has been assumed to be two cycles.

The specific design provisions for laying-up the fluid coolers when not in service for an extended period of time have not been determined. The fluid cooler pans will be drained to prevent corrosion and freezing. However, the tube side of the fluid coolers must be drained with heat tracing operated on any portions of the equipment or piping that cannot be completely drained. The required design provisions will be included in the detailed design.

The ACD is based on data for the stainless steel condenser that has not yet been installed in the facility. During the detailed design the adequacy of the design will be verified based on the installed carbon steel condenser. Any available operating data will also be reviewed to verify the analysis.

Late in the ACD project, it was determined that the design fluid cooler location is over an existing drain field. The acceptability of the location will be determined during detailed design.

The ACD sized the fluid coolers to remove 30 million Btu/hr as directed by the FDC. The facility operators noted that this is less than the 33.6 million Btu/hr required for the facility. This will restrict operation to a lower throughput during the hottest days of the year. The final sizing of the fluid coolers may change to the higher value during definitive design.

The KEH fabrication shop will not need to be removed to install the WSFC at the new location. The project cost estimate does not include funding for replacement of the shop.

B. 244-AR VAULT

This facility may be descoped which will reduce the cost estimate.

C. 241-A TANK FARM

The ACD recommends that effluent from the 244-AR Vault and the 241-A Tank Farm be combined prior to flow metering and sampling. Separate flow metering and sampling will affect the design and cost estimate.

TABLE 2
200 EAST AREA PTECS PROJECTED FLOW RATE

Stream	FDC		ACD	
	Annualized Average Flow Rate/(gpm) ¹	Maximum Flow Rate (gpm) ²	Winter ³ (gpm)	Summer ⁴ (gpm)
242-A Evaporator Cooling Water	17	61		
Fluid Cooler Blowdown ²			30.6 ²	86.6 ²
Air Compressor Auxiliary Cooler ⁵			0	5
244-AR Vault Cooling Water	9.5	22	9.5 ⁶	9.5 ⁶
241-A Tank Farm Cooling Water	3	10	3 ⁶	3 ⁶
B-Plant/WESF Cooling Water	5	15		
Fluid Cooler Blowdown ²				
a) Present Day Heat Load			1.3 ²	4.8 ²
b) Plus Future Returned Capsules and A-G Cells			2.3 ²	9.4 ²
c) Plus 50% Margin			3.5 ²	14.1 ²
Raw Water ⁷			350	350
284-E Powerhouse Wastewater ⁸	33	103		
Fluid Cooler Blowdown ²			7.4 ²	14.7 ²
Continuous Boiler Blowdown			103.2	51.6
Intermittent Boiler Blowdown			16.7	16.7
Water Softener			6.9	6.9
282-E Reservoir/283-E WTF	0	0	5	5
TOTAL	67.5	211	185.8	213.1
Peak	NA	NA	532.3	549.0

1. Based on a fluid cooler concentration cycle of 4. The probable range for the concentration cycles is 2 to 6, 4 being the median. A concentration cycle of six would reduce the total average flow rate to 57 gpm.
2. Flow rates are based on a fluid cooler concentration cycle of two.
3. Winter ambient conditions assumed to be a typical January day with 31°F dry bulb and 28.5°F wet bulb temperatures.
4. Summer design condition is 101°F dry bulb and 68°F wet bulb temperatures.
5. Occurs only when ambient dry bulb temperature is greater than 105°F or if dry surface fluid cooler is not available.
6. Assumes same value as in FDC.
7. Emergency use only (i.e., when closed-loop cooling system is unavailable).
8. Assumes two boilers operating in summer and four in winter. Continuous boiler blowdown is based on 25 percent of rated boiler flow in accordance with CDR requirements. It may be as low as 16 percent depending on water quality. Intermittent blowdown occurs approximately twice per week. Intermittent blowdown discharge flow rate base is based on discharging contents of blowdown holding tank in 24 hours. Water softener discharge rate is based on continuous discharge to the TEDF.

D. B-PLANT WESF

Final sizing of the B-Plant/WESF closed-loop cooling circulation pumps is contingent upon completing detailed hydraulic calculations during definitive design.

The degree or range of variability in the heat removal system for the B-Plant/WESF fluid coolers is unknown. To operate under a variety of flow and/or heat load conditions, variable speed fans and spray pump motors may be required to obtain reasonable system cooling efficiency. The range of variability will be evaluated during definitive design to ensure the correct operating requirements for the equipment can be specified.

The waste stream from the HVAC system in Stairwell 1 is intermittent and has an extremely low flow of approximately 3 gal per day. An evaluation was performed during advanced conceptual design and determined this stream can be diverted to tank TK-10-1. The cost estimate provides funding to route this flow to this tank only.

With the installation of the closed-loop cooling system with raw water backup, the need for the pumps in the 282-B and 282-BA emergency water wells is eliminated. If there is no other need for these pumps, they can be eliminated. The State of Washington requires a closure plan for abandoned wells. This closure plan is not a part of this project.

The number of cycles of concentration for the wet surface fluid coolers is uncertain. Based on two cycles of concentration, the wet surface fluid coolers blowdown effluents will exceed the discharge target values specified by the project W-049H FDC. Wet surface fluid coolers cycles of concentration will be set by the allowable release limit criteria for the generating facilities. The allowable release limit criteria will be determined by the permitting process. Therefore, until the permit limitations have been established, the number of wet surface fluid coolers cycles of concentration cannot be determined, but has been assumed to be two cycles.

The specific design provisions for laying-up the fluid coolers when not in service for an extended period of time have not been determined. The fluid cooler pans will be drained to prevent corrosion and freezing. However, the tube side of the fluid coolers must be drained with heat tracing operated on any portions of the equipment or piping that cannot be completely drained. The required design provisions will be included in the definitive design.

The design details for the installation of the storage pool sump pumps have not been developed. The pumps must be installed such that they do not interfere with other equipment in the area.

Late in the ACD project, it was determined that the design fluid cooler location is adjacent to a contaminated area that could potentially have spread contamination to the fluid cooler location. The acceptability of the location will be determined during definitive design. In addition, other fluid cooler locations will be investigated.

The design heat load of the closed loop cooling water system has been reduced to 3.26×10^6 Btu/hr. This revised heat load is based on the WESF heat load evaluation (Internal Memo 16610-94-JFB-051, dated July 26, 1994), transmitted to Montgomery Watson from WHC on July 27, 1994. This evaluation identifies the current heat load associated with each cell, the additional heat loads associated with returning cesium capsules and the hot cell heat exchanger, and a safety factor of 1.5. In accordance with this evaluation, the pool cell with the greatest current heat load is cell number 7 (2.84×10^5 Btu/hr). The ACD is based on these values. However, during a teleconference with B-Plant/WESF personnel (September 28, 1994), it was stated that each pool cell should be designed for a heat load of 8.8×10^5 Btu/hr (80% of the 1.1×10^6 pool heat exchanger design value). ACD analyses have verified the capability to remove 8.8×10^5 Btu/hr from each cell with direct raw water cooling. The capacity of the closed loop cooling system to remove 8.8×10^5 Btu/hr from one pool cell has not been verified during the ACD. The analysis required to verify this capacity will depend on the total system heat load and on how the heat load is divided between the remaining cells. This condition will be evaluated during the definitive design.

The B-Plant process sewer is used for part of the PTECS line. This process sewer is also the stormwater collection system and becomes hydraulically limited during storm events. The ACD is recommending use of the TEDF line E instead of this line. Surcharging of the existing process sewer pipeline will continue to occur.

E. 284-E POWERHOUSE

Final sizing of the 284-E Powerhouse closed-loop cooling circulation pumps is contingent upon completing detailed hydraulic calculations during definitive design.

The number of cycles of concentration for the cooling tower is uncertain. Based on two cycles of concentration, the cooling tower blowdown effluents will exceed the discharge target values specified by the project W-049H FDC. Cooling tower cycles of concentration will be set by the allow release limit criteria for the generating facilities. The allowable release limit criteria will be determined by the permitting process. Therefore, until the permit limitations have been established, the number of cooling tower cycles of concentration cannot be determined but has been assumed to be two cycles.

The PTECS pipeline alignment is quite long. An alternative alignment to run due north is feasible but requires input from KEH as to the water depth in the TEDF pipeline. This information has been requested but has not been received. The design could change but should be a cost reduction.

The cooling water system heat load for the 284-E Powerhouse is uncertain. The ACD is based on the best available heat load information, including assumed equipment heat loads for both summer and winter operation. Winter operation assumes the operation of four boilers, while two boilers are assumed to operate during the summer. Late in the ACD project, it was determined that the actual heat loads associated with boiler blowdown are significantly less than the heat loads assumed in the ACD. The reduced blowdown heat

loads will result in smaller fluid coolers. The sizing analyses will be completed during the definitive design.

The specific design provisions for laying-up the fluid coolers when not in service for an extended period of time have not been determined. The fluid cooler pans will be drained to prevent corrosion and freezing. However, the tube side of the fluid coolers must be drained with heat tracing operated on any portions of the equipment or piping that cannot be completely drained. The required design provisions will be included in the definitive design.

The installation of a new water-to-water heat exchanger in the continuous blowdown line will be investigated during definitive design to determine if it is cost-effective based on capital costs.

The back pressure associated with the new discharge piping on the water softeners has not been determined. The pressure will be calculated during the definitive design to verify compatibility with the water softener design.

F. 283-E WATER TREATMENT FACILITY

Project B-604 is currently evaluating alternative concepts for the configuration of the 200-E Area water system. The final configuration of the water system could affect the project W-252 routing of supernatant line and the reservoir level controls. These items will be evaluated during the project W-252 definitive design phase. The estimate includes adequate fundings for potential changes.

It was assumed that the existing flocculator mechanism can be adequately retrofitted to provide three stages of flocculation with the desired mixing energy criteria. The estimate does not include funding, in case the equipment cannot be retrofitted.

A detailed study of the existing filter needs and underdrains will be conducted during definitive design. The cost estimate is for full replacement of the underdrains and filter media so changes should reduce the costs.

The location of the sludge lagoons shown on Engineering Sketch ES-252-ACD-29 requires the relocation of 2,400 volt power lines and relocation of three trailers. During definitive design, alternate layouts that could be constructed without moving the 2,400 power lines will be evaluated.

OUTSTANDING ITEMS TO BE RESOLVED DURING DEFINITIVE DESIGN

The following items were presented by reviewers of the 30% and 90% ACD Report and are pertinent to Definitive Design:

1. M.C. Arntzen had a number of comments on QA for tanks, pipes, and installation in both the 30% and 90% reviews. These items will be included in the Definitive Design.

2. C. Hatch suggested in the 90% Review Comment Record (RCR) to evaluate replacement of the existing 284-E Powerhouse blowdown heat exchanger. The blowdown heat exchanger is a shell and tube heat exchanger that transfers heat from the blowdown steam to the incoming feed water. The old exchanger in the 284-E building is out of service and was scheduled for replacement by another project, but has been deleted due to budget cutbacks. The cost-effectiveness of replacement will be evaluated.

3. G. True had the following comments in the 90% RCR for the 284-E Powerhouse:

Provide the back pressure with the new system on the water softeners so WHC can incorporate this into the new softener design or make changes to the present system.

The cooling system needs to be designed for -10 degrees F ambient.

The fluid coolers need adjustable shutters to prevent freeze-up during cold temperatures, and low cooling loads.

There shall be by-pass valves around all the control valves, in case the control valve fails.

There should be a "tell-tale" valve (we will use a paddle wheel flow indicator) before the discharge valve on the equipment to check for plugged cooling line or check flow through equipment. This would be a drain valve.

The air compressors each need their own cooling line to the main header with a strainer to protect the air compressor cooling water control valve. These possibly should be 3/4 inch lines.

Since the fluid coolers are in a dusty environment and are down-wind of the coal pile, the spray washers need to be easy to clean out. This would also include the sump.

Need two chemical addition pumps for the open side of the fluid coolers with one for biocide and one for corrosion (inhibitors).

4. G. Brown had the following 90% RCR comments for the 284-E Powerhouse:

1. (Evaluate need for) screens to remove tumbleweeds and birds.
2. (Evaluate need for) platform for cleaning cooling spray header nozzles.
3. Install lighting at outside locations.
4. Install automatic air vents at high points with isolation valve.
5. Provide a way to blow out or adequately drain pipelines to inoperative fluid coolers.

6. Install sight glass and low level alarm on the make-up tank for the closed loop system.
9. Install fan bearings grease extensions to outside of fluid coolers.
5. R. Wahlquist had the following 90% RCR comments for the 242-A Evaporator:
 2. Redo the calculations to ensure condensate is less than 110°F based on operating data (WHC to provide operating data).
 5. Evaluate provisions for laying up the WSFC for extended periods of time.
6. T.O. Looney, Jr. had the following 90% RCR comment for B-Plant:
 12. Design Analysis, section 7, Storage Pool Sump Pumps (2). Provide design concept for installing this type of pump at the storage pools.
7. R. Weissenfels had the following 90% RCR comment for B-Plant:
 4. Page 21, 4th paragraph, last sentence; size of heater and voltage required. Could get power from lighting panel in stairwell at 2nd floor level if 220 voltage or less required.
8. T. Sweet had the following 90% RCR comments for the 282-E/283-E WTF:
 1. The text description in the ACD does not address what will be done with the clearwell overflow. This needs to be considered during Definitive Design.
 3. ES-252-ACD-28 (Dwg Zone B/8) – A manhole is shown off the Southwest corner of the 283E in the line going to the sludge lagoons. During Definitive Design it needs to be verified that this location does not conflict with Trailer MO-040.
 4. ES-252-ACD-28 (Dwg Zone B/8) – Consideration should be given to moving the sludge lagoons further south than the relative position shown on the sketch. Due to the traffic congestion on the corner of Baltimore and 4th, the truck access area to the lagoons should be sized to allow adequate room for the trucks to maneuver.
9. F. Graf had the following 90% RCR comments:
 4. ES-252-ACD-10, 11, 12 (etc.). Need to monitor the temperatures of the FC sumps (an LCU input) to ensure that an adequate temperature is maintained during cold weather.
 11. ES-252-ACD-39, lines between LCU and TEDF should be logic lines, not dashed lines.

10. A. Shoulders had the following 90% RCR comments:
 1. Need two coordinate points to locate fluid coolers and LCU buildings.
 2. Show extent of contaminated and radiologically controlled areas on the drawings.
11. K.E. Shaw (USACE) had the following 90% comments for Architecture:
 1. Consider using some form of natural ventilation – such as a continuous ridge vent. Even well insulated metal buildings can get extremely hot in this climate during the summer months.
 4. Section B – The rail for the 3 ton hoist is shown apparently bearing on a wall girt, centered over a door pair. This may be a problematic structural framing exercise. Consider requiring the roof framing system to be designed to accept the load and attach the rail to the beams above.

The following Items were discussed in various Progress Meeting Minutes and were deferred to Definitive Design:

June 30, 1994 Item 3G, per FDC, may need to provide redundant sumps to ensure sump integrity so that one can be inspected while the other is in use.

September 8, 1994 Item 5 (9th paragraph) – construction phasing for B-Plant will be developed (see also January 11, 1995 Item 2.6, 3rd paragraph).

September 28, 1994 Item 2 (4th paragraph) – size the 242-A Evaporator sump for flow directly from the steam condensate basins.

October 20, 1994, Item 10.H, include a generic note on Definitive Design drawings stating that all replaced, unused cooling water pipes must be removed.

November 30, 1994, Site Tour:

283-E May need to reslope the filter waste pipe to reverse flow.

Need to reslope flow in filter piping gallery to allow drainage.

Need a separate utility water pipeline with backflow preventor to supply water to the Equalization Basin, Solids Contact Clarifier, and Recycle Pump Station.

December 20, 1994:

Item 2.j (3rd paragraph) – possibly use the LCP at the neutralization facility to forward alarms to TEDF.

Item 2.j (4th paragraph) – evaluate need for an uninterruptible power supply for B-Plant LCP.

January 11, 1995:

Item 2E, need to reroute the back-up cooling water system from discharge to B-Pond to discharge to the chemical sewer.

Item 3Be, need to address prevention of corrosion in the 242-A Evaporator condensers and tube bundle during lay-up.

Item 3C, evaluate need for additional filters on 242-A Evaporator raw water make-up system.

VIII. REFERENCES

1. Tri-Party Agreement, "Hanford Federal Facility Agreement and Consent Order", U.S. Department of Energy, Richland Operations Office, Washington State Department of Ecology, and U.S. Environmental Protection Agency, May 1989.
2. Plan and Schedule, "Plan and Schedule to Discontinue Disposal of Contaminated Liquids into the Soil Column at the Hanford Site", prepared by U.S. Department of Energy, Richland Operations Office, 1987.
3. Engineering Report, "Phase II Liquid Effluent Program (Project W-252) Wastewater Engineering Report and BAT/AKART Studies", prepared by Westinghouse Hanford Company, Document No. WHC-SD-W252-ER-001, Rev. 0, September 1993.
4. Functional Design Criteria, "Phase II Liquid Effluent Treatment and Disposal", Project W-252, prepared by Westinghouse Hanford Company, Document No. WHC-SD-W252-FDC-001, Rev. 0, September 1992.
5. Kawamura, Susumu, *Integrated Design of Water Treatment Facilities*, John Wiley and Sons, Inc., 1991.
6. U.S. Environmental Protection Agency, *Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources*, 1989.
7. Kawamura, Susumu, *Design and Operation of High-Rate Filter - Part I*, Journal AWWA, December 1975.
8. Conceptual Design Report, Phase II Liquid Effluent Treatment and Disposal, Project W-252, prepared by Kaiser Engineer Hanford Company, Document WHC-SD-W252-CDR-001, Rev. 0, June 1993.
9. Kaiser Engineers Hanford Co., Letter Report W252LR5, Waste Stream Removal at B-Plant Facility, Project W-252, April 18, 1994.

Appendix A

MONTGOMERY WATSON

Stone & Webster Engineering Corporation

To:	Larry Bennett	Date:	October 10, 1994
		Revised:	Jan. 20, 1995
From:	Paul A. D'Errico	Job No.:	04847.10
Subject:	W-252 Wet Surface Fluid Cooler Freeze Protection Measures, Location and Orientation		

1.0 PURPOSE

The Conceptual Design Report (CDR) for Project W-252 includes the addition of wet surface fluid coolers (WSFC) to the 242-A Evaporator facility, the B-Plant/WESF facility and the 284-E Powerhouse. An open item relating to freeze protection and location of the WSFCs has been identified. The purpose of this report is to address Scope of Work (SOW) Item 10.2.3.1 and Open Items List item 3, and to provide recommended resolutions. The resolutions will be incorporated into the Advanced Conceptual Design (ACD) Report.

Section 2.0 of this report describes existing conditions and design basis information. Section 3.0 discusses cooling tower and WSFC equipment options; freeze protection options; and considerations for siting WSFCs. Section 4.0 provides recommendations for application of the various options on a facility specific basis. Decisions made as a result of the Criteria Review Meeting held on September 8, 1994 are reflected herein.

2.0 EXISTING CONDITIONS**2.1 General**

The once-through cooling systems at the following facilities will be retrofitted with closed systems using WSFCs as part of the project:

242-A Evaporator

244-AR Vault

B-Plant/WESF

284-E Powerhouse

More detailed discussions of each follow.

2.2 242-A Evaporator

The primary condenser, inter- and after condensers presently use approximately 3650 gpm (design flow) of raw water from the 200 East Area for cooling which is then disposed of in B-Pond along with eight other low flow effluent streams. The evaporator does not operate year-round but in campaigns of approximately two months each for 24 hours per day. Total operating time is four to six months per year. One of the low flow effluent streams is the cooling water for the air compressors. This is presently once through cooling water which will be converted to a closed-loop cooling system in this project. The remaining flows are minor.

2.3 244-AR Vault

The pertinent cooling loads for this facility are the two air compressors (one main and a backup) and the associated air aftercooler. The main air compressor uses a glycol cooling system for jacket cooling. The backup air compressor jacket and the common aftercooler utilize once-through cooling from the raw water system which is disposed to B-Pond. The facility is presently not operating.

2.4 B-Plant/WESF

The pertinent cooling system for this facility is used for dissipating heat from pools storing waste capsules. Heat exchangers are installed in five storage pool cells and one hot cell. These heat exchangers transfer heat from the pool water to raw water which is disposed to B-Pond. This facility is in constant operation. The heat loads may be increased in the future.

2.5 284-E Powerhouse

The Powerhouse supplies steam to various users in the 200 East Area. It houses five coal-fired boilers and associated auxiliary equipment. Once through cooling is used from the sanitary water system to cool the auxiliary equipment. This facility is under constant operation although not all of the equipment is used constantly. During the colder months up to four boilers are operated. During warmer times of the year, fewer boilers are operated and less equipment is used. Intermittent boiler blowdown occurs twice per week from each boiler. In addition, each operating boiler has a continuous blowdown. This blowdown heat load will be a major portion of the cooling load when retrofitted.

3.0 EVALUATION

The subject open item states:

- **SOW 10.2.3.1 and Open Item 3: Equipment layouts for cooling towers. Evaluate layouts during ACD and definitive design to accommodate freeze protection, maintenance and seal water during freezing weather. Determine need to locate equipment inside buildings.**

3.1 Cooling Equipment Considerations

The use of WSFCs featuring extended surface finned tubes were considered. This design would negate the need for spray water during the cooler months of the year when heat transfer would be by sensible heat alone. The use of fins, however, together with anticipated airborne dust and contaminants, was discounted because of the fouling of the finned tubes that would occur. The unfinned design was judged more resistant to such fouling and would be considerably easier to clean in any case. Additionally, the evaporation of water is of benefit because it means less water must be processed for disposal.

Dry surface fluid coolers (DSFCs) were also considered for the major loads. DSFCs would eliminate the need for makeup water altogether as well as fouling and external freezing potentials. They would not, however, provide adequate cooling during the warmer months because the ambient heat sink temperature is too high. DSFCs are adequate for the minor loads, however, and will be used as applicable.

Wet evaporative cooling towers were considered. The process fluid, however, would be in direct contact with the ambient air which may contain airborne contaminants. An inherent feature of the WSFC design is that the process fluid is isolated from the ambient air thus eliminating the need to be concerned about airborne contaminants.

The closed WSFC design utilizing spray water over unfinned tubes is judged to be the most appropriate for the major load applications for this project.

The cooling systems for this project will be retrofitted with two types of coolers: WSFCs and DSFCs. The major loads will use WSFCs. WSFCs operate with the fluid to be cooled circulating inside of thin, unfinned tubes. Air is conveyed over the outside of the tubes that are deluged with spray water. The spray water is supplied by a pump taking suction from a collection sump at the bottom of the WSFC which is integral with the WSFC structure. WSFCs utilize the latent heat of evaporation and sensible heat transfer to the air as the mechanisms for dissipating the heat load from the warm process fluid. Water lost to the atmosphere through evaporation and drift is made up from a separate source of water.

Minor loads will utilize a design similar to the WSFC without the water spray and makeup. Heat transfer will be totally by sensible heat transfer to the air. These units are referred to as DSFCs.

3.2 Freeze Protection Options

As long as heat load is close to design values, no freezing will occur. If the operating heat load is significantly less than the design value, various combinations of the following freeze prevention methods may be utilized to accomplish the objective. A discussion of protecting the various auxiliary cooling system components external to the WSFC such as pumps, valves, and piping is also included.

3.2.1 Heat Load

If heat load is kept high and the WSFC design has been suitably selected, the probability of freezing is generally eliminated. The spray water and tube temperature distribution throughout the WSFC is particularly uniform and such that the average water and air temperatures are much higher than the cold air temperature. With the heat load near design, temperatures even at the extreme points in the equipment will be above freezing in the most severe weather except for small amounts of frozen spray and some rime ice.

3.2.2 Air Side Control

Air flow reduction brings less cold air into the WSFC causing higher average water and air temperatures throughout the WSFC. The reduction can be accomplished by several means. The simplest is to periodically shut off one or more fans. This, however, requires the most vigilance on the part of the operator. Two speed or variable speed fans offer greater flexibility of operation which allows for good ice control but at greater expense. Louvers can be used to reduce air flow, however, the actuating mechanisms must be well maintained to be effective. Coating by freezing rain would impede the louver control and then would require manpower for opening or closing. Louvers are used in extreme cases and may not be required except if load is far lower than design.

3.2.3 Water Side Control

Where multiple celled WSFCs are specified, one or two cells can be taken out of service to place a higher heat load on the in-service cells. The water flow is bypassed around the out-of-service cell(s) and would not be cooled. It would join the cooled flow resulting in a higher net cold water equilibrium temperature. This would raise the average air and water temperatures throughout the system. Alternately, the flow of the out of service cell(s) could be distributed to the in-service cells. The extra flow and heat load to those cells would result in higher average air and water temperatures throughout the system. Care must be taken to properly specify this mode so the manufacturer can provide the proper equipment.

3.2.4 Sump Draining to Remote Indoor Sump

The spray water sprayed over the tube bundle is collected in a sump at the bottom of the WSFC. The sump is an integral part of the WSFC support structure. The evaporated water is made up to maintain a level in this sump. During operation a pump constantly recirculates that spray water. As long as the WSFC has a heat load and the pump is operating, the water in the sump will not freeze. During periods of no heat load with the pump off, the possibility of freezing exists. One method of preventing freezing is to drain the water to a remote indoor sump. This solution may not always be practical because of the remoteness of some applications from suitable indoor areas.

3.2.5 Sump Draining During Cold Weather

If a WSFC is to be out of operation during an extended period of cold weather, an option to prevent freezing would be to completely drain the water from the sump and associated headers and above ground piping.

3.2.6 Tubeside Drainage

If a WSFC is to be out of operation during an extended period of cold weather, an option to prevent freezing would be to completely drain the water from the tubes, and associated headers and above ground piping. A method of ensuring that all of the water is quickly drained must be devised. WSFCs are inherently drainable due to the sloping of the tubes. A disadvantage, however, is the possibility of corrosion by the introduction of air to these inside spaces. A low-pressure nitrogen blanketing system can be devised to prevent this. It must be assured that this blanketing system is leak tight.

3.2.7 Freeze Resistant Fluids

An antifreeze solution of ethylene-glycol and water could possibly be utilized. Compatibility with equipment and processes must be ensured. The added expense of the glycol solution as well as the requirement for more heat exchange surface area must be considered. The additional heat transfer surface area requirement is due to its heat transfer properties of ethylene-glycol being inferior to pure water. It also is a hazardous and flammable material which must be dealt with. The advantage of using ethylene-glycol is that it is a sure and passive method of providing freeze protection. Due to the expense of the large amount of solution required for the larger applications (i.e. 242-A and B-Plant), other methods of freeze protection should be considered. However for small applications, such as air compressor coolers, the use of an ethylene-glycol solution is considered viable.

3.2.8 Heat Tracing

Heat tracing involves placement of heating elements under the insulation of piping and equipment. Electric or steam heat tracing may be used. This will find application on sections of above ground pipe and equipment which are undrainable or otherwise unprotected during periods of low heat load.

3.2.9 Supplementary Heating

WSFCs can have electric heaters installed in the sumps to prevent the water temperature from dropping below a preset value. This is very frequently done.

3.2.10 Protection of Auxiliary Components

In general, three different ways of auxiliary component freeze protection may be provided: heat tracing; housing in a new heated building; and, housing in an existing heated building.

The protection methods for these components depends on the component to be protected and its physical location and location relative to other components. In general, a single piece of equipment installed outside could be protected by insulation and heat tracing. However a small building would be more appropriate to protect several components that need to be located in the same area. If equipment can be located in an existing, heated building no additional protection would be required.

Each situation is individually evaluated to determine the most appropriate method. In terms of priority, use of a small pre-engineered heated buildings appears to offer the best solution because it would optimize layout and maintenance access. Existing heated buildings will receive second consideration due to the complexity of locating new equipment in an existing facility. Space must be found, evaluated and discussed with the building staff to determine acceptability.

Where appropriate, valving should be leak tight to prevent leakage of water into a section of piping where freezing could occur. Valve materials, especially seat materials, must be carefully selected to be reliable in cold weather. In addition, drains are required to eliminate any leakage into the dry piping.

3.3 WSFC Location and Orientation Considerations

The WSFC should be located away from structures which would present a restriction or any other interference to inlet and outlet airflow of the WSFC. The

plume from the WSFC should not infringe upon air intakes or other sensitive items on those structures. Remote location from other structures and roads would prevent the WSFC plume from forming ice on those structures during the winter.

Judgement must be exercised in the choice of location which not only accounts for these items but also the cost of running piping and wiring to the tower site. This may involve considerable investigation in congested areas where there is an abundance of existing aboveground structures and roads, underground piping and wiring as well as overhead items such as power lines, pole mounted transformers, etc.

WSFC orientation is of importance with regard to WSFC performance and to a lesser extent with location. It is important that the plume rise over and away from the air intakes of the WSFC thus avoiding recirculation. Recirculation of heated and humidified exhaust air reduces WSFC performance. Preventing recirculation is best accomplished with the intakes oriented so they are as nearly as possible into the prevailing wind. The type of WSFCs anticipated for this project have air intakes on only one side. This is an advantage because it may be oriented into the wind with no possibility of the plume being recirculated back to the intake.

Alternately, if a multiple installation of relatively large WSFCs is needed, they can be placed such that the intakes are oriented perpendicular to the prevailing wind. The closed sides of said WSFCs may be placed back to back with each other without the consequence of recirculation.

The summer and winter prevailing winds are from the northwest at seven miles per hour. Therefore, with the exception of multiple WSFC installations, the WSFCs are best oriented with the intakes facing northwest. The specific location of each installation for this project will be evaluated for WSFC location and orientation is discussed in Section 4.0. Existing local site restrictions may or may not allow optimum orientation.

4.0 RECOMMENDATIONS AND CONCLUSIONS

4.1 242-A Evaporator

Primary, Inter- and Aftercondensers

This is the major load for this facility and it is anticipated that it will utilize six Baltimore Air Coil (BAC) F2661-N WSFC or equivalent. Although the heat load is expected to be essentially constant for this facility, variations and transients will occur and, of course, variations occur in ambient conditions. To accommodate these variations, individual WSFCs can be taken out of or put back into service as required.

The facility operates in campaigns of approximately two months at a time approximately three times a year. These operating periods could occur without regard to season of year.

Specific recommendations for winter freeze protection are:

1. All routine maintenance of the WSFC should be scheduled between Evaporator campaigns when they are not being used. This is to ensure that there is minimal chance of having to deal with WSFC drainage, isolation, freeze protection equipment failure and attendant loss of facility cooling capacity during a campaign.
2. Insulate and heat trace all exposed above ground piping to and from the WSFCs.
3. Utilize leak tight valves for isolation so water can not leak into previously drained system portions or equipment which may be at below freezing temperatures.
4. Specify the WSFCs to have closable outlet dampers with limit switches to prevent starting of the respective draft fans with the dampers closed. The dampers of any one WSFC should be closed during freezing weather when that WSFC is out of service.
5. Specify the WSFCs to have pan heaters so a minimum water temperature can be maintained in the pans.
6. Manage the number of WSFCs operating so that each is operating near its individual share of the design heat load. This can be done by shutting off the fans and spray pumps of selected WSFC(s).
7. If load or ambient temperatures vary over short periods such that one WSFC is cycled on and off frequently (day/night operation for instance), the flow can continue through the tubeside with the fans and spray pumps turned off. This will effectively use the tubeside flow path as a bypass without frequent valve realignments. The dampers should be closed and pan heaters turned on if ambient temperatures significantly below freezing are anticipated.
8. If a WSFC must be taken out of service for maintenance during a campaign the tubes, headers and pan must be drained and properly isolated. Heat tracing of stagnant piping must be assured. Bypass of the associated tubeside flow through a separate bypass line will assure that full design system flow is still attainable.
9. When the WSFCs are not being used during cold weather (facility not operating) it is best to completely drain all water from all parts of the WSFCs.

Heat tracing must be operated on undrainable portions of external piping. The dampers should be closed and temporary covering should be applied to the fan intakes to avoid unnecessary contamination. Alternately, if draining is not to be performed, pan heaters and heat tracing must be operating, dampers must be closed, and air intakes should be covered. Isolation valving should not be closed thus avoiding overpressurization of isolated portions due to ambient temperature variations.

WSFC location is anticipated to be approximately 400 feet east of the 242-A building. There are no other buildings or equipment susceptible to icing near this location.

Orientation of the WSFCs along the northwesterly line should be attainable in the space allocated. However, due to the size of the WSFC footprint anticipated, further evaluation of underground items must be performed.

Air compressors

This is a minor facility load. A closed cooling loop utilizing a DSFC will be used. Freeze protection will be by using a freeze resistant solution of ethylene-glycol and water. No additional freeze protection measures are necessary.

4.2 244-AR Vault

There are two air compressors and one common aftercooler of concern at this facility. All will be cooled by utilizing a DSFC. Freeze protection will be by using a freeze resistant solution of ethylene-glycol and water. No additional freeze protection measures are necessary.

4.3 B-Plant/WESF

The load for the B-Plant/WESF is produced by encapsulated radioactive waste products stored under water in pools. Heat generated by these capsules heats the pool water which in turn must be cooled from an external source. This external cooling loop will utilize three Baltimore Air Coil (BAC) F2441-L WSFC or equivalent. Each of these WSFCs is independently operable. The heat load for this facility is perpetual. Three values of heat load have had to be accommodated in the design of the cooling system: the present load; that resulting from anticipated additional capsules and activation of cells A-G; and, the preceding load with 50 percent margin. The last of these is the maximum design load. Each heat load by coincidence, incrementally contributes approximately one third of the maximum design load. This lends itself well to the use of three equal sized WSFC.

It is anticipated that although two WSFCs are initially required (one active and one standby), all three will be initially purchased and installed. The specific

winter freeze protection recommendations are formulated on this basis. They are as follows:

1. All routine maintenance of the WSFC should be scheduled during spring and fall times of year. This is to ensure that they are available for service with the proper redundancy during summer and to ensure that there is minimal chance of having to deal with WSFC drainage, isolation, freeze protection equipment failure and attendant loss of facility cooling capacity during winter.
2. Insulate and heat trace all exposed above ground piping to and from the WSFCs.
3. Utilize leak tight valves for isolation so water can not leak into previously drained system portions or equipment which may be at below freezing temperatures.
4. Specify the WSFCs to have closable outlet dampers with limit switches to prevent starting of the respective draft fans with the dampers closed. These dampers should be closed during freezing weather when the WSFC is out of service.
5. Specify the WSFCs to have pan heaters so a minimum water temperature can be maintained in the pans.
6. Initially operate with one active WSFC, one standby WSFC and the third WSFC completely drained and turned off. The initial heat load (the present load) will be close to design for the one active WSFC. When heat load is increased by adding more capsules and/or activating cells A-G, the standby WSFC will have to be brought on line. At this time, the third WSFC must become the standby WSFC.
7. If a WSFC must be taken out of service for maintenance, the tubes, headers and pan must be drained and properly isolated. Heat tracing of stagnant piping must be assured. Bypass of the associated tubeside flow through a separate bypass line will assure that full design flow is still attainable.
8. When a WSFC is not being used during cold weather and is not in standby service, it is best to completely drain all water from all parts of the WSFC. Heat tracing must be operated on undrainable portions of external piping. The dampers should be closed and temporary covering should be applied to the fan intake to avoid unnecessary contamination. Alternately, if draining is not to be performed, pan heaters and heat tracing must be operating, dampers must be closed, and the air intake should be covered. Isolation valving should not be closed thus avoiding overpressurization of isolated portions due to ambient temperature variations.

The WSFC location shown in the CDR is to the south of WESF and next to building 224-B. However, during the ACD it was determined that the WSFC could not be located in the area south of the WESF due to the size of the units. As a result the WSFCs will be located to the northwest of WESF. There is a sufficient distance between the WSFC location and the B-Plant/WESF facility to ensure that the facility will not be affected by icing.

Orientation along the northwesterly line should not be a problem for this WSFC since it will be small relative to the space available at the anticipated location.

4.4 284-E Power Plant

The load for this facility is provided by various auxiliary equipment within the power plant as well as boiler blowdown. The latter is a major contributor because the blowdown must be cooled from boiler drum temperature down to a maximum of 120° F so it may be discharged to the TEDF. The heat load is variable with season being at maximum during winter. The facility is never completely shutdown. To accommodate the wide variation in heat load, the cooling system will utilize four Baltimore Air Coil (BAC) F2842-K WSFC or equivalent. Each of these WSFCs is independently operable. It is anticipated that three WSFCs will be needed during normal operation. The fourth WSFC is to be on standby. The specific winter freeze protection recommendations are formulated on this basis and are as follows:

1. All routine maintenance of the WSFC should be scheduled during spring, summer or fall times of year. This is to ensure that there is minimal chance of having to deal with WSFC drainage, isolation, and freeze protection equipment failure during winter.
2. Insulate and heat trace all exposed above ground piping to and from the WSFCs.
3. Utilize leak tight valves for isolation so water can not leak into previously drained system portions or equipment which may be at below freezing temperatures.
4. Specify the WSFCs to have closable outlet dampers with limit switches to prevent starting of the respective draft fans with the dampers closed. These dampers should be closed during freezing weather when the WSFC is out of service.
5. Specify the WSFCs to have pan heaters so a minimum water temperature can be maintained in the pans.
6. Winter operation should include three active WSFCs and one standby WSFC. Manage the number of WSFCs operating so that each is operating near its

individual share of the design heat load. This can be done by shutting off the fans and spray pumps of selected WSFC(s). Specific procedures must also be adopted to ensure that the WSFC outlet water temperature remains near 80° F as specified for the equipment to be cooled. This will take the form of a temperature control bypass around the active WSFCs. Integrating these procedures will be finalized during detail design.

7. If a WSFC must be taken out of service for maintenance, the tubes, headers and pan must be drained and properly isolated. Heat tracing of stagnant piping must be assured.

8. If load or ambient temperatures vary over short periods such that one WSFC section is cycled on and off frequently (day/night operation for instance), the flow can continue through the tubeside with the fans turned off. This will effectively use the tubeside flow path as a bypass without frequent valve realignments. The dampers should be closed and pan heaters turned on if ambient temperatures significantly below freezing are anticipated.

The WSFC location shown on the CDR is more than 100 feet north of the power plant. Evaluation of this location indicates that there is not an icing concern for the power plant building.

An alternate closed loop cooling system featuring a shell and tube heat exchanger cooled by the raw water makeup to Reservoir 282-E was evaluated separately. The results of the evaluation indicate that the alternative design is not feasible.

Appendix B

MONTGOMERY WATSON

Stone & Webster Engineering Corporation

To:	Larry Bennett	Date:	October 10, 1994
		Revised:	Jan. 20, 1995
From:	Craig J. Baron	Job No.:	04847.10
Subject:	W-252 Resolution of 242-A Open Items		

1.0 PURPOSE

The Conceptual Design Report (CDR) for Project W-252 includes modifications to the 242-A Evaporator facility. Several open items have been identified relative to these modifications. The purpose of this report is to address Scope of Work (SOW) 10.2.3.2 and Open Item List items 5, 8, 9, 16, 18, 21, 23, 24, 25, and 29, and to provide recommended resolutions. The resolutions will be incorporated in the Advanced Conceptual Design (ACD) Report.

2.0 EVALUATION

Each of the referenced open items is evaluated below. A summary of the conclusions is presented in Section 3.0:

- **SOW 10.2.3.2a and Open Item 5:** Since the existing closed-loop system is primarily constructed of carbon steel and will be well corroded by the time this project is instituted, normal corrosion control inhibitors will not work effective until the system is chemically clean. Incorporate taps in the piping design that will permit the addition of cleaning solvents and determine chemistry feed and control requirements for the closed-loop system.

Open Item 5 address two issues: system preoperational inspection and cleaning as well as chemistry control during operation. Each issue is addressed below.

The specific procedures for inspection and cleaning of the existing carbon steel piping will be developed during the design phase. However, the procedures will include the following general provisions:

- Preliminary inspection of the existing piping to ensure that it can be used for the closed-loop system operating conditions. This inspection may include ultrasonic examination to determine wall thickness and visual

examination to determine the overall condition of the piping. Any portions of piping requiring replacement will be identified.

- Cleaning of the existing piping to remove any corrosion products or debris from the piping. This cleaning may include velocity flushes, mechanical cleaning, or acid cleaning. The need to perform acid cleaning will be determined based on inspection of the piping. It is expected that the piping will be cleaned separately from the equipment to avoid fouling or damage to the equipment. This cleaning will require the addition of piping taps and flanges to the existing piping. These design provisions are included in the ACD. The required cleaning will be completed prior to attaching new piping or equipment to the existing piping. The chemical cleaning agents used to clean the system will be selected based on compatibility with the materials of construction of the existing equipment and components.
- Maintaining the interior of the system in a clean condition during construction. The use of temporary pipe caps and other provisions will avoid the introduction of debris that could damage equipment.
- Flushing of the completed system during startup. This flush will be performed to remove any debris from the system and will include the use of temporary strainers in the piping upstream of equipment. The provisions for temporary strainers will be included in the system design, as required.

After the closed-loop system is put in service, a method of controlling the system chemistry will be required. The primary method of corrosion control will be the addition of chemicals to remove oxygen. The conceptual design does not currently address chemistry control. A review of the system design indicates that the following changes are required:

- The system expansion tanks (TK-J-1 and TK-J-5) are shown in the CDR with an "Air Charge Connection" to provide pressure head on the tanks. It is recommended that a local nitrogen bottle be provided to provide pressure head. The use of nitrogen will prevent oxygen from being absorbed in the tanks.
- It is recommended that chemical addition tanks be added adjacent to the system pumps and expansion tanks. These tanks would be manually filled with concentrated corrosion inhibitor and aligned to flush the concentrate into the system. The concentrate would be flushed by a line from the pump discharge to the chemical addition tank. Refer to Figure 1 for a typical chemical addition tank design.

- **SOW 10.2.3.2b and Open Item 8: Reference Sketch M1, Sheet 2. The raw water makeup water is shown entering at a location B3 into the common header to all four cooling towers. The raw water should be routed so that it can be added to each individual tower.**

The basis of this open item was discussed at the Criteria Review Meeting (CRM) on September 8, 1994. The request to route raw water lines to each WSFC was intended to maximize operational flexibility, by directing raw water to only one WSFC. However, directing raw water to one of the four WSFCs would result in different water treatment and blow down requirements for that WSFC due to different water chemistry.

It was discussed and agreed at the CRM that the raw water makeup should be equally directed to all four WSFCs because this design would simplify chemistry control and result in cost savings due to less piping and valves. As a result, it is recommended that the raw water makeup be added to the common makeup header upstream of all the WSFCs. The raw water makeup would be throttled, as required, to supplement the makeup water from the 207A Retention Basins. This design will result in consistent water chemistry in all the WSFCs while controlling the raw water makeup flow with a single valve. The design will be revised to reflect this configuration.

- **SOW 10.2.3.2c and Open Item 9: Reference Sketch M1, Sheet 3, Zone D8. Need to be able to isolate chemical addition rather than adding chemicals through the surge tank.**

As discussed in the response to Open Item 5, it is recommended that separate chemical addition tanks be added adjacent to the closed-loop system pumps and expansion tanks. The required chemicals would be manually added to the system through this tank with the system on line. The amount of chemical addition required would be determined by local sampling.

- **Open Item 16: Evaluate the option of independent operation of the four cooling towers at the 242-A. This includes determining requirements for feed stream control/segregation and chemical feed control.**

The intent of the design is to allow independent operation of the WSFCs. The design will include makeup and blowdown controls for each WSFC. The chemical feed will be routed to the common makeup header. This arrangement will maximize the operational flexibility of the design, allowing one or more WSFCs to be taken out of service due to maintenance requirements, reduced heat load, or lower ambient temperatures.

- **Open Item 18: At the 242-A facility, the two existing flow control valves on the recirculation line are not shown on the conceptual P&IDs. The control**

valves will be removed and reinstalled as part of W-252. These valves must be shown on subsequent design drawings.

Existing control valve FV-EC1-1 is installed in the 12-inch raw water discharge piping from the primary condenser. Control valve FV-EC3-1 is installed in the 3-inch raw water discharge piping from the after condenser. The conceptual P&IDs show FV-EC3-1, along with the associated bypass piping and instrumentation, as being used. Control valve FV-EC1-1 will be reused, with the required instrumentation and bypass piping, in the primary condenser 12-inch discharge piping.

Because closing these control valves could isolate the entire flow from circulation pumps P-J-101 and P-J-102, a minimum flow recirculation line will be installed from the discharge header to the suction header of the pumps. The piping and control valve will be sized for approximately 25 percent design flow from one circulation pump. The minimum flow control valve will automatically open as required to protect the pumps during low flow conditions.

- **SOW 10.2.3.2d and Open Item 21: Evaluate the use of a fan coil unit to supply closed-loop cooling to the compressor jackets instead of a chiller.**

The cooling water requirements for the compressors, CP-E-1 and CP-E-2, as well as the aftercooler have been evaluated. The maximum allowable cooling water temperature for the compressors is 115° F, based on manufacture's information. A maximum cooling water temperature of 115° F is also acceptable for the aftercooler. An analysis has been performed to size a dry fan coil unit for this application. Based on this evaluation, a dry fan cooler is appropriate for this application and will be included in the design. However, in the event of extremely high ambient temperatures, additional cooling will be required to maintain the maximum cooling water temperature. A supplemental water-to-water cooler will be included in the design to ensure the cooling water does not exceed 115° F.

- **Open Item 23: The water chemistry control for the closed-loop and the cooling towers requires evaluation to determine (1) control and equipment required and (2) if a FDC change is required.**

As discussed in response to open item 5, design changes to control the closed-loop system chemistry are recommended. Concentrated corrosion inhibitor could be added to the system by manually filling chemical addition tanks. The system chemistry would be monitored by analyzing water samples taken from a local sample connection. A manual chemical addition system is appropriate for a closed-loop system of this type because the water chemistry should only require infrequent adjustment. The same system would be used to control chemistry with the system operating or shut down. However, it would be necessary to operate a circulation pump while adding chemicals during shut down periods.

Water chemistry control for the WSFC spray water would be accomplished by controlling the makeup and blowdown flows and by chemical injection to control bio-fouling and pH. The ACD addresses the required chemical control equipment for the WSFCs. A FDC change is not required.

The specific chemicals used for water chemistry control would be determined based on system equipment availability, water chemistry, and cost. However, the recommended system design will be consistent with normally used, environmentally acceptable chemicals.

- **SOW 10.2.3.2e and Open Item 24:** At the 242-A, evaluate the location of the four MCCs for the tower fans from outside to inside the LCU building where the pump MCC is located.

The current conceptual design was based on the MCCs being located outside. This was based on having the MCCs near the motors which reduces wiring costs because the wire and conduit runs between the MCC and the motor are shorter than if the MCC was located inside a building. However, the cost of the outside MCC is higher than the inside MCC since the outside MCC needs to be weather rated. Also, since another MCC is already located inside the LCU building, there will be less cost to bring in the main power if all the MCCs are in the same location than if MCCs are in separate locations.

The outside MCC is harder to maintain due to both the enclosure construction and the need to either schedule maintenance for decent weather or erect a weather resistant shelter during inclement weather. The indoor MCC is preferred because of the maintenance issues.

For ease of maintenance, it is recommended that all the MCCs be located inside the LCU building.

- **Open Item 25:** For 242-A, reference sketch M-1, sheet [3], zone D/8 of the CDR. Verify the type of gas for inerting the expansion tank is specified during the definitive design.

As discussed in response to open item 5, the system expansion tanks (TK-J-1 and TK-J-5) are currently shown with an "Air Charge Connection" to provide pressure head on the tanks. However, the use of air would provide a source of oxygen to be absorbed in the tanks. It is recommended that a local nitrogen bottle be installed to provide the required pressure head. The use of nitrogen in this application is appropriate based on availability and cost. The use of a local bottle is recommended based on the small amount of nitrogen make-up required. The ACD design includes local nitrogen bottles.

- **Open Item 29:** Al Larrick has prepared some notes related to the 242-A

Appendix C

MONTGOMERY WATSON

Stone & Webster Engineering Corporation

To:	Larry Bennett Montgomery Watson	Date:	October 10, 1994
		Revised:	Dec. 15, 1994
From:	Craig J. Baron	Job No.:	04847.10
Subject:	W-252 Resolution of B-Plant/WESF Open Items		

1.0 PURPOSE

The Conceptual Design Report (CDR) for Project W-252 includes modifications to the B-Plant/WESF facility. Several open items have been identified relative to these modifications. The purpose of this report is to address Scope of Work (SOW) Item 10.2.3.3 and Open Item List items 15, 19, and 22, and to provide recommended resolutions. The resolutions are incorporated in the Advanced Conceptual Design (ACD) Report. In addition to the open items, the feasibility of providing a backup once-through cooling system using raw water is investigated.

2.0 EVALUATION

Each of the referenced open items is evaluated below. A summary of the conclusions is presented in Section 3.0:

- **SOW 10.2.3.3a and Open Item 15: At the B-Plant, can the jets be changed to pumps for the cell flush sump?**

The ACD includes pumps in place of the currently installed steam jets to eliminate the effluent associated with the jets. As discussed during the September 28, 1994 tele-conference, the pumps will be sized to transfer approximately 5000 gallons in less than four hours. This flow requirement corresponds to approximately 25 gpm pumps. Conceptual P&ID ES-252-M12, Sheet 3 of 4 shows the two steam jets being retained to provide flow from storage pool numbers 9 and 10 to the new pool flush receiver tank, TK-3. The revised ACD P&ID shows two pumps installed in place of the steam jets. Additional evaluation is being performed during the ACD to determine the most appropriate type of pump for this application. Either self-priming or submersible sump pumps will be installed depending on the lift capacity of available self-priming pumps, the available space, operational considerations, and the installed equipment cost.

- **SOW 10.2.3.3b and Open Item 19: At B-Plant, investigate capping of the CDL upstream of the cell 7 tie-in since the line is badly corroded.**

As shown on conceptual P&ID ES-252-M12, Sheet 1 of 4 (Zone A-8), the unused 4-inch discharge piping upstream of cell 7, E-S7-1, will be capped. However, the ACD is based on reusing the existing piping from cells 1, 3, 4, 5, 6, and 7 as well as the discharge piping from the heat exchanger for cells A-G. As discussed during the September 28, 1994 tele-conference, the condition of the piping between the individual coolers and the discharge header is not known. Therefore, it is recommended that the existing piping be inspected to ensure that it can be used for the closed-loop system operating conditions. This inspection may include ultrasonic examination to determine wall thickness and visual examination to determine the overall condition of the piping. Any portions of piping requiring replacement will be identified.

- **SOW 10.2.3.3c and Open Item 22: The suitability of emergency water/demineralized water for B-Plant/WESF cooling tower makeup water is uncertain from a solids concentration/corrosion standpoint.**

As shown on conceptual P&ID ES-252-M12, Sheet 3 of 4, there are several sources of makeup water available for the B-Plant/WESF WSFCs. Makeup water is available from the raw water system; the WESF pool cell flush system; and the B-Plant sanitary water system. The B-Plant sanitary water system will provide a backup source of makeup water and will not be normally used. The WESF pool cell flush system will provide makeup water from the pool flush receiver when it is available. However, the pool cell flush system alone will not provide sufficient makeup water for the WSFCs. The main source of makeup water will be the raw water system, augmented by the WESF pool cell flush system. The quality of this makeup water, with the required treatment, is suitable for the WSFCs. Raw water quality water is commonly used for WSFCs of this type and is not expected to cause significant corrosion. Use of the other makeup water sources may require some adjustments to the water treatment. The system design will include the required water treatment design provisions to operate with the available makeup water.

The CDR states that the capacity of the pumps for the 282-B and 282-BA emergency water wells can be reduced. This is based on using the pumps for makeup to the WSFCs only. However, the ACD includes provisions to provide direct raw water cooling to the cells. The existing 282-B and 282-BA emergency pumps are not required for makeup to the WSFCs and will not be used.

- **Backup Source of Cooling Water**

The feasibility of providing a backup source of cooling water from the raw water system was evaluated. A backup source of water is required to ensure that the cells will continue to be cooled in the event that the closed-loop cooling water system is lost due to a single failure or an external event. The current design includes a

backup source from the 282-B and 282-BA emergency cooling water pumps. As a result these pumps are periodically tested to ensure availability. Using the raw water system to backup the closed-loop system should eliminate the emergency cooling water pumps testing requirements, and the associated effluent.

The raw water system evaluation was based on a maximum flow of 350 gpm and an assumed raw water inlet temperature of 72°F (22°C) (WHC to confirm raw water design basis temperature). The 350 gpm flowrate is based on the maximum flow that can be transferred to the TEDF, per Westinghouse Hanford. Based on the maximum total heat load of 3,262,525 BTU/Hr, the average cell temperature would be approximately 96°F (36°C) and the return temperature from cells A-G would be approximately 100°F (38°C). Based on these results, the use of raw water as a backup is recommended and is included in the ACD.

3.0 CONCLUSION

As discussed in Section 2.0, the ACD report will address open items 15, 19, and 22. A brief summary of the recommendations associated with each item follows:

- Open Item 15: The design will include pumps in place of the existing steam jets to transfer water from storage pool numbers 9 and 10 to the pool flush receiver tank.
- Open Item 19: The unused 4-inch discharge piping upstream of cell 7 will be capped. It is also recommended that the remaining existing piping be inspected to verify that it can be reused for the closed-loop system.
- Open Item 22: The water quality of all potential makeup water sources is acceptable for WSFCs of this type. In addition the design will include provisions for water treatment to ensure that the appropriate water quality is maintained.
- The design will include the use of raw water as a backup to the closed-loop cooling water system. The capacity of the TDEF pump station limits raw water flow to 350 gpm. Assuming this flow rate and a raw water inlet temperature of 72°F (22°C), the average pool temperatures will be approximately 96°F (36°C). This is an acceptable temperature based on a maximum pool operating temperature limit of 113°F (45°C). Thus, provision for discharge to B-Pond will not be incorporated in the ACD.

Appendix D

MONTGOMERY WATSON

Stone & Webster Engineering Corporation

To:	Larry Bennett Montgomery Watson	Date:	November 28, 1994
		Revised:	Dec. 15, 1994
From:	Craig J. Baron	Job No.:	04847.10
Subject:	W-252 Alternate Fluid Cooler Location - 242-A Evaporator		

1.0 BACKGROUND

As shown in the Conceptual Design Report (CDR) and the 30 percent Advanced Conceptual Design (ACD) report for Project W-252, the CDR proposed design for the 242-A closed-loop cooling water system includes the addition of WSFCs and a LCU/Storage building west of the evaporator building. The circulating pumps, expansion tank, and other equipment required for the new cooling water system would be located in the LCU/Storage building. The new 14-inch cooling water supply and return piping between the evaporator building, WSFCs, and pumps would be routed above-ground to avoid interferences with existing buried piping and to avoid any excavation in the contaminated area west of the evaporator building.

The new 14-inch supply piping from the circulation pumps would be routed above-ground from the LCU/Storage building to the evaporator building, across the roof of the building, through the roof, and would connect to the existing 14"-RW-600-M5 line inside the evaporator building HVAC room. In addition, the CDR proposed design includes replacing and rerouting the 12-inch discharge piping from the E-C-1 condenser inside the evaporator building. The discharge line size would increase to 14-inch inside the building, run through a new penetration in the wall of the condenser room, run across the roof of the building above the HVAC room, and be routed above-ground to the WSFCs. The discharge line from E-C-2 and E-C-3 would tie into the E-C-1 discharge line inside the evaporator building. The existing 12-inch used raw water discharge line from E-C-1 would be partially removed inside the evaporator building and abandoned outside the building.

As part of the CDR proposed design, a new 3-inch WSFC blowdown piping would be routed from the WSFCs (located west of the evaporator building), through a valve pit, to the TEDF line (approximately 300 feet east of the evaporator building); this line would be buried. The primary source of makeup water for the WSFCs would be from the

steam condensate retention basins. The makeup line would be a buried 3-inch line from the 207-A pump pit (approximately 600 feet east of the evaporator building) to the WSFCs. In addition, a new makeup line from the raw water system would be added. The new line would be routed from an existing raw water line in the water service building and would be tied into the new buried makeup line from the 207-A pump pit, near the service building.

As an alternative to the CDR proposed design, relocation of the WSFCs to the area between Canton Avenue and the 207-A retention basins has been proposed. This alternative would involve locating the new WSFCs, the LCU/Service building, and associated equipment approximately 300 feet east of the evaporator building instead of 100 feet west of the building. The majority of the 14-inch cooling water piping to and from the WSFC location would be buried under the parking lot and Canton Avenue. The primary source of makeup water for the WSFCs would still be from the steam condensate retention basins. However, the buried 3-inch makeup line from the 207-A pump pit to the WSFCs, would be considerable shorter than the CDR proposed design (approximately 75 feet). The new makeup line from the raw water system would, however, be considerably longer than the CDR proposed design. This new line would be routed from an existing raw water line in the water service building to the WSFC location (approximately 400 feet). Unlike the CDR proposed design, the alternative design would not include replacing or rerouting the 12-inch discharge piping from the E-C-1 condenser inside the evaporator building.

2.0 PURPOSE

The purpose of this engineering evaluation is to determine the advantages and disadvantages of both the CDR proposed design and the alternative design described above. This evaluation includes an order-of-magnitude cost estimate of the cost difference between the options, an estimate of the time required to perform the construction activities that would impact operation of the facility for both options, and an evaluation of the operational impacts associated with each option. A recommendation, to be included in the ACD report, is developed based on these estimates.

3.0 EVALUATION

3.1 COST ESTIMATE

A summary of the order-of-magnitude cost estimate is presented below. This estimate only addresses the costs that would differ significantly between the options. The other aspects of the design are not related to these design options and are omitted from the cost estimate. The estimate does not include the costs associated with construction management or overhead because these costs are assumed to be independent of the design option selected. In addition, the estimate does not account for the costs associated with relocating the existing fabrication shop or fence located west of the evaporator building. A contingency of approximately 20 percent is included in the estimate.

CDR proposed Design

<u>Description of Work Items Required</u>	<u>Estimated Cost</u>
1. Installation of 14-inch supply and return piping to and from the WSFC location (west of building). All piping is above ground, heat traced, and insulated. The estimate is based on approximately 300 feet of pipe.	\$ 60,000
2. Installation of new discharge piping from E-C-1 condenser inside evaporator building. This work includes the removal of a portion of the existing piping and a penetration through the building wall. The estimate is based on approximately 40 feet of pipe.	\$ 18,000
3. Installation of 3-inch makeup piping from the 207-A retention basins to the WSFC location (west of building). All piping is buried. The estimate is based on approximately 800 feet of pipe.	\$ 32,000
4. Installation of 3-inch blowdown piping from the WSFC location (west of building) to the TEDF line. All piping is buried. The estimate is based on approximately 700 feet of pipe. The cost of excavation and back-fill is included in item number 3.	\$ 20,000
<u>Cost for CDR proposed Design Work Items</u>	<u>\$ 130,000</u>

Alternative Design

<u>Description of Work Items Required</u>	<u>Estimated Cost</u>
1. Installation of 14-inch supply and return piping to and from the WSFC location (east of building). All the return piping and the majority of the supply piping is buried. A portion of the supply piping is above ground, heat traced, and insulated. The estimate is based on 600 feet of pipe and includes the cost of the connection to the existing, buried discharge piping from E-C-1 condenser north of the evaporator building.	\$ 91,000

2. Installation of 3-inch makeup piping from the 207-A retention basins to the WSFC location (east of building). All piping is buried. The estimate is based on approximately 200 feet of pipe. \$ 8,000

3. Installation of 3-inch blowdown piping from the WSFC location (east of building) to the TEDF line. All piping is buried. The estimate is based on approximately 50 feet of pipe. The cost of excavation and back-fill is included in item number 1. \$ 1,500

4. Installation of 3-inch raw water makeup piping from the water service building to the WSFC location (east of building). All piping is buried. The estimate is based on approximately 500 feet of pipe. The cost of excavation and back-fill is included in item number 1. \$ 15,000

5. Additional engineering and design associated with the revised WSFC location. This includes the cost of updating ACD drawings, engineering reports, and analyses affected by the change. \$ 4,500

Cost for Alternative Design Work Items \$ 120,000

As show above, the estimated order-of-magnitude cost of the work items associated with the alternative design is approximately \$ 10,000 less than the cost of the work items associated with the CDR proposed design. This estimate does not account for the potentially significant costs associated with relocating the existing fabrication shop or fence located west of the evaporator building, as required by the CDR proposed design. The primary reasons for the lower cost of the alternative design are elimination of significant work inside the evaporator building, and shorter pipe runs between the WSFCs and both the 207-A retention basins and the TEDF. This reduction in cost is partially offset by the longer cooling water pipe runs associated with the alternative design.

3.2 CONSTRUCTION TIME ESTIMATE

A summary of the estimated time required to perform the construction activities that would impact operation of the facility for both options is presented below. This estimate only addresses those activities that would differ significantly between the options and would impact operation of the facility. The estimated time does not include the time associated with construction activities that could be performed while the evaporator facility is operating.

CDR proposed Design

The most significant construction activity that could not be performed with the facility operating would be installation of new discharge piping from the E-C-1 condenser inside the evaporator building condenser room. The work would include the removal of a portion of the existing piping, installation of new 12-inch piping and valves, relocation of an existing control valve and instrumentation, and the addition of a penetration through the exterior wall.

Because this area is radiologically controlled and because of the limited space available in the room, this work is expected to be time consuming. It is estimated that required work would require a minimum of four weeks to be completed. Assuming that an additional four to six weeks of system testing would be required prior to placing the evaporator facility back in service, this construction activity is expected to require approximately eight to ten weeks. This estimate does not include any time for unanticipated installation or testing problems.

The other construction activities associated with the CDR proposed design could either be completed with the facility operating or be expected to require less time to complete. Based on the other required construction activities being completed prior to the work in the condenser room, some component testing could be performed in parallel with condenser room work. However, the overall cooling water system testing could not be performed until all the condenser room work was completed. It is, therefore, unlikely that the modifications required by the CDR proposed design could be completely installed and tested during the two to three months expected to be available between evaporator campaigns.

Alternative Design

The two most significant construction activities that could not be performed during facility operation would be the connection of new cooling water supply piping inside the evaporator building and the connection of new cooling water return piping to the existing buried used raw water pipe north of the evaporator building. The new cooling water supply connection would also be required for the CDR proposed cooling water system design.

The new cooling water supply piping connection inside the evaporator building would include the addition of a penetration through the evaporator building HVAC room roof, the removal of an existing flanged raw water strainer, and the installation of a short section of piping inside the building. It is estimated that the required work would take approximately one week to complete.

The connection of the new cooling water return piping to the existing buried used raw water piping would include the excavation of the existing used raw water piping, removing a section of the piping, welding the new piping in place, and back-filling the piping. It is estimated that this work would also take

approximately one week to complete, not including the excavation and back-fill work that could be completed with the facility in service.

The two construction activities discussed above could be completed in parallel. Assuming that an additional four to six weeks of system testing would be required prior to placing the evaporator facility back in service, this construction activity is expected to require approximately five to seven weeks. This estimate does not include any time for unanticipated installation or testing problems.

The other construction activities associated with the alternative cooling water system design could either be competed with the facility operating or be expected to require less time to complete. The overall cooling water system testing could not be performed until this work was completed. Therefore, it is feasible that the modifications required by the alternative cooling water design could be completely installed and tested during the two to three months expected to be available between evaporator campaigns.

3.3 OPERATIONAL IMPACT

The potential operational impacts associated with both the CDR proposed cooling water system design and the alternative cooling water system design are summarized below. This summary only addresses those issues that would differ significantly between the options.

CDR proposed Design

The most significant operational advantage of the CDR proposed design is that the WSFC location (west of the evaporator building) is somewhat closer to the facility control room than the alternate WSFC location (east of the building). This location is expected to be more easily accessible during operation. However, the cooling water system design is intended to minimize the requirement for local action. All instrumentation and controls required for normal operation would be accessed from the facility control room. The only requirement to access the WSFCs, and the adjacent LCU/Service building, would be either to perform normal maintenance activities or to respond to an abnormal condition.

Alternative Design

The most significant operational advantage of the alternative design is that the amount of above-ground piping requiring heat tracing and insulation is minimized. The majority of piping associated with this design option is buried or installed inside heated buildings. This design is expected to minimize the power consumption and maintenance associated with heat tracing and insulation. In addition, the above-ground piping, heat tracing, and insulation would be more susceptible to potential damage from the elements.

As discussed above, the alternate WSFC location is somewhat further from the facility control room than the CDR proposed location. However, the alternate design location is adjacent to the 207-A retention basins and the 207-A pump pit. It is expected that any required maintenance activities at the WSFCs could be combined with activities that require access to the retention basins or pump pit. The higher power consumption requirement for the circulating pumps will not be significant.

4.0 CONCLUSION

Based on the above evaluation, it is recommended that the WSFCs be located at the alternative location east of the evaporator facility, between Canton Avenue and the 207-A retention basins.

The most significant advantage of this design change would be to minimize the required construction in the evaporator building condenser room. Because the condenser room is a radiologically controlled area and because of the limited space available, any work performed in the area would be costly and time consuming. Work in this room would only be possible when the evaporator facility was not operating. The CDR proposed cooling water system design would require a significant amount of work in the area. It is, therefore, unlikely that the modifications required by the CDR proposed design could be completely installed and tested during the two to three months expected to be available between evaporator campaigns.

The alternate WSFC location described above would require little or no construction work in the condenser room, reducing the impact on the construction schedule. Therefore, it is feasible that the modifications required by the alternative cooling water design could be completely installed and tested during the two to three months expected to be available between evaporator campaigns.

As summarized above, an order-of-magnitude cost estimate indicates that the recommended alternative design would be slightly less costly than the CDR proposed design. There is no significant operational advantage to either of the WSFC locations; however, the alternative design includes significantly less above-ground piping, therefore, requiring less heat tracing and insulation. The alternative design is, therefore, expected to require less maintenance.

Appendix E

MONTGOMERY WATSON

Stone & Webster Engineering Corporation

To:	Larry Bennett Montgomery Watson	Date:	November 22, 1994
		Revised:	Dec. 15, 1994
From:	Craig J. Baron	Job No.:	04847.10
Subject:	W-252 Alternate Cooling Water System Design 284-E Powerhouse		

1.0 PURPOSE

The Conceptual Design Report (CDR) for project W-252 proposes a closed-loop cooling water system design for the 284-E Powerhouse. This closed-loop system would be cooled by a WSFC. During the development of the CDR, use of the nearby 282-E Reservoir as an alternate heat sink had been considered. The use of this reservoir, instead of a WSFC, was initially considered to be the preferred design and was recommended. However, this option was ruled out, apparently due to plans to remove the 282-E Reservoir from service and replace it with a new reservoir. After the CDR was issued, the plans to remove this reservoir from service were canceled, making the 282-E Reservoir available as a potential heat sink for the 284-E Powerhouse.

The purpose of this Engineering Report is to investigate the feasibility of using the reservoir, instead of a WSFC, as the cooling water system heat sink, and to provide recommendations to be included in the Advanced Conceptual Design (ACD). The resolution will be incorporated into the Project W-252 ACD report.

2.0 EVALUATION

The feasibility of using the 282-E Reservoir as the cooling water system heat sink is evaluated based on several factors. Each of the significant issues is addressed below:

1. The project Functional Design Criteria (FDC) specifies a total heat load of 0.25×10^6 BTU/hr for the 284-E Powerhouse. However, ACD analyses indicate that the maximum cooling water system heat load associated with the 284-E Powerhouse during the summer is approximately 3.3×10^6 BTU/hr. During the winter, the maximum heat load is approximately 7.6×10^6 BTU/hr. The basis of these calculated heat loads is discussed in Stone & Webster's letter of December 15, 1994. Based on these calculated heat loads and on the historical temperature data for the Hanford site, the steady state reservoir temperature would be approximately 89° F during the summer and 67° F during the winter.

The average annual reservoir temperature would be approximately 75° F. These temperature values are based on the heat load and the size of the reservoir, and are independent of the cooling water flow rate.

Manufacture's information indicates that a maximum cooling water temperature of 80° F is required for some powerhouse equipment. The required cooling water temperature could not be maintained with the elevated reservoir temperatures discussed above.

It is our understanding that the reservoir currently experiences significant bio-fouling. It is expected that increasing the reservoir temperature throughout the year would increase the amount of bio-fouling. The potential effect of the increased temperature on the other reservoir water users has not been determined.

2. The operation of the 284-E Powerhouse requires continuous heat removal from operating equipment. The heat sink for the closed-loop cooling water system must, therefore, be continuously available. It is our understanding that the 282-E Reservoir must be taken out of service periodically for cleaning and maintenance. Use of the reservoir for a heat sink would, therefore, require a backup heat sink that could be used when the reservoir is not available. The only identified backup heat sink would be the use of once-through raw water cooling. Preliminary analyses indicate that the backup cooling system would produce a raw water discharge flow of approximately 200 gpm whenever the reservoir was not in service. Because the reservoir could be out of service for an extended period of time, discharges of this flow to TEDF is not expected to be acceptable.
3. The proposed alternate cooling water system design would include a water-to-water, shell and tube heat exchanger to transfer heat from the closed-loop system to a secondary cooling water loop. The secondary loop would consist of new piping and valves to route cooling water from the existing pressurized water header, through the closed-loop system heat exchanger, and to the 282-E Reservoir. It is our understanding that the existing pressurized water header is supplied from the reservoir through existing pumps, and that the maximum available return flow rate from that header to the reservoir is approximately 200 gpm. Based on this information, analyses determine that the maximum required temperature rise across the heat exchanger, on the secondary loop side, would be approximately 76° F during the winter. During the summer the temperature rise would be approximately 33° F. These values are the calculated differences between the secondary cooling water loop supply and return temperatures.

Although the analyses indicate that the required heat loads could be removed with a cooling water flow of 200 gpm, the temperature rises associated with these heat loads are unusually large for a cooling water system. If the reservoir was taken out of service during the winter (Refer to item 2.), the discharge temperature to the TEDF could approach 120° F. This high temperature discharge flow could approach the design temperature limit of TEDF system components during the

winter with heat exchanger temperature rise of 76° F and an assumed raw water temperature of 40° F to 45° F.

3.0 CONCLUSION

Based on the above evaluation, use of the 282-E Reservoir as the heat sink for the 284-E Powerhouse closed-loop cooling water system is not considered feasible. The primary reasons for this conclusion are the elevated reservoir temperatures that would result from the maximum heat load, and the problems associated with taking the reservoir out of service when the powerhouse is required to operate. It is therefore recommended that the 284-E Powerhouse closed-loop cooling water system design include a WSFC to remove heat from the system. This recommendation will be incorporated into the ACD report.

Appendix F

MONTGOMERY WATSON

M E M O R A N D U M **MONTGOMERY WATSON**

To:	DISTRIBUTION	Date:	December 15, 1994
From:	Pat Naylor	Revised:	January 27, 1995
Subject:	W-252 Monitoring Instrumentation Review	Reference:	1202.0610/3.1.2

PURPOSE

This memorandum is a revision of a document prepared for the 30% Advanced Conceptual Design (30% ACD), included in that document as Appendix D. It discusses Montgomery Watson's review of the Kaiser Engineers-Hanford (KEH) Project W-252 Conceptual Design Report (CDR) Piping and Instrumentation Drawings (P&IDs) and associated Outline Specifications for the 241-A/244-AR area, the B-Plant/WESF, the 242-A Evaporator, 282-E Reservoir, 283 Water Treatment Facility, and 284-E Powerhouse areas. Also discussed is Montgomery Watson's comparison of the requirements of the Functional Design Criteria (FDC) with the instrumentation section of the outline specifications included in Appendix E of the CDR. The purpose of the review is to identify potential problems or inconsistencies and to request additional information needed to prepare for a Definitive Design. This revision of the 30% ACD Appendix D incorporates (in *italics*) resolutions of issues raised in the original document, based on information provided in the Review Comment Record (RCR) and by WHC personnel at progress meetings, at site visits, and in personal communications. Also included are discussions of CDR modifications for the 282-E Reservoir, 283-E Water Treatment Facility, and 284-E Powerhouse which were not discussed in Appendix D of the 30% ACD Report.

SCOPE OF WORK

The focus of the review is on the instrumentation associated with the monitoring of effluent. Effluent monitoring includes pH, conductivity, temperature, and flowrate at all locations, as well as radiation monitoring at three locations and pressure monitoring at one location. Various monitoring instruments and appurtenances are identified on the P&ID drawings and are compared with the requirements of the FDC, Section 3.0, Process Design Criteria. Questions and comments arising from this comparison are included herein.

The CDR includes outline specifications for the W-252 project, including Section 13440, Instrumentation. This section of specifications is compared to the FDC Process Design Criteria to evaluate the suitability of the specification requirements in fulfilling the objectives stated in the FDC. Comments and questions pertaining to this evaluation are included herein.

Open Items (OI) list numbers 2, 6, 7, 10, 11, 12, and 20 from the Scope of Work are also discussed.

P&ID REVIEW

General

The following questions are based on review of the P&IDs:

1. Based on instruments shown, the pH alarm and automated valve controls are apparently activated only at high pH. Is low pH also a potential concern? *Yes. Low pH alarms should also be included.*
2. Radiation alarms are designated by the acronyms "RAH" and "RAX". "R" stands for radiation, "A" stands for alarm, and "H" stands for high, meaning above a set limit. What does "X" stand for? *Failure alarm.*
3. The FDC, Section 3.1.1 (BAT/AKART Instrumentation and Control), requires "Failure alarms for individual system and/or unit operation". What constitutes a system failure? Selection of a monitoring program for system failure will depend on how it is defined. *Individual system failures are defined by MW to be any condition which would indicate that the monitoring system is not operating properly. Sampling equipment will be equipped with self-diagnostic capabilities which will signal a general alarm whenever minimum sampling requirements are not met, including no liquid detected, power failure, sampler pump failure, or distributor arm jamming.*
4. The FDC, Section 3.1.2 (PTECS Instrumentation and Control), requires historical record of waste streams. How will data be recorded? No strip recorder or datalogger is identified in the P&ID for the Local Control Units (LCUs). Our assumption is that a datalogger is included as part of the centralized monitoring system, and that this datalogger will continuously or periodically record data from each individual LCU source. If this assumption is incorrect, a data recorder will be required. *The assumption regarding data recording within the centralized monitoring system is correct.*
5. Section 3.1.2 of the FDC calls for primary leak detection, where required. None of the P&IDs reviewed show any mechanism for leak detection. All piping for monitoring purposes is to be single-walled without leak monitoring safeguards. Is some method of leak detection required for parameter monitoring piping? *Leak detection will not be required for monitoring of parameter monitoring piping.*
6. All motor-controlled valves should be labeled with the prefix "MV" rather than "HV", as they are currently labeled (see also OI-11). *Corrected in the 90% ACD P&ID submittal. Note that most of the motor-controlled valves have been removed for the 90% ACD at the request of WHC.*

241-A/244-AR Effluent Monitoring Systems (CDR Drawing ES-252-Y8; ACD Drawing ES-252-ACD-25)

Because of the similar nature of these two systems, all questions and comments apply to both systems.

1. The monitoring elements are shown on the suction side of the sampling pumps. To prevent false readings in the event of temporary shutdown, monitoring elements should be located on the discharge side of the pumps. As an alternative to the configuration shown in the CDR, we propose a sampling configuration similar to that used at 284W of the W-291H project, as shown on ES-W252-ACD-40.
2. Is the separate sampling pump for the radiation element necessary? Could radiation be monitored without a separate pump, if samples are drawn from the discharge side of the pump? *Where a separate sample pump is not provided, a pump for sampling radionuclides is required to ensure a uniform flow rate, which is essential in obtaining accurate measurements of radionuclides. Where a separate sample pump is provided, a pump for sampling radionuclides is not required; however, if the vendor-supplied equipment is equipped with a pump, it will be easier to use the vendor-supplied item than to retrofit the equipment to omit the pump.*
3. The P&ID shows the monitoring piping circuit, pumps, motor control center, sampling equipment, and sample ports within the LCU boundary. This is incorrect; this equipment will be located at the respective locations, rather than within the LCU.

242-A Evaporator (CDR Drawing ES-252-M1, Sheet 3; ACD Drawing ES-252-ACD-13)

1. The analysis element for temperature and pH ties into indicators for both pH and temperature, but the associated analysis alarm feature does not specify which parameter the alarm applies to. Is it pH, temperature, or both? Should temperature sensing instrumentation also be associated with conductivity? See the temperature monitoring configuration on the attached drawing from the 284W area for a proposed alternative. Alarms will apply to pH, conductivity, and temperature. A separate temperature element will be installed.
2. This facility has a flowrate alarm light, but the B-Plant and 241-A/244-AR monitoring systems do not. Why is one needed here but not at the other locations? *A flowrate alarm light is not needed at the 242-A Evaporator.*
3. The FDC, Section 3.1.1, requires a status indicator for all "rotating equipment". The sampling pump should include this requirement. *This has been included in the ACD engineering sketches.*
4. The bypass line of the valve pit appears to be designed to route flow around the valve pit monitoring equipment by manually opening the bypass gate valve and manually closing the valve pit monitoring piping gate valves on each end of the monitoring piping. Is this understanding correct? *Yes.*
5. It is assumed that the gate valves attached to flanges on each end of the monitoring piping system are intended for system drainage. Why are two valves needed for this? *No reason has been identified. One valve will suffice for drainage. The other valve has been eliminated.*

6. A motor-controlled ball valve is located upstream of the monitoring station. Does this valve serve any purpose other than to stop effluent when the contaminants are in excess of the discharge limits (automatic shutoff)? For example, is the valve used to regulate flowrate or to maintain pressurized conditions upstream? (This information is needed for valve sizing and selection purposes.) *This valve will be used only to stop effluent discharge and will be operated manually. The motorized requirement is not required.*

B-Plant/WESF (CDR Drawing ES-252-M12, Sheets 2 and 3; ACD Drawings ES-252-ACD-19 and 22)

1. At this facility, low and high level alarms are provided. These alarms are assumed to serve as system failure alarms as required by the FDC, Section 3.1.1. No other system failure alarms are proposed for this location. Is this acceptable? *No. All sampling equipment will be equipped with self-diagnostic capability which will activate a general failure alarm in the event of monitoring system failure. See General Item #3.*
2. This effluent monitoring system pumps water from the TK-2 sump tank, past the monitoring elements, through a motor-controlled ball valve, and out to the TEDF. In the event that the ball valve were to be closed, either automatically or manually, continued pumping from the sump tank could result in substantial pressure buildup within the piping system. A pressure indicator is shown at the sump tank, but no provision is allowed for either monitoring pressure buildup or for automatic shutoff of the tank pumps in the event of valve closure. No pressure alarm is shown either. It is recommended that a pressure alarm and pressure indicator be included at the LCU in the system for the piping between the pumps and ball valve. Also, automatic shutoff of both pumps should be implemented in the event of ball valve closure. *This automatic valve will be removed based on WHC direction.*
3. No flow indicator or alarm is shown. We will include a flowrate indicator and high flowrate alarm.

282-E AND 283-E (No corresponding CDR Drawings; ACD Drawings ES-252-ACD-37, 38 and 39)

The 282-E and 283-E facilities will be designed to match project W-291. Modifications to the corresponding W-291 design (282-W Reservoir) at the 282-E Reservoir include addition of a level-regulated knife gate (hydraulic) valve in Weir House 282-EB, abandonment in place of the valve in Weir House 282-EA, and elimination of the reservoir bypass line. For 283-E, the corresponding W-291 facility (283 W) design changes include replacement of sonic meters with magnetic and vortex meters and inclusion of automatic effluent valve control on the filters.

284-E Powerhouse (CDR Drawings ES-252-M18, Sheets 1 through 4; ACD Drawings ES-252-ACD-31 through 36 and 40)

The 284-E facility design was modified from the corresponding W-291 facility (284-W) P&ID by eliminating discharge from the metal fabrication shop to the v-notch flume and relocating the interlock control for the sampling pump from the LCU building to the sampling area. Changes to the P&IDs include addition of isolation valves and an aftercooler for boiler blowdown,

elimination of automated motorized valve closure triggered by monitoring alarms prior to discharge to the TEDF, and replacement of sonic valves with magnetic or vortex valves.

OUTLINE SPECIFICATIONS EVALUATION

The outline instrumentation specifications (Section 13440) contained in the CDR were compared with the FDC Process Design Criteria (Section 3.0). The specifications appear to contain all the relevant major pieces of equipment outlined in the FDC Process Design Criteria, with the exception of provision for leak detection. Also, although the specifications identify the Micon control system, no direction is provided for the programming required for the system, including the LCUs and the monitoring and control systems (MCS). *Leak detection will not be required in this case. Because the local control systems will govern the cooling tower controls, only parameter monitoring will be controlled by the Micon system. Existing control systems at the B-Plant and 242-A Evaporator will be reprogrammed to receive signals from the LCU monitoring systems.*

EVALUATION OF OPEN ITEMS

Open Item No. 2: 242-A Evaporator Cooling Tower. The LCU should be a Texas Instruments D/3 PCM rather than a Micon A/S local control unit. Then alarms will then go to the ETF.

The Montgomery Watson instrumentation engineer visited the site and met with interested parties to discuss the Process and Instrumentation Diagrams (P&IDs) to more fully understand this issue. The DCS equipment used at the 242-A Evaporator will be an extension of the TI D/3 system already in place. Additional hardware will be purchased to accommodate the new signals within the new 242-A area and for communication to the TEDF. Specifications for the new equipment will be finalized during the definitive design.

Open Item No. 6: Evaluate the use of nonintrusive flow instrumentation as currently identified in the outline specification. This type of instrumentation located on the outside of the pipe won't work for steam condensate feed flow measurement because the conductivity of this stream is not high enough to make this kind of instrumentation work.

The Montgomery Watson instrumentation engineer visited the site and met with interested parties to discuss the Process and Instrumentation Diagrams (P&IDs) to more fully understand this issue. The equipment specified in the original outline specification for non-intrusive flow instrumentation uses the ultrasonic flow measurement principle. The measurement does not require that the fluid being measured be electrically conductive. However, the non-intrusive flow device specified for full pipe applications is a clamp-on unit with marginal accuracy and is difficult to set up. Therefore, the specification will be changed to magnetic flowmeters for fluids that have conductivities above 5 $\mu\text{S}/\text{cm}$ and vortex meters for fluids that have conductivities below 5 $\mu\text{S}/\text{cm}$.

Open Item No. 7: Evaluate local indication instrumentation specified in outline specification. A lot of the local indication instrumental will not be required because the same indication can be visually obtained from the local operation interface screen display.

A Montgomery Watson instrumentation engineer has compared the monitoring instrumentation outline specifications with the FDC Process Design Criteria to evaluate the suitability of the instrumentation addressed in the outline specifications. He visited the site and met with interested parties to discuss this OI in order to determine what is needed to provide adequate indication instrumentation at the appropriate locations. The local indication specified for some instruments in the outline specifications is usually considered useful for a number of reasons, including ease of maintenance and calibration, local troubleshooting, and local operation needs if the local operation interface (LOI) screen display should fail. This becomes more of an issue when no LOI will be present in areas such as 242-A Evaporator and the B-Plant. Also, many of the instrumentation transmitters, such as the specified pH, conductivity, and turbidity transmitters, automatically come with indicators which double as the means to program and calibrate units.

It has been past practice at Hanford to automatically purchase local indication for any instrumentation/transmitter that has the option, no matter what the circumstance. However, after consultation with Frank Graf of WHC, it was decided that local indication should not necessarily be automatic, but rather should be dealt with on a case-by-case basis.

Open Item No. 10: Evaluate use of nonintrusive flow metering rather than sonic flow meters.

Magnetic flow meters will be used in all locations except where ultra-low conductivity may affect accuracy. In those instances (e.g. steam condensate), vortex meters will be employed. See response to OI 6.

Open Item No. 11: Change labeling of motorized valve from HV to MV during definitive design.

Most motorized valves will be replaced with hand operated valves where automated control is not essential. Those retained have been relabeled.

Open Item No. 12: Standardize (1) tag numbering of instruments/equipment (2) equipment nomenclature, instrument and software logic symbols, system list and color terminology during definitive design/advanced conceptual design.

The Montgomery Watson instrumentation engineer coordinated with Frank Graf of WHC to establish the appropriate tagging, nomenclature, symbols, and other identifiers for P&ID development. WHC engineers at each facility will be consulted to develop tag numbers for instruments and equipment. Numbering and nomenclature may therefore vary from facility to facility, but this appears to be the only way to avoid numbering conflicts at the individual facilities. This approach to numbering will require a considerable amount of effort and coordination with WHC facility managers and was not originally anticipated; therefore it will be completed as part of the definitive design.

Open Item No. 20: On the various CD P&IDs, the destination of the various local signals need to be determined.

To more fully understand the OI issues, the Montgomery Watson instrumentation engineer visited the site and met with interested parties to discuss the P&IDs. The destination of various local signals will be incorporated in the P&IDs for the ACD and definitive design. The P&IDs will show the destination of the signals with labels to designate each indicating device.

SUMMARY

Montgomery Watson has reviewed KEH's CDR P&IDs and Outline Specifications for the W-252 Project. As a result of this review, comments and questions have been prepared for WHC. Most of these issues were resolved between the 30% and 90% ACD Reports. The responses received from WHC will be used to develop the information needed for Definitive Design.

Appendix G

MONTGOMERY WATSON

B-PLANT and 242-A EVAPORATOR LIQUID EFFLUENT RADIATION MONITORING EQUIPMENT

Prepared by Kevin Salmon of NFS, December 5, 1994

PURPOSE

This report discusses the current operating status and detection limits of two existing liquid effluent radiation monitoring instruments relative to the existing regulatory requirements for Project W-252. Also included is a response to Open Item #13 from the U. S. Army Corps of Engineers Statement of Work for Project W-252, dated 18 July, 1994.

SCOPE OF WORK

Nuclear Fuel Services, Inc. was retained by Montgomery Watson to evaluate two existing liquid effluent radiation monitoring systems currently operating at B-Plant and the 242-A Evaporator. The Nuclear Measurement Corporation PIOPS™ Continuous Beta-Gamma Monitor for B-Plant chemical sewer and the Canberra 802 system for continuous gamma monitoring for the 242-A Evaporator steam condensate were reviewed for operating status and detection limits. The evaluation assesses the capabilities of these instruments to measure radionuclide concentrations at the specified regulatory limit. Evaluation of the Victoreen 940-2 system capabilities specified in the Conceptual Design Report is also included. Additionally, this report contains a brief evaluation of radiation instrument needs and locations addressing Open Item 13, "Need to provide additional guidance for on-line alpha-beta monitoring which is compatible with commercially available instruments."

SUMMARY

B-Plant PIOPS™ system:

This system is operating efficiently and within its intended design specifications. It cannot meet detection limits capable of validating soil column release regulatory criteria, but no commercially available technology currently has this capability.

Recommendation:

Retain this system in its present configuration.

242A Evaporator Canberra 802 system:

This system is currently operating in a high background environment due to its proximity to contamination. It is an old system, but is operating adequately under its intended design specifications. However, while operating under present background levels it cannot detect

small increases in contamination with the same degree of accuracy as the PIOPS™ or other equivalent commercially available instruments.

Recommendation:

Retain this system in its current configuration. A new "Best Available Technology" (BAT) radiation monitor is slated to be installed down stream of this location.

Open Item #13, "Need to provide additional guidance for on-line alpha-beta monitoring which is compatible with commercially available instruments.":

The drawing ES-252-Y8 in the Conceptual Design Report entitled, "P & ID, 241-A EFL Monitoring System," for the proposed liquid effluent radiation monitoring systems for 244-AR and 241-A shows independent sample stream pumps for the alpha-beta monitoring instruments. The PIOPS™ that have been previously manufactured for WHC have been designed with pumps as a part of the system. This reports recommends the use of PIOPS™ liquid effluent monitors for the W-252 Project, however the preferred procurement will not come with the monitoring skids equipped with a sample pump.

The FDC contains a statement which calls for continuous alpha-beta monitoring. Continuous alpha monitoring of a liquid effluent is not possible. Alpha analysis of liquids must be performed by liquid scintillation or solid-state spectrographic technologies in laboratories.

Recommendation:

The above referenced drawing should be changed to show radiation monitoring skids without independent sample pumps. Also, amend the FDC to indicate continuous beta-gamma monitoring.

EVALUATION

Regulatory Requirements:

Releases to the soil column are defined to include effluent discharge to surface ponds. Currently the combined B-Plant cooling water effluent and chemical sewer effluent join into a single line that is discharged to B-Pond under normal operating conditions. Project W-049 intends to reroute the B-Plant chemical sewer into the 200 Area Treated Effluent Disposal Facility (TEDF). Project W-252 plans to reroute the B-Plant/WESF cooling water line and the 242A Evaporator steam condensate line into TEDF.

Regulatory requirements state that the dose shall be limited to 0.04 mSv/yr (4 mrem) from discharges to the soil column. This limit is based on unlimited continuous public use (i.e. 2 liter/d consumption from public drinking water supplies). Derived Concentration Guides (DCG) for liquid effluent are established by the Department of Energy (DOE Order

5400.5). This DOE Order provides the concentrations of radionuclides in water for continuous unrestricted use from exposure to water for one year resulting in an effective dose equivalent of 1.0 mSv (100 mrem). Four percent of the DCG provides the basis for establishing public drinking water radionuclide limits. The following concentrations (0.04 x DCG) are the individual maximum average radionuclide concentrations acceptable to maintain regulatory compliance for the radionuclides of interest in the present systems evaluated [A note to the reader, a sum of concentrations rule must be applied to calculate the 0.04 mSv dose (4 mrem); this requires calculating the percentages of maximum concentrations of the individual radionuclides and summing the percentages (DOE Orders 5400.1 and 5400.5, and WHC-CM-7-5)].

- ^{90}Sr 4.0×10^{-8} uCi/ml
- ^{137}Cs 1.2×10^{-7} uCi/ml

DOE Orders 5400.1, 5400.5, and 6430.1A specify the use of "best available technology" (BAT) and "all known and reasonable methods of prevention, control and treatment" (AKART) for pollution control and verification of control measures (monitoring technology) for modifications to existing facilities, and design and construction of new facilities. Below are briefly outlined the salient features of the existing on-line radiological monitoring systems to measure environmental level liquid discharges from B-Plant cooling water and chemical sewer, and 242-A Evaporator steam condensate lines. Recommendations and comments follow each system evaluation.

B-Plant:

B-Plant cooling water and chemical sewer discharge approximately 1,700 gal/min flow into B-Pond (216-B-3 Pond). In the 211-BA Facility, the chemical sewer stream is continuously sampled by the PIOPSTM continuous beta/gamma liquid monitoring system manufactured by Nuclear Measurements Corporation for WHC. Similarly, the B-Plant/WESF cooling water is sampled by a PIOPSTM unit in the 221-BG Facility. Below are listed the pertinent specifications of the PIOPSTM:

- detectors:

beta:	glass scintillator 3" x 0.315"
gamma:	NaI(Tl) scintillator 2" x 2"
- counting mode:

beta:	gross counting above ^{90}Sr beta energies
gamma:	single channel window to measure ^{137}Cs 662 keV gamma

- sensitivities:

beta: background at 40 cpm;
95 % Confidence Level (CL), 1×10^{-6} uCi/ml ^{90}Sr

gamma: background at 20 cpm in the 662 keV gamma ^{137}Cs
energy window
95 % CL, 2×10^{-7} uCi/ml ^{137}Cs

Summary of B-Plant PIOPS™:

The B-Plant Facility Effluent Monitoring Plan (FEMP) states, "In general, the EMS (Effluent Monitoring System) is adequate for liquid effluents." Historical analytic records listed in the FEMP show average annual concentrations for samples from the chemical sewer (FEMP, Table 8-3.) and from cooling water (FEMP, Table 8-8) for ^{90}Sr and ^{137}Cs . Values in uCi/ml are listed below:

chemical sewer

	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
^{90}Sr	<1.93e-08	1.7e-08	1.8e-08	2.2e-08
^{137}Cs	<5.30e-08	6.6e-08	<5.5e-08	4.0e-08

cooling water

	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>
^{90}Sr	<1.8e-08	1.8e-08	1.6e-08	1.8e-08
^{137}Cs	<6.3e-08	5.7e-08	<5.5e-08	5.0e-08

These values are all below regulatory limits.

The PIOPS™ unit in 211-BA is a good unit; operating correctly. Calibration data, on-line records, and analytic sampling data confirm that the instrument is operating well within its intended tolerances.

However the PIOPS™ cannot meet the current regulatory requirements. The units 95 % confidence level for beta is 25 times greater than the regulatory limit, and the units 95 % confidence level for gamma is two times greater than the regulatory limit. No radiation liquid effluent monitor is currently capable of measuring "real-time" concentrations at the levels identified above; whether customized or "off-the-shelf."

Recommendation:

The B-Plant PIOPS™ system should be retained because it is considered compatible BAT in this evaluation, as well as in two other independent assessments (Ford, 1994 and OGDEN, 1993). Historical records indicate that no releases above regulatory limits (on average) to B-Pond have occurred and the unit is fully capable of detecting slight increases in radioactivity which may be indicative of a process upset condition. Upon detection of increasing radionuclide concentrations, adequate alarm set points (Rathbun, 1992) are established to provide time to divert the liquid stream, if necessary, to divert the effluent stream to the emergency effluent retention basin, 216-B-59.

Comment:

Better detection limits may be achieved if the system is allowed to increase the sample count times. Additionally, a prime calibration will be needed for the beta monitor because of the limited range of beta particles in water. The current calibration procedure utilizes a disc source at the detector interface. The problem that may result by employing longer count intervals is that as the sample count time is extended, and an alarm level is reached, there may not be ample time to divert or retain that stream for analytic testing.

Additionally, even priority samples at the 222-S Laboratory will rarely meet a 48 hour turn around time. Flow cannot be contained long enough for the return of analytic results without diversion to 216-B-59. These comments may be irrelevant since the final discharge from TEDF will be the ultimate monitoring and sampling location.

Conversations with Robert Ford from WHC Radiological Engineering Group indicate that a similar independent evaluation and recommendations for the 300 Area TEDF resulted in similar conclusions. He indicated that because PIOPS™ cannot meet the regulatory requirements for discharge concentrations, the project management for the 300 Area TEDF decided to retain all the applicable liquid effluent in a retention basin; the 300 Area TEDF operators receive laboratory analytical results prior to discharge. This is not currently possible for the B-Plant effluent streams.

242A Evaporator:

Steam condensate from the 242A Evaporator is monitored by a Canberra Scintillation Detector Model 802 and supporting electronics. The system provides for continuous monitoring of gamma activity in an energy dependent window of operation. Below are the pertinent specifications of the Canberra Scintillation Detector model 802:

- detector:

gamma: NaI(Tl) 2" x 2"

- counting mode:
 - single channel window to measure ^{137}Cs 662 keV gamma
- sensitivities:
 - 8% resolution in ^{137}Cs 662 keV gamma window
 - background at 900 to 1200 cpm (total beta/gamma)
 - no CL statistics

Summary of Canberra 802:

Based on the reported background and operations calibration records, the unit appears to be functioning correctly. Historical records indicate that it reports activities around 20 counts per second (approximately 1200 cpm). This reporting level for ^{137}Cs gammas is 60 times the background readings of the PIOPSTM system. It is approximately 17 years old and measures specific gamma activity only (it does not measure beta independently). Additionally, the background reporting level is very high. This may be due to inadequate shielding, poor supporting electronics, or proximity to contamination; or all of the above.

The same regulatory and technological constraints apply for the 242-A system as for B-Plant. However, this system was installed in late 1976 and is clearly outdated. Operating in a contaminated environment is counter productive to detecting and measuring the low concentrations of environmental concern. The background the instrument is reporting is above these levels, and the system cannot respond to small increases in radionuclide concentration like the PIOPSTM, or other commercially available products.

Recommendation:

Retain this system in its current configuration. Project W-252 calls for a BAT radiation monitor to be placed down stream of the present steam condensate effluent monitor at the 242-A Evaporator Cooling Tower. The recommended unit at this location is a PIOPSTM.

Comment:

None.

Victoreen 940-2:

Appendix E of the Conceptual Design Report for Project W-252 (June, 1993) includes specifications for various items. Item #3 on page E-6 is for the radiation monitoring system which is suggested as a Victoreen model 940-2. The Victoreen 940-2 is continuous gamma monitor similar to the gamma monitoring portion of the PIOPSTM. It does not measure beta

independently. Below are listed pertinent specifications of the Victoreen 940-2 system:

- detector:
 - gamma: NaI(Tl) 2" x 2"
- counting mode:
 - gamma: single channel window to measure ^{137}Cs 662 keV gamma
- sensitivities:
 - 9% resolution at ^{137}Cs 662 keV gamma window
 - gross background approximately 125 cpm
 - ^{137}Cs background approximately 15 cpm
 - 95% CL, 7.07×10^{-8} uCi/ml ^{137}Cs

Summary of Victoreen 940-2:

As stated above the system does not measure beta independently. Its approximate "off-the-shelf" price is \$40,000.00. Its apparent sensitivity is one-third the present PIOPS™ system.

Recommendation:

The PIOPS™ systems at B-Plant is estimated to cost approximately \$35,000.00. The PIOPS™ system is recommended for project W-252 because it is less expensive, measures beta independently, and has greater gamma sensitivity than the Victoreen 940-2.

Comment:

None

Open Item #13, "Need to provide additional guidance for on-line alpha-beta monitoring which is compatible with commercially available instruments.":

It appears that the drawing ES-252-Y8 in the Conceptual Design Report for Project W-252 (June, 1993) entitled "P & ID, 241 EFL Monitoring System for 244-AR and 241-A" includes a pump on each radiation monitoring system skid. This would be the case for "off-the-shelf" systems which were procured as a self-contained system. There is no specific requirement for a pump at these locations, and no increase in monitoring efficiency by using a separate pump. The PIOPS™ is the recommended system, however for these two locations it is preferred to procure the units without independent sample pumps.

This open item, also refers to monitoring continuous alpha-beta concentrations. Continuous

alpha monitoring in liquid is not possible. The effective range of alpha particle radiations in water is very short; so short that only a very small number of the available emanations would be recorded. Additionally, the waste streams intended for Project W-252 are well characterized, and reportedly will not contain alpha contaminants. Analytic results from scintillation or solid-state spectrographic technologies are required for alpha determinations in liquids.

Recommendation:

Change the above referenced drawings to indicate radiation monitoring skids without independent sample pumps and amend the FDC to specify continuous beta-gamma monitoring.

Comment:

None.

Redundancy:

During visits and conversations with operating personnel, questions were raised relative to redundancy requirements for monitoring these effluent streams. Redundant monitoring instruments are not required, since laboratory analytic testing will be performed at the point of final discharge (TEDF) to the soil column for regulatory compliance validation.

BASIS:

DOE Order 5400.1, "General Environmental Protection Program," June, 1990.

DOE Order 5400.5, "Radiation Protection of the Public and Environment," January, 1993.

DOE Order 6430.1A, "General Design Criteria," April, 1989.

WHC-SD-W252-CDR-001, Rev. 0, Conceptual Design Report for Project W-252, "Phase II Liquid Effluent Treatment and Disposal," Westinghouse Hanford Company, June 1993.

WHC-SD-W252-FDC-001, Rev. 0, Functional Design Criteria for Project W-252, "Phase II Liquid Effluent Treatment and Disposal," Westinghouse Hanford Company, September, 1992.

WHC-CM-7-5, Environmental Compliance Manual, Section 8.0, "Water Quality," Westinghouse Hanford Company, June, 1993.

WHC-EP-0467, Rev. 1, "Facility Effluent Monitoring Plan for the B Plant," Westinghouse Hanford Company, September, 1994.

Rathbun, L., WHC I.M. 33630-92-LAR-006, "Radiological Validation of Effluent Monitor," March, 1992.

Ogden Environmental and Energy Services Co., WHC W-275186, "Best Available Technology (BAT) for Detection of Leaking Strontium (Sr) and Cesium (Cs) Capsules," September, 1993.

Drawing, H-2-98993, "P&ID Steam Condensate System."

Drawing, H-2-82926, sheet 1 of 7, "IEFD Chemical Sewer Neutralization System."

Drawing, H-2-82926, sheet 7 of 7, "IEFD Chemical Sewer Neutralization System Beta/Gamma Monitor."

Nuclear Instruments Corporation, "PIOPS™ Beta/Gamma Liquid Monitor," Letter from manufacturer to WHC (undated).

Canberra Nuclear Electronics, "Model 802 Specifications," (undated).

Victoreen, Inc., "Liquid Monitor Information," Facsimile dated 11/14/94 from Steve Nawalaniec, of Victoreen, to Kevin Salmon, of NFS.

B-Plant and 242A Evaporator instrument calibration and sample analysis data from October 1993 to September, 1994.

Ford, R., Telephone and personal conversations of exiting instrument capabilities and regulatory requirements with WHC Radiological Control , November, 1994.

Appendix H

MONTGOMERY WATSON

MONTGOMERY WATSON

To:	DISTRIBUTION	Date:	September 28, 1994
From:	Larry Bennett	Revised:	October 12, 1994
Subject:	W-252 Value Engineering Study	Job No.:	W-252 1202.0610/3.1.2

PURPOSE

This letter report provides the results of the Value Engineering Study performed on Project W-252 in accordance with the Scope of Work and Cost Proposal.

SCOPE OF WORK

A Value Engineering Study is required by the Statement of Work for Delivery Order No. 10 dated July 18, 1994, items 4.1.d and 4.2.1.b. These items correspond to Montgomery Watson's Work Breakdown Structure items WBS 1.2.6 and 1.3.1.2. Item 4.1.d requires a list of at least one item to be value engineered. Item 4.2 includes the completion of the value engineering study.

SUMMARY

A Value Engineering (VE) study team evaluated the project as defined in the Conceptual Design Report and makes the following recommendations:

General

These recommendations should be promptly reviewed and direction promptly provided to the engineer as to which recommendations are to be evaluated and implemented.

242-A Evaporator - no recommendations.

244-AR Vault:

1. Reuse the existing dry air cooler for both air compressors, if redundancy is not a concern.
2. Postpone the improvements until a long-term mission for the facility is determined.
3. Evaluate use of the dormant cooling towers for other parts of the project.

241-A Tank Farm - no recommendations.

B-Plant

1. Move the wet surface fluid coolers from south of B-Plant to northwest of B-Plant.
2. Use a wet surface fluid cooler instead of a dry/wet cooling tower.
3. Provide either multiple wet surface fluid coolers or a single wet surface fluid cooler with multiple cells.

284-E Powerhouse

1. Move the two blowdown tanks from east of the powerhouse to either southeast or northeast of the powerhouse.
2. Evaluate use of the 282-E reservoir for a heat sink instead of a mechanical cooling tower.
3. Evaluate other discharge piping alignments, such as due north.

283-E Water Treatment Facility

1. The direction provided to the engineer to model the design of 283-E after the design of 283-W, which is currently under construction, is correct and more appropriate than the design proposed in the CDR.

STUDY TEAM

The study team was comprised of individuals with a wide range of technical experience including specialists in cooling tower design and operation. The study team members were Larry Bennett, Montgomery Watson (MW); Pat Naylor, MW; Elayne Crowe, MW; Don Kurkjian, Stone and Webster Engineering Corp. (SWEC); Dick Jensen, SWEC; Paul D'Errico, SWEC; and Hal Winger, SWEC.

OVERALL PROJECT DESCRIPTION

The Conceptual Design Report (CDR) dated June 1993 (WHC-SD-W252-CDR-001, Rev. 0) provided the basis for the Value Engineering study. The following is from the Summary of that Report:

“Modifications to the 242-A Evaporator, 244-AR Vault, 241-A Tank Farm, B-Plant/Waste Encapsulation and Storage Facility (WESF), 284-E Powerhouse, and 283-E Water Treatment Facility (WTF), are necessary to complete implementation of best available technology(BAT)/all known, available, and reasonable methods of prevention, control, and treatment (AKART).”

“Installation of enhanced monitoring and sampling systems is necessary to ensure that all remaining wastewater effluents are acceptable for discharge to the Treated Effluent Disposal Facility (TEDF). Instrumentation measuring the quality and flowrate of effluent from each facility to the TEDF is required for proper operation of the TEDF piping network.”

"A description of the facility upgrades to be completed under project W-252 follows:

- **242-A Evaporator**
Waste streams will be controlled at the 242-A Evaporator by installing a closed-loop cooling system which will recirculate the cooling water from the evaporator condensers and use the steam condensation as makeup water for the cooling towers. Additionally, there will be a separate cooling system installed for the facility air compressors. The remaining waste stream will be rerouted through a new drain line to the TEDF for disposal.
- **244-AR Vault**
A new electrical vessel vent heater will be installed at the 244-AR Vault replacing the existing steam heater. Additionally, there will be a new cooling system installed for the facility air compressors. The minor waste streams from the heating, ventilating, and air-conditioning system, an eyewash station, and backflow preventers will be collected and routed to TEDF for disposal.
- **241-A Tank Farm**
The BAT/AKART for the 241-A Tank Farm cooling water will be implemented through project W-030. Drainage from the cooling towers will be the only remaining waste stream from the 241-A Tank Farm. Project W-252 will provide all equipment necessary to sample, monitor, and discharge the cooling tower waste stream to the TEDF.
- **B-Plant/WESF**
The waste streams at B-Plant/WESF will be controlled by installing a closed-loop cooling system that will recirculate cooling water from the WESF storage pools and process cells heat exchangers. Water from the WESF pool flush system will be collected and pumped to the cooling tower for makeup water. The remaining waste stream will be routed through a new drain line to the existing B-Plant process and then to the TEDF for disposal.
- **284-E Powerhouse**
The waste from the 284-E Powerhouse will be controlled by installing a closed-loop cooling system that will recirculate the cooling water for specific pieces of equipment in the powerhouse. Additionally, new surge tanks will be installed to collect the blowdown from the boilers and the ion exchange columns. The overflow from the cooling tower and the boiler blowdown will be routed to the TEDF through a system of new and existing pipes.
- **283-E Water Treatment Facility**
The backwash waste, waste from the settling basins, and floor drains at the 283-E WTF will be collected and pumped through a new system. This system will be designed to remove solids which will be dried in new drying beds and disposed of according to regulations. The supernatant will be returned to the 282-E Reservoir. The waste streams from overflow of the 282-E Reservoir and the 283-E Clearwell

will be eliminated by installing level control equipment. All waste streams will be eliminated; therefore, no connection to the TEDF will be provided.”

The cost estimate for the total project as listed in the CDR is as follows:

Facility Construction Costs

242-A Evaporator (WBS 3x01)	\$ 3,676,644
244-AR Vault (WBS 3x02)	\$ 596,433
241-A Tank Farm (WBS 3x03)	\$ 951,135
B-Plant/WESF (WBS 3x04)	\$ 1,836,051
284-E Powerhouse (WBS 3x05)	\$ 2,401,891
282-E/283-E Water Treatment Plant (WBS 3x06)	\$ 4,563,635
Construction Management	<u>\$ 2,885,673</u>
Subtotal	\$16,911,462
Engineering, Procurement, and Management (WBS 1, 2, 4)	\$ 9,713,399
Other Project Costs (WBS 5)	<u>\$ 6,298,066</u>
Total Project Costs	\$32,922,927

INITIAL IMPRESSIONS

The CDR and associated Functional Design Criteria (FDC) were reviewed. These reports thoroughly present the purpose for this project and the specific implementation plans for each facility. The Total Project Costs of almost \$33,000,000 makes this project a logical candidate for a value engineering study. After a more detailed review of the cost estimate, the costs of each facility were determined.

Three of the facilities include cooling towers. These facilities are the 242-A Evaporator, B-Plant, and 284-E Powerhouse. The cost estimate for those three facilities are over 56 percent of the total project cost. Therefore these facilities warranted further evaluation.

The cost estimate for 282-E/283-E WTF is almost 33 percent of the total project costs. However, the architect/engineer was directed to utilize the design for the 282-W/283-W WTF for this facility instead of the proposal included in the CDR. Since the 283-W/283-W facility is currently under construction, this recent bid price for that project was considered to confirm that adequate funding was allocated in the cost estimate for the 282-E/283-E WTF.

The 244-AR Vault and 241-A Tank Farm are approximately 11 percent of the total project and are therefore not candidates for extensive evaluation. Based on the review of the FDC and CDR, the facilities proposed for the 241-A Tank Farm appear to be correct.

PRIORITY AREAS FOR VALUE ENGINEERING ANALYSIS

Based on the initial impressions (see above) and the site tour on June 28, 1994, the following facilities were determined as priority areas for the value engineering analysis:

244-AR Vault
B-Plant/WESF
284-E Powerhouse

The 242-A Evaporator was discussed but the location of the equipment, need, and proposed piping implementation appeared to be correct.

RESULTS OF VALUE ENGINEERING ANALYSIS

A value engineering study highlights both quantitative items and qualitative items. During the evaluation, some items are discussed that are determined to be not recommendable. The following lists items in each of the three categories.

Quantitative Items

Quantitative items are items that can be thoroughly evaluated and either costs or benefit assigned.

244-AR Vault. Westinghouse Hanford Co. (WHC) staff suggested that the VE team evaluate reuse of the existing dry air cooler on one air compressor as the dry air cooler for both air compressors since only one air compressor operates at a time. The VE team reviewed and accepted this suggestion. Piping the 244-AR air compressors in series as suggested will eliminate the existing redundant cooling system. Currently the main compressor and the compressor air aftercooler are cooled by raw water. The backup air compressor is cooled by a completely independent dry air cooler. The VE team cautions that since there is only one dry air cooler if it is inoperable, neither air compressor can operate. However, due to the current use of the air compressor, this does not appear to be a major concern. If the use of these compressors change, a redundant dry air cooler may be required.

B-Plant/WESF. Three major items were evaluated at B-Plant: Location of cooling towers, type of cooling towers, and reliability of cooling towers.

Location

The proposed location of the cooling towers was discussed and numerous problems associated with the proposed location were identified. One problem is the small area, restricted on the west side by an existing structure (221-BF) and on the east side by a buried, contaminated pipeline. Another problem is that due to underground utilities, all

new piping was proposed to be above grade, which would require expensive pipe supports, road crossings, seismic design, and freeze protection. A significant portion of the above-grade pipeline parallels electrical power lines. This would make construction more difficult and expensive. The VE team recommends relocating the cooling towers to northwest of the B-Plant in an existing open area. This location will allow underground piping to be used, will provide a larger area for access and construction, and shorter pipe lengths.

Type of Cooling Towers

The CDR recommends a combined dry/wet cooling tower that can be operated either as a dry unit during cold temperatures or as a wet unit during warm temperatures.

However, there is a year-round requirement to use the cell flush water as makeup water in the cooling tower which is only feasible in the wet operation mode. Therefore, the VE team recommends a wet surface fluid cooler design only. This will allow year-round use of the cell flush water, is less expensive than a combined dry/wet unit, and reduces operational concerns as the operators have a simpler unit to operate.

Reliability of Cooling Tower

The CDR proposes a single cooling tower with redundant pumps and piping. The VE team recommends that either multiple wet surface fluid cooler or a single wet surface fluid cooler with multiple cells be provided. The B-Plant stores nuclear material in water. Failure of the storage pool cooling water system will cause the pool water temperature to exceed operating safety limits in a relatively short period of time. This facility needs redundant units.

Another viable alternative may be to retrofit the existing emergency cooling water pumps and route the emergency once-through cooling discharge to the TEDF under emergency conditions. The viability of this approach will be discussed in the teleconference with B-Plant/WESF personnel.

284-E Powerhouse. Two major items were evaluated at the 284-E Powerhouse; location of tanks, and type of cooling.

Location

The location of the two surge tanks to collect blowdown from the boilers and ion exchange column was quickly identified as a problem. The location proposed in the CDR on the east side of the powerhouse is insufficient and impractical due to the existing boiler induced draft fans and baghouse. The VE team strongly recommends moving the tanks to the southeast side of the powerhouse. If the cooling tower remains in the project (see below) the tanks alternatively could be located at the northeast corner of the powerhouse and near the cooling towers, which would combine all the new facilities in one area and could reduce electrical and trench costs over the southeast location.

It must be noted that the distance between the blowdown tank and the associated boilers must be kept as short as possible to minimize the potential of the flashing in the blowdown lines. Blowdown occurs at near saturated conditions. Any significant pressure drop will cause it to flash and result in potentially damaging water hammer conditions.

Type of Cooling

This cooling tower is a small unit. Alternative types of cooling, such as a heat exchanger using water from the 282-E Reservoir, may be more cost-effective. This is recommended for further review.

Qualitative Items

Qualitative items are items that have insufficient information provided for a complete review or are of an administrative or operational nature such that costs benefits cannot be provided.

244-AR Vault. Two qualitative recommendations are made on this facility.

First, because the facility is currently inoperative and no mission has yet been assigned, the proposed modifications appear to be unnecessary. The use of the facility is currently under review. Pending that review, the modifications to this facility may be deleted from this project. The VE team supports that review and assessment.

Second, the cooling towers in the adjacent 244AR 715 building are currently unused. These cooling towers could possibly be reused at another location. The VE team recommends that WHC investigate the potential to transfer "ownership" to another project.

284-E Powerhouse. The pipeline alignment appears to be unnecessarily long. The VE team recommends that the design team evaluate alternative alignments that are mainly due north, instead of the proposed east-northeast alignment.

Items Not Recommended

284-E Powerhouse. One item was discussed but not recommended. It would be feasible to install the cooling tower on the roof of the powerhouse, thereby eliminating a significant amount of yard piping and making that portion of the site available for future uses. However, the structural evaluation of a 50-year old roof and problems associated with getting approval to place equipment on the roof, with the associated maintenance and monitoring, would outweigh the potential benefits.

IMPLEMENTATION PROCEDURES, TIMING, PROBLEMS

The recommendations included in the report should be reviewed by WHC and direction promptly provided to the design engineer. This direction should indicate which of the recommendations should be further evaluated and implemented.

Since the project is currently in advanced conceptual design, the implementation for the recommendations should not affect the project schedule.

No problems are foreseen in any of the recommendations unless review and direction by WHC is delayed extensively.

LIFE CYCLE COST SUMMARY

Due to budget constraints, no cost estimate could be developed. Therefore life cycle costs are unavailable.

DISTRIBUTION:

Richland Office Project Files
Kevin Kelly, MW-RCH
Larry Bennett
Boise Office Project Files
Dick Jensen, SWEC
Andy Shoulders, USACE
Tracy Tevington, USACE
Paul Sato, WHC

Appendix I

MONTGOMERY WATSON

M E M O R A N D U M **MONTGOMERY WATSON**

To:	DISTRIBUTION	Date:	October 13, 1994
From:	Larry Bennett	Revised:	December 15, 1994
Subject:	W-252	Reference:	W-252
	Resolution of Miscellaneous		1202.0610/3.1.2
	Open Items		

PURPOSE

This memorandum discusses the Miscellaneous Open Items (OI) evaluated for project W-252 that are not covered in other memos in accordance with the Scope of Work and Cost Proposal.

SCOPE OF WORK

All the Open Items in the Open Items List appended to the Statement of Work are to be addressed in the Advanced Conceptual Design (ACD). Other reports included in the ACD Report cover most of the open items. This memorandum discusses the remaining open items, namely OI numbers 1, 4, 17, 26, 27, and 28.

SUMMARY

This memorandum discusses the following six open items which are not discussed in other reports.

OI-1:Coordination between projects W-252 and B-602 is ongoing.
OI-4:Standby power for the 242-A cooling tower is not required.
OI-17:.....A replacement shop will not be provided for the shop located near 242-A.
OI-26, 27, and 28:.....The design of 282-E and 283-E will duplicate the design of 282-W and 283-W as much as possible.

EVALUATION**Open Item No. 1: Resolve interfaces with Project B-604.**

This work is ongoing. Draft drawings from project B-604 have been received. Tom Sweet is providing coordination for both projects.

Open Item No. 4: Conduct Study to determine the need for standby power for cooling tower operation.

This work was previously completed by WHC Central Engineering which indicated that standby power is not required for the 242-A cooling tower.

Open Item No. 17: Evaluate KEH fabrication shop replacement to determine (1) if cooling towers can be located so relocation is not required or (2) if space is available on-site at another location to accommodate the fabrication shop.

The engineering report entitled "W-252 Alternate Fluid Cooler Location - 242-A Evaporator" recommends locating the wet surface fluid cooler east instead of west of the 242-A evaporator. With this different location, the KEH fabrication shop does not need to be replaced.

Open Item No. 26: For the 284-E, evaluate need for instrumentation for total dissolved solids.

The following water quality parameters will be measured by instrumentation on the 284-E wastewater effluent:

- pH
- conductivity
- temperature

These are the same parameters measured on the 284-W wastewater effluent.

All the instrumentation for the 282-E Raw Water Reservoir, 283-E Water Treatment Facility, and wastewater effluent from 284-E will conform as closely as possible to that provided for the 282-W Raw Water Reservoir, 283-W WTF, and 284-W effluent (Project W-291). Minor modifications will be made as necessary.

Open Item No. 27: For the 283-E and 284-E, identify areas that should be consistent/similar with the W-291 design incorporated into the W-252 definitive design (i.e. placement of the polymer mixing tank).

The 282-E Raw Water Reservoir modification and the 283-E WTF modifications will be as similar as possible. The 282-E Raw Water Reservoir will operate off an ultrasonic level indicator that will open and close the influent valve to keep the water surface elevation of the reservoir at a nearly constant elevation. The 283-E WTF will be converted to a direct filtration mode of operation, the same as the 283-W WTF. Site visits indicate that process changes can be the same for both facilities. Layout of equipment/facilities at the 283-E WTF will be similar to 283-W WTF.

Open Item No. 28: For the 283-E, resolve the DOE-RL verbal comment/concern regarding the routing of drain water from the sink and floor drains to the thickener and recycling back to the supernate.

At the 283-W WTF, drainage from sinks, floor drains and the clearwells were routed to TEDF. This is because of concerns that chemicals used for water quality analysis at the WTF could spill into this drainage and potentially cause violations of state and federal drinking water regulations if they were recycled back into the plant inflow. Clearwell overflow was also routed to TEDF because overflows from the clearwell will be very small and insignificant based on the new WTF control strategies.

The same reasoning applies to 283-E WTF, and the sinks, floor drains, and clearwell overflow will be routed to TEDF.

/db

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 Advanced Conceptual Design Report

Appendix J

MONTGOMERY WATSON

M E M O R A N D U M **MONTGOMERY WATSON**

To:	DISTRIBUTION	Date:	October 14, 1994
From:	Larry Bennett	Revised:	December 7, 1994
Subject:	W-252 Evaluation of Procurement of Long Lead Items	Reference:	W-252 1202.0610/3.1.2

PURPOSE

This memorandum provides the results of the evaluation of procurement of long lead items for project W-252 in accordance with the Scope of Work and cost proposal.

SCOPE OF WORK

An itemization of the items required for a long lead procurement is required by the "Revised Statement of Work for Architectural/Engineering Services – Phase II Liquid Effluent Treatment and Disposal Project W-252 – Delivery Order No. 10, dated 18/July/1994". Task 4.2.d Requires the "Identification of Long Lead Procurement Items". Long lead items are defined as those products for which the time required for submittal preparation, review and approval; manufacturing; and product delivery is projected to exceed the critical path time duration for that product. This evaluation is based on recent experience on previous projects, vendor contacts, and discussion with knowledgeable personnel.

SUMMARY

Based on this evaluation, there are not any equipment items that are long lead items. The only items requiring procurement outside the general construction contract are the Micon Local Control Units (LCUs), modems, and General Purpose LAN (Local Area Network) Interface (GPLI).

OVERALL PROJECT DESCRIPTION

The Conceptual Design Report (CDR) dated June 1993 (WHC-SD-W252-CDR-001, Rev. 0) provided the basis for the Value Engineering study. The following is from the Summary of that Report:

"Modifications to the 242-A Evaporator, 244-AR Vault, 241-A Tank Farm, B-Plant/Waste Encapsulation and Storage Facility (WESF), 284-E Powerhouse, and

283-E Water Treatment Facility (WTF), are necessary to complete implementation of best available technology(BAT)/all known, available, and reasonable methods of prevention, control, and treatment (AKART)."

"Installation of enhanced monitoring and sampling systems is necessary to ensure that all remaining wastewater effluents are acceptable for discharge to the Treated Effluent Disposal Facility (TEDF). Instrumentation measuring the quality and flowrate of effluent from each facility to the TEDF is required for proper operation of the TEDF piping network."

"A description of the facility upgrades to be completed under project W-252 follows:

- **242-A Evaporator**

Waste streams will be controlled at the 242-A Evaporator by installing a closed-loop cooling system which will recirculate the cooling water from the evaporator condensers and use the steam condensation as makeup water for the cooling towers. Additionally, there will be a separate cooling system installed for the facility air compressors. The remaining waste stream will be rerouted through a new drain line to the TEDF for disposal.

- **244-AR Vault**

A new electrical vessel vent heater will be installed at the 244-AR Vault replacing the existing steam heater. Additionally, there will be a new cooling system installed for the facility air compressors. The minor waste streams from the heating, ventilating, and air-conditioning system, an eyewash station, and backflow preventors will be collected and routed to TEDF for disposal.

- **241-A Tank Farm**

The BAT/AKART for the 241-A Tank Farm cooling water will be implemented through project W-030. Drainage from the cooling towers will be the only remaining waste stream from the 241-A Tank Farm. Project W-252 will provide all equipment necessary to sample, monitor, and discharge the cooling tower waste stream to the TEDF.

- **B-Plant/WESF**

The waste streams at B-Plant/WESF will be controlled by installing a closed-loop cooling system that will recirculate cooling water from the WESF storage pools and process cells heat exchangers. Water from the WESF pool flush system will be collected and pumped to the cooling tower for makeup water. The remaining waste stream will be routed through a new drain line to the TEDF for disposal.

- **284-E Powerhouse**

The waste from the 284-E Powerhouse will be controlled by installing a close-loop cooling system that will recirculate the cooling water for specific pieces of equipment in the powerhouse. Additionally, new surge tanks will be installed to collect the blowdown from the boilers and the ion exchange columns. The

overflow from the cooling tower and the boiler blowdown will be routed to the TEDF through a system of new and existing pipes.

- **283-E Water Treatment Facility**

The backwash waste, waste from the settling basins, and floor drains at the *283-E Water Treatment Facility (WTF)* will be collected and pumped through a new system. This system will be designed to remove solids which will be dried in new drying beds and disposed of according to regulations. The supernatant will be returned to the 282-E Reservoir. The waste streams from overflow of the *283-E WTF* and the 283-E Clearwell will be eliminated by installing level control equipment. All *major* waste streams will be eliminated. A connection to the TEDF will be provided *for floor, sink, and sampler drain. (Note: abbreviations show Dec. 1994 edits)*"

OVERALL SCHEDULE

The overall project schedule is dictated by two dates. The first is that the start of advanced conceptual design occurred in August 1994 and the second is that the Tri-Party Agreement milestone number M-17-00B requires that the modifications be operational by October 1997. Therefore, all advanced conceptual design, definitive design, bidding, construction, and start-up services must be complete within approximately three years. Figure 1 (attached) was developed to reflect this schedule and it is based on the following assumptions:

1. Advanced conceptual design will be complete in January of 1995.
2. Definitive design will start in January of 1995 and will be completed in accordance with the schedule and the Statement of Work which calls for September 1995 completion.
3. Advertising and bidding is estimated to take approximately 1.5 months.
4. Evaluating bids and awarding the contract is estimated to take 2.5 months. This will allow contractor move-in and site preparation to begin February of 1996.
5. The operational readiness review is estimated to take one month.
6. The start-up activities and acceptance test procedures/operational test procedures (ATP/OTP) are estimated to take three months and would therefore need to start in June of 1997.
7. This allows 16 months for the actual procurement of all equipment and construction of facilities. If the procurement of equipment cannot be completed by the General Contractor in sufficient time to be installed and operational by May 1997, then early procurement activities must be initiated to meet this schedule.

CONSTRUCTION SCHEDULE

The construction for each facility is reviewed in the following paragraphs.

242A Evaporator

The major components for this system will be wet surface fluid coolers (WSFC) and associated equipment and electrical facilities. One concern with the construction of the facility is that the existing shop has to be demolished prior to initiation of construction. The personnel who use this shop have requested that the replacement shop be operational prior to demolition of the existing shop. However, this would delay initiation of work on the 242-A facilities. It is assumed that temporary quarters can be used for two to four months during shop drawing review and construction of the new shop. The general contractor will be directed to expedite the construction of the new shop. Therefore, the construction of the 242-A facilities would not be delayed. From an overall construction standpoint, there are no components of this facility that should take more than 16 months to construct. There will be some piping connections in radiological controlled zones within the 242A Evaporator facility that will require special coordination and possibly work by the on-site contractor. However, the remainder of the work should easily be completed within approximately 12 months.

The major delivery items associated with the facility are the WSFC, 200 hp pumps, air compressor chiller, LCU, and motor control center (MCC). These are discussed in a subsequent section.

244-AR Vault

The major facilities for this building are the electrical vessel vent heater and a cooling system for the second facility air compressor. It has been tentatively determined that the existing cooling system on the first air compressor can also cool the second facility air compressor with only minor repiping and electrical work required. There will also be other piping changes within the facility. Excluding the vessel vent heater, all other construction should be easily accomplished within six months. Also, this entire facility will probably be descoped from the project, so it is not considered further.

The major delivery items associated with this facility are the vessel vent heater and the LCU. These are discussed in a subsequent section.

241A Tank Farm

The 241A Tank Farm modifications are comprised of a metering manhole with associated LCU and sample building, a small standby generator, and an access road to the facility. Some yard piping is also required to connect the tank farm to the TEDF pipeline. The construction for this facility should take 3 to 4 months to complete. The major delivery items associated with this facility are the LCU and diesel generator. These are discussed in a subsequent section.

B-Plant/WESF

This is a major facility with a closed-loop cooling system, significant modifications to the cooling piping, a storage tank, and possible replacement of two well pumps. There is a significant amount of work in this facility; however, the construction work should be easily

completed within the 16-month overall construction period as long as equipment can be procured in sufficient time. The replacement of the two well pumps may be descope from the project.

The major delivery items associated with this facility are the WSFC, diesel generator, storage tank, LCU, and MCC. These are discussed in a subsequent section.

284-E Powerhouse

A WSFC is required for this facility although evaluation is currently underway regarding the use of a water-to-water heat exchanger using the 282-E Reservoir as a heat sink. There are also storage tanks for the water softener blowdown and boiler blowdown with a heat exchanger on the boiler blowdown water. There is a significant amount of repiping inside the facility with approximately 22 cooling water sources converted to the recirculating loop cooling water system. There is a fair amount of Phase II Effluent Collection System (PTECS) piping also. However, all the piping should be installed and modifications should be easily completed within 12 to 15 months as long as the equipment can be procured in sufficient time.

The major delivery items associated with this facility are the cooling towers, heat exchanger, storage tanks, LCU, and MCC. These are discussed in a subsequent section.

282-E Reservoir and 283-E Water Treatment Facility

The modifications to these two facilities are very similar to what is being constructed under project W-291. The W-291 project is scheduled to take 9.5 months to construct with the solids contact clarifier procured separately. The procurement for the solids contact clarifier started approximately 2 months before the construction contract procurement. Therefore, the entire project could be constructed in less than a year and there is no need to do early procurement for this facility.

SPECIFIC EQUIPMENT PROCUREMENT ITEMS

In the Conceptual Design Report and associated cost estimate, and also in a memorandum from Paul Sato dated November 11, 1993, various items were listed as needing early procurement. Those items are as follows:

- a) WSFC
- b) Pumps
- c) Diesel generators
- d) Chillers
- e) Heat exchangers
- f) Storage tanks
- g) Electric heater
- h) Distributed control system including the monitoring and control equipment
- i) Electrical equipment including the motor control centers
- j) Communication system computers

The following paragraphs discuss each of these items.

Cooling Towers

The Stone Webster Engineering Corporation (SWEC) is sizing the cooling towers (WSFC). Currently all the cooling towers on the project, including 242-A Evaporator, B-Plant/WESF and 284-E Powerhouse, are fairly standard (off-the-shelf) cooling tower sizes. In reviewing the process and instrumentation diagrams (P&IDs), there does not appear to be any special instrumentation associated with these cooling towers. Previous project experience indicates that these WSFC can be provided in 8 to 12 months. Therefore, early procurement of these items is not anticipated.

Pumps

There are a number of pumps to be provided, however, based on review of the P&IDs, there is no special instrumentation required and the pumps should be easily procured as part of the cooling tower packages. The Conceptual Design Report indicated that the two 200 hp recirculation pumps at 242-A Evaporator were intended for early procurement. Based on vendor contacts, these pumps can be delivered in 10 to 12 weeks after receipt of approved shop drawings.

Diesel Generators

There are two diesel generators still included in the project. A 350 KW unit at 242-A Evaporator and a 5 KW package unit at 241-A Tank Farm. Both of these generators are fairly standard size. Recently a 350 KW engine generator was procured in an 8 to 12 week delivery time, therefore, it is not anticipated that these items will require early procurement.

Chillers

Chillers are required for the air compressors at the 242-A Evaporator and the 244-AR Vault. The chiller at 244-AR Vault will probably be a retrofit from the existing chiller, so this is no longer an issue. The chiller at 242-A Evaporator is a small, fairly standard item and should be easily procured within the construction schedule.

Heat Exchangers

There is one heat exchanger included as part of the boiler blowdown cooling for the 284-E Powerhouse. SWEC is just beginning evaluation of this facility. Currently they are considering either a shell and tube heat exchanger or a plate-type heat exchanger as options. The shell and tube type heat exchanger is a site specific fabricated item and could easily be fabricated within the construction schedule. The plate-type heat exchanger is a standard equipment item so delivery should not be a problem.

Storage Tanks

There are three storage tanks anticipated for the project. There is a 5,000 gallon carbon steel tank at B-Plant, a 5,000 gallon boiler blowdown tank, and a 15,000 gallon fiberglass tank for softener regenerate at the 284-E Powerhouse. Vendors were contacted for delivery times. The

boiler blowdown tank will most likely be a fabricated steel tank with probably a 3 to 4 month construction period including shop drawing review. The other two tanks should require 1 to 2 months for delivery.

Electric Heater

There is an electric heater as part of the 244-AR Vault. Since this item will be descoped, it is not evaluated further.

Distributed Control System and Monitoring and Control

The project requirement is to expand the Bailey system at the B-Plant, expand the TI system at the 242-A Evaporator, and use Micon LCUs at other locations. There may be one to two Micon LCUs available from pervious projects. These LCUs are required to be sole sourced in order to match other units. To meet sole source requirements, these will be procured separately from the construction contract.

Electrical Equipment including Motor Control Centers (MCCs)

Currently none of the MCCs are anticipated to require early procurement. They should be able to be procured within the 12 to 17 months allowed for construction.

Communication System Computers

The communications control equipment consists of GPLI and five modems shown on Drawing ES-252-41 of the CDR. The telephone modems and the GPLI will be procured separately in order to match other equipment used on-site.

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 Richland Office Project Files
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Figure 1. Project W-252 Schedule

Appendix K

MONTGOMERY WATSON

M E M O R A N D U M **MONTGOMERY WATSON**

To:	DISTRIBUTION	Date:	December 15, 1994
From:	John Bergen/Cyndy Bratz	Reference:	W-252
Subject:	Contract Administration		1202.0610/3.1.1

PURPOSE

This memorandum provides discussion and recommendation regarding contract administration and sole source equipment procurement for DOE Project W-252 in accordance with the Scope of Work and cost proposal.

SCOPE OF WORK

An evaluation of contracting under various packages is required by the "Revised Statement of Work for Architectural/Engineering Services - Phase II Liquid Effluent Treatment and Disposal Project W-252 - Delivery Order No. 10, dated 18/July/1994. Task 4.2. g. requires an "evaluation of the potential benefits of administering several contracts as opposed to one contract for the construction activities."

SUMMARY

Based on the predominantly mechanical and structural nature of this work, its common location, and the total cost (less than \$20 M), it is recommended that the project be bid as a single lump sum contract.

Sole source specifying of equipment is acceptable given adequate justification, such as compatibility with existing equipment. It is recommended that the Owner request a letter from the supplier giving a "guaranteed maximum price" for their equipment, encouraging the supplier to provide a fair price for their equipment. It is also recommended that a provision be included in the specifications and possibly on the drawings stating that bids including equipment differing from the named equipment will be rejected.

PROJECT ELEMENTS

The overall work for DOE Project W-252 consists of the following five project elements:

- 242-A Evaporator
- B Plant

- 284-E Powerhouse
- 282-E Reservoir/283-E Water Treatment Facility
- 244-AR Vault/241 Tank Farm

Project elements 242-A, B Plant, and 284-E will include cooling towers. Project element 282-E/283-E involves primarily structural concrete and mechanical work. The location of all project elements are within approximately three to four miles of each other.

The estimated construction cost for each project element, with the exception of 244-AR/241-A, is approximately \$2 to 5 M, with a total of approximately \$17 M.

CONTRACT ADMINISTRATION

In general, it is desirable to bid related work as a single construction contract unless there are very compelling reasons (political, schedule constraints, cash flow, access, permitting/environmental constraints, etc.) for dividing the project into smaller elements. The reasons for this are that a single bid has reduced bid package preparation effort/cost, reduced contractor mobilization/demobilization costs, reduced coordination and interface issues, simplified contract administration, and simplified inspection effort/costs. Bidding as a single package also enables the Owner to derive maximum cost savings from economy of scale. Breaking work into too many contracts can often contribute to coordination problems which may result in delay claims against the Owner.

There are experienced contractors in the area who have worked on the Hanford site and who have the capability to perform the work required for the various project elements of DOE Project W-252 through a single contract. It is assumed that there are an adequate number of contractors in the area to ensure competitive bidding and that all the project elements can be completed by the appropriate subcontractors.

Based on the predominantly mechanical and structural nature of this work, its common location and the total cost (less than \$20M), it is recommended that the project be bid as a single lump sum contract.

SOLE SOURCE EQUIPMENT PROCUREMENT

The Owner would like to sole source specify instrumentation and control equipment and programming of that equipment to ensure its compatibility with existing equipment at several of the sites. Existing equipment includes the Bailey-Net 90 at the B Plant and the TI at the 242-A Evaporator. Micon LCUs will be used at the other facilities to match the TEDF project equipment and there are likely to be spare Micon LCUs available from other projects for use on project W-252.

Based upon our understanding of the Federal procurement regulations which apply to EPA funded projects and on the assumption that DOE regulations are similar, sole sourcing is an acceptable practice as long as it can be justified by either the Owner or the Engineer.

Compatibility with existing equipment is an acceptable justification for sole sourcing of equipment.

It is recommended that a provision be included in the specifications and possibly on the drawings stating that bids including equipment differing from the named equipment may be subject to rejection.

Sole source equipment purchase eliminates competitive bidding during the bid process. Therefore it is recommended that the Owner request a letter from the supplier giving a "guaranteed maximum price" for their equipment. This letter would not be legally binding since it would be written prior to the bid award, but it helps to ensure that the Owner receives a fair price from the supplier of the sole sourced equipment.

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Boise Office Project Files
John Bergen, WCK-1

Appendix L

MONTGOMERY WATSON

APPENDIX L

OUTLINE SPECIFICATIONS

These outline specifications were copied from the CDR and changes made during the ACD are added.

OUTLINE SPECIFICATION

DIVISION 2 - SITEWORK

Section 02200 Earthwork, *including trench excavation and back fill for utilities*
And backfill and compaction for Structures

1. Excavation.
2. Fill or backfill.
 - a. Structural.
 - b. Common.
3. Stabilization: Crushed rock, 3/4 inch maximum for walkways and 2 inch minus for other areas.

~~Section 02225 Excavating, Backfilling, and Compacting for Utilities~~

- ~~1. Excavation.~~
- ~~2. Fill or backfill.~~
 - ~~a. Structural.~~
 - ~~b. Common.~~

4.8. Bedding for underground pipe, conduit, and cable: Sand, ASTM D 653.

- ~~4. Stabilization: Crushed rock, 3/4 inch maximum for walkways and 2 inch minus for other areas.~~

5. Plastic sheet marker ^{with metal detector wire} for buried pipe and conduit.

6. *Clearing and grubbing - remove top 6" of existing soil.*

~~Section 02235 Road Subgrade and Granular Base 02510 Asphaltic Concrete Paving & Bus.~~

1. Base course: WSDOT M41-10, Section 9-03.9(3), Base Course Classification.
2. Leveling course: WSDOT M41-10, Section 9-03.9(3), Top Course Classification.
3. Backfill: WSDOT M41-10, Section 2-03.3(14)C, Method B.

~~Section 02512 Hot-Laid Asphaltic Concrete Paving~~

- 4.8. Asphalt: WSDOT M41-10, Sections 9-02.1(2) and 9-02.1(4). Paving asphalt, Grade AR-4000W; Prime coat, Grade MC-250.
- 5.2. Aggregate: Class B WSDOT M41-10, Section 9-03.8(1), (2), and (3)B.

6. Blending sand: WSDOT M41-10, Section 9-03.8(4).
 7. Mineral filler: WSDOT M41-10, Section 9-03.8(5).
 8. Proportioning of asphalt concrete materials: WSDOT M41-10, Section 9-03.8(6) Class B asphalt concrete.

9. *Pavement Marking*

~~Section 02650 Piped Utilities~~

1. Carbon steel pipe: See Section 15493 Pipe Code M-5.
2. PVC pipe: See Section 15493 Pipe Code M-11 and P-1.
3. Exterior protective coating: AWWA C203; Tapecoat Company "Tapecoat 20."

*Replaced
with
attached
Sections
02565
02595
02596
02540
02831*

~~Section 02730 Sanitary Sewerage~~

1. Pipe: PVC, ASTM D 3034 SDR 35, or ductile iron, AWWA C151 Class 50, cement-mortar lined, AWWA C104.
2. Fittings: ASTM D 3034 SDR 35.
3. Manholes: Precast or cast-in-place concrete, 48 inch inside diameter, WSDOT M21-01 Standard Plan B-23c.

~~Section 02831 Chain Link Fences and Gates~~

1. Fence fabric: FS RR-F-191/1, Type I, 2 inch mesh, 11 gauge, 84 inch height, top and bottom selvages twisted and barbed.
2. Posts, top rails and braces: FS RR-F-191/3, Class 1, Grade A or B.

DIVISION 3 - CONCRETE

Section 03300 Cast-In-Place Concrete

Section 03100 Concrete Formwork
Section 03200 Reinforcing Steel

1. Minimum allowable compressive strength: ⁴⁰⁰⁰3000 psi at 28 days.
2. ^{Reinforcing} Steel bars: ASTM A 615, deformed, Grade 60.
3. Welded wire fabric: ASTM A 185.
4. Nonshrink grout: ASTM C 1107.

DIVISION 5 - METALS

Section 05500 Metal Fabrications

1. Rolled steel shapes, plates, and bars: ASTM A 36.
2. Steel pipe: ASTM A 53 (black), standard weight, Schedule 40.
3. *Handrail: Aluminum*
4. *Ladders: Aluminum*
5. *Floor hatches: Aluminum*

SECTION 02565 - DUCTILE IRON PIPE

1. Pipe: Ductile iron, ANSI/AWWA C-151, Class 53. Mortar lined, ANSI/AWWA C104. Polyethylene wrapped, ANSI/AWWA C105.
2. Joints: Mechanical and push-on, ANSI/AWWA C111. Flanged, ANSI/AWWA C115.
3. Fittings: ANSI/AWWA C153 or C110, minimum pressure rating of 250 psi.
4. Exterior coating: Exposed, as per manufacturer's recommendations, using rust-inhibitive primer. Buried, asphaltic, 1 mil thick.

SECTION 02595 - SMALL PVC NONPRESSURE PIPE, RUBBER JOINTS

1. Pipe: ASTM D 3034, Class SDR 35. Material, ASTM D 1784 for Class 12454-B or 12454-C.
2. Joints: Compression-type, elastomeric seals, ASTM D 3212.
3. Fittings: ASTM D 2241.

SECTION 02596 - LARGE PVC NONPRESSURE PIPE, RUBBER JOINTS

1. Pipe: ASTM F 679. Material, ASTM D 1784 for Class 12364-C or 12454-C.
2. Joints: Compression type, rubber gaskets, ASTM F 477.
3. Fittings: ASTM F 679.

SECTION 02540 - PRECAST CONCRETE MANHOLES

1. Manhole rings: precast concrete, 4-inch min. wall thickness, steel-reinforced, Type V Portland cement, ASTM C 150.
2. Castings: ASTM A 48, Class 30, covers and frames H-20 heavy traffic loading. 30 inch diameter, WSDOT M21-01 STANDARD PLAN B-23C.

SECTION 02831 - CHAIN LINK FENCES AND GATES

1. Fence fabric: 2-inch mesh, 9-gage galvanized steel wire, 6 feet height, knuckled finish on top edge, twisted and barbed finish on bottom edge, ASTM A392. Topped with 3 strands of 2-strand, No. 12-1/2 gage zinc-coated steel or iron, 4-point, 14-gage barbs.
2. Ties and wires: No. 9 galvanized steel wire, 14 inches apart on posts, 24 inches on rails. Continuous No. 7 gage galvanized steel wire along fence bottom.
3. Posts: Line posts, 2-inch diameter schedule 40, 3.65 lb/ft. End and corner posts: 2-1/2-inch diameter, schedule 40, 5.79 lb/ft. Gate posts, 3-1/2-inch diameter schedule 40, 9.1 lb/ft. All posts, ASTM A702.
4. Top rails and braces: 1-1/4-inch diameter schedule 40, 2.27 lb/ft, ASTM F626.

3. Steel tubing: ASTM A 500, Grade B.

DIVISION 6 - WOOD AND PLASTIC

See attached Section 0611

Section 06611 Fiberglass Metering Station

1. Fiberglass metering station: Completely integral unit consisting of: 48 inch corrosion resistant fiberglass reinforced plastic (FRP) manhole with sealed fiberglass bottom; 48 inch diameter hinged fiberglass cover with locking hasp; fiberglass access ladder; and metering flume with grating cover. Manhole shall be equipped with hold down brackets for anchoring unit to a concrete slab. A 1/2-inch thick expanded polystyrene bead board will be placed between manhole and concrete slab. Plasti-Fab, Tualatin, Oregon.

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

Section 07200 Insulation

1. Blanket and batt insulation: ASTM C 665, UL listed, "flame spread" and "fuel contributed" of 25, and "smoke developed" of 50 or less.
2. Roof and wall insulation: Type III mineral fiber batts with minimum thermal resistance of R-19.
4. Perimeter insulation: ASTM C 578, Type IV, 1 inch thick; Dow Chemical Company "Styrofoam SM."

DIVISION 8 - DOORS AND WINDOWS

Section 08100 Metal Doors and Frames

1. Hollow metal doors: Full-flush type, 1 3/4-inch thick, with no seams or joints on face, in accordance with SDI 100 and 108; face sheets 0.0478-inch (18-gauge) minimum, stiles and rails, 0.0598-inch (16-gauge) minimum. Reinforced with steel members welded in place and spaces filled with insulation in accordance with ISDSI 102 or water resistant honeycomb core bonded to both faces.
2. Pressed metal frames: 0.0598-inch (16-gauge).

Section 08331 Overhead Coiling Doors

1. Overhead coiling doors: Manually chain operated, with locking devices for padlocking, wind load resistance 20 lb/ft²; Overhead Door Corporation.

SECTION 06610 - GLASS FIBER AND RESIN FABRICATIONS

1. Fiberglass metering station: Totally integrated fiberglass metering manhole consisting of corrosion resistant fiberglass reinforced plastic (FRP) with sealed fiberglass bottom, 30-inch diameter concentric manway opening, fiberglass access ladder, metering flume with grated cover, and special discharge sump/sample well. Two neoprene boots with stainless steel clamps sized for inlet and outlet pipe stubs, hold down brackets for anchoring to concrete slab. Expanded polystyrene bead board, 1/2 inch thick, placed on concrete slab under manhole. Plasti-Fab, Tualatin, Oregon.
2. Filter washwater fiberglass troughs: ANSI/AWWA F101.

DIVISION 9 - FINISHES**Section 09250 Gypsum Board**

1. Fire-retardant board: ASTM C 36, 5/8-inch thick Type X.
2. Water-resistant backing board: ASTM C 630, 5/8-inch thick water-resistant face, back coverings, and core.
3. Steel studs and runners: ASTM C 645 screw studs, nonloadbearing channel type, roll-formed from 0.0247-inch (25-gauge), galvanized, nominal 1 inch flange width.

~~**Section 09500 Acoustical Treatment**~~

1. Acoustical panels: 2- by 4-foot lay-in panels, ASTM E 1264, Type III, Form 1, Pattern D, Class A; light reflectance, greater than 75%; noise reduction coefficient range, 0.60 to 0.70.
2. Suspension system: Exposed 2-way tee grid, ASTM C 635, intermediate duty.

~~**Section 09650 Resilient Flooring**~~

1. Vinyl composite tile.
2. Sheet vinyl flooring.
3. Rubber base.

Section 09800 Special Protective Coating

1. Coating materials: Products of Protective Coatings Division of Ameron, Brea, California.
 - a. ~~Filler: Nu-Klad 114.~~
 - b. ^{Galvanized} Surface conditioner: ^{Per SSPC-SP-1} ~~Ameron Products of Ambler, PA.~~ "Galvaprep SG."
 - c. Primer: ~~Dimecote Steel Primer 205.~~ *Ameron 5105 or equal*
 - d. Finish coating: ~~Amercoat 33.~~ *Ameron 5401 HS or equal*

Section 09900 Painting

1. Semigloss latex for interior walls.
2. Gloss enamel for exposed steel surfaces and exterior metal wall panels.
3. ~~Enamel for concrete floors.~~ *Do not paint floors, use floor hardeners*

See Attached Division 11

DIVISION 11 - EQUIPMENT

A. 283-E Water Treatment Facility

Section 11100 - Pumps

1. Vertical Turbine Pumps: 3 @ 125 gpm/25 ft TDH;
3 @ 125 gpm/350 ft TDH.
2. Submersible Sump Pumps: 1 @ 20 gpm/25 ft TDH;
1 portable @ 100 gpm/16 ft TDH.

Section 11200 - Mixers and Flocculators

1. Horizontal Flocculators: 4 basins, 3 stages each; first stage $G = 40$ to 60 sec^{-1} , second stage $G = 20$ to 40 sec^{-1} , third stage $G = 5$ to 20 sec^{-1} .
2. In-line Static Mixers: 4 @ $24 \text{ gpm}/\Delta P = 2 \text{ psig}$.

Section 11230 - Solids Contact Clarifier: 250 gpm/0.96 gpm/ft²; 19 ft diameter basin, 10.25 ft sidewater depth.

Section 11258 -Chemical Feeding Equipment

1. Polymer Mix/Feed Units: 2 @ 4.0 gph;
2 @ 0.01 gph;
1 @ 0.005 gph;
1 @ 0.25 gph.
2. Calibration Columns: 1 liter
3. Chemical Feed Appurtenances: Drum platform scale; drum inlet dryer, drum suction wand.

Section 11420 - Filter Surface Washers: rotary surface wash agitators, 160 gpm @ 70 psi.

Section 11426 - Anthracite Media: ANSI/AWWA B100.

Section 11428 - Sand and Torpedo Sand Media: ANSI/AWWA B100.

DIVISION 13 - SPECIAL CONSTRUCTION**Section 13120 Pre-Engineered Structures**

1. Metal building: Single-span structure, rigid-frame, beam and column, or self-framing type.
2. Primary framing: Rigid frame of rafter beams and columns braced end frames, end wall columns and wind bracing.
3. Secondary framing: Purlins, girts, sill supports, clips and other items required for complete installation.
4. Wall and roof system: Preformed metal panels of vertical profile, insulation, and accessory components.
5. Sheet steel stock: ASTM A 446 zinc-coated (galvanized) to ASTM A 525 G90. Factory color finished.
6. Wall system: 0.0217 inch (26-gauge), exposed fastening panels.
7. Roof system: 0.0217 inch (26-gauge), concealed fastening, standing seam construction.
8. Insulation: See Section 07200.

Section 13215 Underground Storage Tank

1. Diesel storage tank: Double-shelled fiberglass, with leak detection monitoring system, secondary containment collar and turbine enclosure; Owens-Corning Hydroguard System.

Section 13440 Instrumentation

L INSERT SECTION 13222

1. Level monitoring systems: Floatless level sensor, transmitter, indicator, switch, other system interface, 4-20 mA dc output for interface with Distributed Control System.
2. Flow monitoring systems

a. ~~Flow monitoring system (full-flow pipes): Nonintrusive transducer located outside of full flow pipe, flow processor equipped with flow indicator, flow totalizer, flow switches, 4-20 mA dc signal output for interface with Distributed Control System; Controlotron System 990 Uniflow.~~

Replace with following information

Section 13222 - Strainer Nozzle Filter Underdrain: 1 to 5 gpm/ft² filtration rate
14 to 20 gpm/ft² backwash rate

Section 17100

2. Flow monitoring systems

- a. Flow monitoring system (for process fluids with conductivity values above 5 μ S/cm)
Magnetic flow transducer, with integral flow transmitter equipped with optional flow indication, alarm contacts, 4-20mA dc output for interface with Distributive control system; Rosemount 8701/8712C, Endress and Hauser Promag 30/33 or equal.
- b. Flow monitoring system (for process fluids with potential conductivity values of less than 5 μ S/cm)
Vortex flow transducer, with integral flow transmitter equipped with optional flow indication, alarm contacts, 4-20mA dc output for interface with Distributive control system; Foxboro E83FA, Endress and Hauser Swingwirl II or equal.
- c. Flow monitoring system (open channel)
No changes to text. However manufacturer and model should be Endress and Hauser Prosonic, Badger Meter, or equal.

See PRECEDING PAGE

	PIPE OD	
	0.5" to 4"	6" to 24"
Transducer:	991 NMS-1	991 NMS-3
Mounting Track:	992MTNHMS-1B	992MTNHMS-3
Transducer Cable Assembly:	992CNW-100	DO
Flow Computer:	994N3DS-23N	DO
Analog Computer module:	994-7	DO
Alarm Relay module:	994-10NBD	DO

b. Flow monitoring system (Open channel): Nonintrusive transducer located above the open channel flume, flow processor equipped with flow indicator, flow totalizer, flow switches, 4-20 mA dc signal output for interface with Distributed Control System; TN Manning Model UF-1100 with 50 foot sensor cable.

3. Radiation monitoring system: ^{ON} Off-line radiation monitoring system capable of monitoring beta activity levels of ~~8.6 pCi/litre;~~ *2 x 10⁻⁷ µCi/ml*
~~Victoreen Model 940-2 System with modifications required.~~
Nuclear Measurements PROPS
4. pH monitoring system

- a. Probe: Annular double junction with integral preamplifier and automatic temperature compensation; Rosemount Analytical Model 399.
- b. Analyzer/transmitter: Microprocessor based with dual alarm contacts, and 4-20 mA dc output for interface with Distributed Control System; Rosemount Analytical Model 1054H.

5. Conductivity monitoring system *See following page*

- a. ~~Conductivity cell: Stainless steel probe with automatic temperature compensation; Cole Parmer Model L-05970-50.~~
- b. ~~Conductivity controller: Microprocessor based, 4-20 mA dc or 0-10 Vdc output for interface with Distributed Control System; Cole Parmer Model L-05970-24.~~

6. Turbidity monitoring system: Local indication and remote signal transmission. Hach Model 1720C and 19800.

Range:	0-100 NTU	0-100%
	Transmittance	
Accuracy:	± 2% (0-30 NTU)	
	± 5% (30-100 NTU)	
Output Signal:	4-20 mA dc	4-20 mA dc
Accessories:	Calibration kit, additional sensor mounting hardware for both units	

Section 17100

5. Conductivity monitoring system

- a. Conductivity cell: Stainless steel probe with built-in RTD for temperature compensation purposes; Rosemount Analytical model 222 or equal.
- b. Conductivity controller: Microprocessor based, 4-20mA dc output for interface with Distributed control system; Rosemount Analytical model 54 or equal.

7. Temperature monitoring system: ~~Temperature element, platinum RTD, dual element with thermowell; Rosemount Model 0078 F 25 N 00 A030 T24.~~ *see following page*
8. Valve position monitoring system: Valve position limit switches will be procured as an integral part of valve assembly.
9. Refrigerated composite/sequential liquid effluent sampler: Sample mode to be selectable for timed sequence or flow increment sequence using flow signal from item 2 "Flow Monitoring Systems." Sampler to have built-in self diagnostic routines to detect system failures, nonvolatile or battery backup memory, peristaltic sample pump and NEMA ICS 6, Type 3 or 4 enclosure; ISCO Environmental Division Model 3700 *OR TN Tech, Inc., Model 6400; with form C alarm contact option SPA 648.*
10. Pressure monitoring systems
- Local pressure gauge: 4-inch dial, liquid filled 316 stainless steel bourdon tube and socket, ranges to be determined later; Ashcroft Duragauge Model, Type 2100.
 - Pressure indicating/transmitting system: 4-1/2-inch dial, 316 stainless steel bourdon tube and socket, range to be determined later, 4-20 mA dc output; Ashcroft Duratran Transmitter Type 2279.
 - Pressure indicating switch: 4-1/2-inch dial, 316 stainless steel bourdon tube and socket, range to be determined later, with low-pressure electric contacts; Ashcroft Duragauge, Type 1379 XEF.
- The LCU will include a*
11. Pump control system: Multipump alternator to sequence (alternate) lead and lag pumps, local start/stop switch for test and emergency stop for each pump, lead/lag pump sequence based upon level switch setpoints generated by level monitoring system in ~~LCU~~ *B/W* Controls ~~LEV-L-LOGIC solid-state system.~~
12. Local control unit (LCU) for interface with distributed control system: Micon A/S OPEN Automation System.
- RCM-32/U-32 integral I/O with power supply unit.

	242-A/B-Plant	284-E	282-E/283-E	183-D/182-D	241-A/244-AR
Analog Inputs	32 32	64	32	48	32
Analog Outputs	32 32	64	32	48	32
Discrete Inputs	128 64	128	64	64	32
Discrete Outputs	128 64	128	64	64	32
Frequency/Pulse Input	2 2	2	2	2	2

COMBINED INTO ONE UNIT

Section 17100

7. Temperature monitoring system

- a. Temperature element: Platinum RTD, dual element with thermowell; Rosemount model 0078 F 25 N 00 A030 T24.
- b. Temperature transmitter: Field mountable, RTD input, with optional local indication and 4-20mA dc output for interface with Distributive control system; Rosemount model 444 or equal.

- b. U-32/GPLI-32 Microprocessor/controller for each system.
- c. Local Operator Interface (LOI-32) for each system.

DIVISION 15 - MECHANICAL

Section 15493 Chemical Process Piping Systems

A. General

- 1. Pipe and fittings: See pipe codes in this Section.

B. 242-A Evaporator

SEE FOLLOWING PAGE

- ~~1. Fluid cooler: Baltimore Aircoil Model F2602-N supplied with ASME coils, Baltibond corrosion protection, extended surface coils, pan heaters, fan/spray pump integrally mounted motor control center, skid-mounted supports and system freeze protection.~~
- ~~2. Chiller: Dunham Bush Model RC-8A remote air cooled packaged chiller.~~
- ~~3. Circulation pump: Goulds Model 3900 in-line pumps, pump size 8 x 10-16, 200 hp (15 inch impeller), mechanical seal; carbon steel materials.~~
- ~~4. Chiller pump: Goulds Model 3900 in-line pumps, pump size 1 1/2 x 2 x 7, 1/2 hp (5-inch impeller) mechanical seal; carbon steel materials.~~

C. B-Plant/WESF

SEE FOLLOWING PAGE

- ~~1. Fluid cooler: Baltimore Aircoil Model F2603-N supplied with ASME coils, Baltibond corrosion protection, extended surface coils, pan heaters, fan/spray pump integrally mounted motor control center, skid mounted supports and system freeze protection.~~
- ~~2. Circulation pump: Goulds Model 3900 in-line pump, pump size 6 x 8 x 16B, 40 hp (16-inch impeller), mechanical seal, carbon steel materials.~~
- ~~3. Sump pump: Goulds Model 3171 vertical industrial pumps, group ST, 1 1/2 x 3 x 6, 3/4 hp, (5-inch impeller) packed stuffing box; carbon steel materials.~~
- ~~4. Receiver tank transfer pump: Goulds Model 3900 in-line pump, pump size 2 x 4 - 7, 2 hp, (7-inch impeller), mechanical seal; carbon steel materials.~~

D. 244-AR Vault

- ~~1. Chiller: Dunham Bush Model RC-20A, remote air cooled packaged chiller.~~

B. 242-A Evaporator

1. Wet Surface Fluid Cooler: Baltimore Air Coil Model F2661-N supplied with ASME VIII coils, Baltibond corrosion protection, pan heaters, fan/spray pump integrally mounted motor control center, skid-mounted supports and system freeze protection.
2. Dry Surface Fluid Cooler: Bohn Model DFS 06 fluid cooler, or equivalent, supplied with one electric motor driven fan.
3. Circulation Pump: Goulds Model 3410, Group L, 1780 RPM, horizontal, single stage pump, pump size -10 x 12 - 12, 150 hp (12 1/2 inch impeller), carbon steel materials.
4. Air Compressor Circulation Pump: Dean Model DL, 3500 RPM, in-line, single stage pump, pump size 3/4 x 3/4, 1/2 hp (4 3/4 inch impeller), carbon steel materials.
5. Service Building Sump Pump: Goulds Model 3171, Group ST, 3500 RPM, vertical pump, pump size 1 x 1 - 5, 1 1/2 hp (4 inch impeller), carbon steel materials.

C. B-Plant/WESF

1. Wet Surface Fluid Cooler: Baltimore Air Coil Model F2441-L supplied with ASME VIII coils, Baltibond corrosion protection, pan heaters, fan/spray pump integrally mounted motor control center, skid-mounted supports and system freeze protection.
2. Circulation Pump: Goulds Model 3196, Group MT, 1780 RPM, horizontal, single stage pump, pump size 4 x 6 - 13, 25 hp (10 inch impeller), carbon steel materials.
3. Cooler Blowdown Sump Pump: Goulds Model 3171, Group S, 3500 RPM, vertical pump, pump size 1 x 1 1/2 - 6, 3 hp, carbon steel materials.
4. Storage Pool Sump Pump: Goulds Model 3171, Group ST, 3500 RPM, vertical pump, pump size 1 x 1 - 5, 3/4 hp, carbon steel materials.
5. Makeup Water Pump: Dean Model DL, 3500 RPM, in-line, single stage pump, pump size 3/4 x 3/4, 1/2 hp, carbon steel materials.
6. Service Building Sump Pump: Goulds Model 3171, Group ST, 3500 RPM, vertical pump, pump size 1 x 1 - 5, 1 1/2 hp (4 inch impeller), carbon steel materials.

2. ~~Chiller circulating pump: Goulds Model 3900, in-line pumps, pump size 1 1/2 x 3 x 7, 1/4 hp, (5-inch impeller), mechanical seal; carbon steel materials.~~
3. TEDF transfer pump: Goulds Model 3900, in-line pumps, pump size 1 1/2 x 2 x 7, 1/2 hp, (5-inch impeller), mechanical steel; carbon steel materials.
4. Heat exchanger: Whitlock (AMETEK) shell and tube heat exchanger, Type MVHT, carbon steel shell, tubes and tube sheet; Size 4-36, 1/4 inch tubes, surface area of 22.8 ft².

may be
discussed

E. 284-E Powerhouse

SEE FOLLOWING PAGE

1. ~~Fluid cooler: Baltimore Aircoil Model F2462-M supplied with ASME coils, Baltibond corrosion protection, extended surface coils, pan heaters, fan/spray pump integrally mounted motor control center, skid mounted supports and system freeze protection.~~
2. Circulation pump: Goulds Model 3900 in-line pumps, pump size 2 x 4 - 7, 20 hp, (6-1/2 inch impeller), mechanical seal carbon steel materials.
3. Condensate circulation pump: Goulds Model 3900 in-line pumps, pump size 2 x 4-7, 1 hp (5-1/2 inch impeller), mechanical seal; carbon steel materials, high temperature seal materials.
4. TEDF transfer pump: Goulds Model 3900 in-line pumps, pump size 4 x 6 - 7N, 3 hp (6-inch impeller), mechanical seal; carbon steel materials.
5. Sump pump: Goulds Model 3171 vertical sump pump, pump size 1 x 1 x 5, 1 1/2 hp (4 7/8 inch impeller), mechanical seal; carbon steel materials.
6. Heat exchanger: Whitlock Process Heat Exchanger, 10 inch nominal shell diameter 17 feet overall length, surface area of 262 ft², 5/8 inch OD x 18 BWG tubes (3/16-inch triangular pitch), 4 tube passes TEMA Type R exchanger classification.

F. 283-E Water Treatment Facility

INSERT ATTACHED INFORMATION

1. Butterfly control valve: Valve actuator, electric 115 V ac, 60 Hz with anti-condensation heater, continuous duty motor, manual override. Model KEYSTONE Figure 776, size EPI-46. Butterfly Valve, 175 psig, cast iron body, SST disc and stem, EDPM seat; KEYSTONE Model HS1-961-001.
2. ~~Lift Station 283E-IS-1: Packaged pumping station complete with priming mechanism and all required equipment contained in a water tight steel chamber. The station shall consist of a steel vault mounted over 10,000 gal capacity standard concrete well and shall be equipped with two motor driven non-clog type pumps, 30 hp,~~

E. 284-E Powerhouse

1. Wet Surface Fluid Cooler: Baltimore Air Coil Model F2342-L supplied with ASME VIII coils, Baltibond corrosion protection, pan heaters, fan/spray pump integrally mounted motor control center, skid-mounted supports and system freeze protection.
2. Circulation Pump: Goulds Model 3198, Group MT, 3550 RPM, horizontal, single stage pump, pump size 3 x 4 - 13, 25 hp (13 inch impeller), carbon steel materials.
3. Cooler Blowdown Sump Pump: Goulds Model 3171, Group S, 3500 RPM, vertical pump, pump size 1 x 1 1/2 - 6, 3 hp, carbon steel materials.
4. TEDF Transfer Pump: Goulds Model 3196 horizontal pump, pump size 2 x 3 - 6, 1 1/2 hp (5 1/2 inch impeller), carbon steel materials.
5. Blowdown Transfer Pump: Goulds Model 3196 horizontal pump, pump size 1 x 1 1/2, 3/4 hp (6 1/16 inch impeller), carbon steel materials.
6. Service Building Sump Pump: Goulds Model 3171, Group ST, 3500 RPM, vertical pump, pump size 1 x 1 - 5, 1 1/2 hp (4 inch impeller), carbon steel materials.
7. Blowdown Heat Exchanger: Straight tube and shell design, ASME VIII, 590 ft² heat transfer area, 5.8 x 106 BTU/hr duty, 60,000 lb/hr blowdown flow, 180 gpm cooling water flow, 80°F cooling water inlet temperature, 212°/115°F blowdown inlet/outlet temperature, carbon steel shell material, stainless steel tube material.
8. Boiler Blowdown Tank: 5,000 gallon capacity, ASME VIII, cylindrical vertical design, vented atmospheric pressure tank, carbon steel materials.
9. Brine Holding Tank: 20,000 gallon capacity, ASME VIII, cylindrical vertical design, vented atmospheric pressure tank, carbon steel materials.

F. 283-E Water Treatment Facility

Section 15000 - Piping

1. Mill Piping: Small steel pipe; stainless steel pipe; copper tubing; PVC pipe (Schedule 80); couplings.
2. Pipe Supports: Hangers, risers.

Section 15200 - Valves

1. Valve Actuators: Electric motor actuators; hydraulic cylinder actuators.
2. Butterfly Valves: AWWA C504.
3. Check Valves: Internal spring loaded; plastic ball check.

4. Ball Valves: 8-inch, V-port; bronze/carbon steel for 4-inch and smaller.
5. Plug Valves: Eccentric type.
6. Miscellaneous Valves: Bi-directional knife gates; air-vacuum and air-release valves; backflow preventors; small pressure reducing valves; pressure relief valves; solenoid valves.

Section 15650 - Hydraulic Gate

1. Slide Gates: Aluminum, downward opening.
2. Sluice Gates: AWWA C501.

Section 15430 - Piping Specialties: Floor drains; cleanout; hose bibbs and hydrants.

Section 15500 - Heating and Ventilating: Fans; electric unit heaters; radiant process heaters; louvers.

~~2000 gpm, 40 foot head, complete with all controls, valves, and fittings. Cascade/Ideal Pump POSI-PRIME TWO lift station with CORNELL vertical mount centrifugal pumps Model 6NHG-VM.~~

- ~~3. Lift Station 283E-LS-2: Packaged pumping station with the same configuration as 283E-LS-1 except that the station shall be equipped with two pumps, 1.5 hp, 30 gpm, 40 foot head. Cascade/Ideal Pump POSI-PRIME TWO lift station with CORNELL vertical mount centrifugal pumps Model 3NLT-VM.~~
- ~~4. Lift Station 283E-LS-3: Packaged pumping station with the same configuration as 283E-LS-1 except that the station shall be equipped with two pumps, 1.5 hp, 30 gpm, 35 foot head. Cascade/Ideal Pump POSI-PRIME TWO lift station with CORNELL vertical mount centrifugal pumps Model 3NLT-VM.~~

~~G. 183-D Water Treatment Facility~~

- ~~1. Raw water pump: Horizontal centrifugal pumps, 75 gpm at 70 feet of head, 3 hp, steel construction, DURCO Process Pumps Mark III (rev vane) 1K1-1/2X1-8.~~
- ~~2. Lift Station 183D-LS-1: Packaged pumping station complete with priming mechanism and all required equipment contained in a water tight steel chamber. The station shall consist of a steel vault mounted over 2000 gallon capacity standard concrete well (by buyer) and shall be equipped with 2 motor driven nonclog type pumps, 2 hp, 30 gpm, 40 foot head, complete with controls, valve and fittings. Cascade/Ideal Pump POSI-PRIME TWO lift station with CORNELL vertical mount centrifugal pumps Model 3NLT-VM.~~
- ~~3. Lift Station 183D-LS-2: Packaged pumping station with the same configuration as 183D-LS-1 except that the station shall be equipped with 2 pumps, 1.5 hp, 30 gpm, 50 foot head. Cascade/Ideal Pump POSI-PRIME TWO lift station with CORNELL vertical mount centrifugal pumps Model 3NLT-VM.~~
- ~~4. Lift Station 183D-LS-3: Packaged pumping station with same configuration as 183D-LS-1 except that the station shall be equipped with 2 pumps, 1/2 hp, 10 gpm, 35 foot head. Cascade/Ideal Pump POSI-PRIME TWO lift station with CORNELL vertical mount centrifugal pumps Model 3NLT-VM.~~
- ~~5. Butterfly Control Valve: Valve actuator, electric 115 V ac, 60 Hz with anti-condensation heater, continuous duty motor, manual override; Model KEYSTONE Figure 776, size EPI-46. Butterfly Valve, 175 psig, cast iron body, SST disc and stem, EDPM seat; KEYSTONE Model HS1-961-001.~~

PIPE CODE M-5		
Operating Press	150 psig	
Operating Temp	150° F	
Sizes	1-1/2" and smaller	2" and larger
Pipe	Carbon steel, ASTM A 53, Type E or S, or ASTM A 106, Grade B, seamless.	
Wall Thickness	Schedule 40	
Fittings	Carbon steel, wrought steel, ASTM A 234, Grade WPB, buttweld per ASME B16.9, wall thickness to match pipe.	
Flanges	150 lb forged carbon steel, ASTM A 105.	
Valves	Class 150, ASTM A 216, Grade WCB carbon steel body flanged ends, standard trim.	

PIPE CODE M-9		
Operating Press	150 psig	
Operating Temp	150° F	
Sizes	1-1/2" through 16"	
Pipe	Stainless steel, ASTM A 312, Grade TP 304L, seamless.	
Wall Thickness	Schedule 40S	Standard weight
Fittings	Stainless steel, ASTM A 403, Class WP304L, buttweld per ASME B16.9, wall thickness to match pipe.	
Flanges	150 lb forged stainless steel ASTM A 182, Grade F 304L.	
Valves	Class 150, ASTM A 351, Grade CF8M, stainless steel, flanged ends, standard trim.	

PIPE CODE M-10		
Operating Press	150 psig	
Operating Temp	150° F 120° F	
Sizes	1-1/2" to 12"	
Pipe	Polyvinyl chloride (PVC), ASTM D 1785, Type 1, Grade 1, PVC 1120, meeting the requirements of ASTM D 1784, Class 12454-B.	
Wall Thickness	Schedule 80	
Fittings	PVC Schedule 80, socket type, ASTM D 2467.	
Flanges	PVC Schedule 80, socket type, ASTM D 2467.	
Valves	PVC with viton seals, socket ends, valves to match Schedule 80 pipe.	

PIPE CODE P-1	
Operating Press	150 psig
Operating Temp	160°F / 120°F
Sizes	4" through 12"
Pipe	Polyvinyl chloride (PVC), Class 150, AWWA C900 (AWWA M23)
Wall Thickness	Schedule 80
Fittings	PVC pressure fittings, AWWA C907.
Check Valves	Iron body, bronze mounted swing check valves, flanged joint in accordance with AWWA C508.

DIVISION-16 - ELECTRICAL**Section 16300 Medium Voltage Distribution****A. 241-A Tank Farm**

1. Transformer, overhead distribution type, oil-filled, single-phase, 10 kVA, 13,800 - 120/240 V ac.
2. Fused distribution cutout, 15 kV, crossarm mounting with 100 A fuseholder.

B. B-Plant/WESF

1. Modification equipment for existing Power Pole C8-L7-112: 8 foot crossarm (2 required) and 15 kV pin insulators (6 required).
2. Power pole, Class 2, 40 feet, 10 foot crossarms (3 required) with all necessary hardware for deadend assembly.
3. Pole-mounted disconnect switch and lightning arrester combination, 15 kV, 100 A switch, 12 kV arrester.
4. Pole-mounted distribution transformer, single-phase, 75 kVA, 13.8 kV-277 V ac. (3 required)

~~C. 183-D Water Treatment Facility~~

- ~~1. Modification equipment for existing power pole: 8 foot crossarm (2 required) and 15 kV pin insulators. (6 required).~~
- ~~2. Power pole, Class 2, 40 feet, 10 foot crossarms (3 required) with all necessary hardware for deadend assembly.~~
- ~~3. Pole-mounted disconnect switch and lightning arrester combination, 15 kV, 100 A switch, 12 kV arrester.~~

- ~~4. Pole-mounted distribution transformer, single-phase, 25 kVA,
13.8 kV-277 V ac. (3 required)~~
- ~~5. Pole-mounted distribution transformer, single-phase, 10 kVA,
13.8 kV-277 V ac. (3 required)~~

Section 16400 Service and Distribution

A. General

1. Indoor lighting fixtures, industrial type, rapid start fluorescent.
2. Outside wall pack lighting fixtures, 18 watt low-pressure sodium with photocell control.
3. Lighting panelboard, NEMA ICS 6, Type 1, 100 A with 60 A main breaker.
4. Receptacle, GFCI, 120 V ac, 20 A, with cast aluminum box and weatherproof cover.
5. Capacitor: Outdoor type, rated 480 V ac, 3-phase. Required for all motors rated 10 hp and larger.
6. Conduit:
 - a. Underground: Rigid metal PVC coated, or concrete-encased PVC.
 - b. Outdoor: Rigid metal.
 - c. Indoor: Electrical metallic tubing.
7. Conductors:
 - a. Service Entrance: Stranded copper, 600 V ac, Type USE-RHW-RHH.
 - b. Feeder and branch circuit: Stranded copper, 600 V ac, Type THHN-THWN.

B. 242-A Evaporator

1. Diesel engine generator: 1200 kW, 1500 kVA, 480Y/277 V ac, 3-phase, 4-wire, in weather enclosure with engine heater.
2. Power circuit breaker: 480 V ac, 1600 A frame with 1600 A solid-state trip on a drawout carriage having long time, instantaneous, and ground fault characteristics.
3. Automatic transfer switch: 480 V ac, 1600 A, 4-pole, with engine start contact in NEMA ICS 6, Type 1 enclosure.

4. Motor control center: 480 V ac, 3-phase, 4-wire, 1600 A main horizontal bus, 600 A vertical bus, in NEMA ICS 6, Type 1 enclosure. The MCC will have a bottom feed incoming with 4-750 kcmil lugs per phase, and the following devices in 5 structure sections:
 - a. 2 - Size 5 combination starters, full voltage nonreversing.
 - b. 2 - Size 1 combination starters, full voltage nonreversing.
 - c. 4 - 225 A frame feeder breakers.
 - d. 1 - 100 A frame feeder breaker.
 - e. 1 - 15 kVA single-phase transformer.
 - f. 1 - 24 circuit panelboard.
5. Components for installation in existing Motor Control Center No. 1.
 - a. 3 - 100 A frame feeder breakers.
6. Components for installation in existing Motor Control Center No. 2.
 - a. ~~2 - Size 1 combination starters, full voltage nonreversing.~~
 - b. 1 - 100 A frame feeder breaker, *feeding a starter panel for the two circulating pumps and the chiller.*
 - c. ~~1 - 30 A fused switch.~~
7. Feeder between standby generator and LCU/Storage Building approximately 40 feet, 4 - 750 kcmil copper conductors 600 V insulated per phase and 2 - 1/0 grounds in 2 - 6 inch PVC ducts, concrete encased.
8. General purpose transformer, dry type, 10 kVA, single-phase, 480-120/240 V ac.

C. 244-AR Vault

1. Enclosed molded case circuit breaker: Rated 480 V ac, 225 AF, 125 AT, 3-pole, 22,000 AIC.
2. Power panelboard: 480 V ac, 225 A, 3-phase, 3-wire, NEMA ICS 6, Type 3R enclosure.
3. Disconnect switch for chiller: 480 V ac, 100 A, 3-pole, NEMA Type 4X enclosure.
4. Combination motor controller: NEMA Size 1, 480 V ac, 3-phase, with motor circuit protector and control transformer, NEMA ICS 6, Type 4X enclosure.

*may
be
designed*

5. Combination heater controller: NEMA Size 3, with thermal magnetic circuit breaker and control transformer, NEMA ICS 6, Type 4X enclosure. (For Vessel Vent Heater)
6. Mini-power center: 5 kVA transformer, 480-120/240 V ac, 6 circuit panelboard with main circuit breaker.

may
be
discovered

D. 241-A Tank Farm

1. Engine-generator: 5 kW, 120/240 V ac, in weather enclosure.
2. Automatic transfer switch, 2-pole, 30 A, 240 V ac with solid neutral.
3. KWH meter and outdoor meter base enclosure, 240 V ac, 100 A.

E. B-Plant/WESF

1. Automatic transfer switch with bypass-isolation switches rated 480Y/277 V ac, 260 A, 3-phase, 4-wire.
2. Diesel engine generator: 350 kW, 480Y/277 V ac, 3-phase, 4-wire, in weather enclosure with engine heater.
3. Motor control center: 480 V ac, 600 A, 3-phase, 4-wire bus, 250 AT main circuit breaker, kWh demand meter, 3 vertical sections. NEMA ICS 6, Type 1 enclosure.
4. Combination motor controller for use in an existing motor control center: NEMA Size 1, 480 V ac, 3-phase, with motor circuit protector and control transformer.
5. Disconnect switch for cooling tower: 480 V ac, 200 A, 3-pole, NEMA ICS 6, Type 4X enclosure.
6. Mini-power center, 15 kVA transformer: 480-208Y/120 V ac, 12 circuit panelboard with main circuit breaker.

F. 284-E Powerhouse and 283-E Water Treatment Facility

1. Motor Control Center (MCC), free standing NEMA ICS 6, Type 1 unit with enough vertical sections to house the units shown in Sketch ES-252-N2 plus a minimum of 25% space for future expansion.
2. 100 A frame circuit breaker compartment and circuit breaker with external switch operator to fit in an existing spare space in an existing GE 8000 Line Motor Control Center.
3. Feeder between outdoor unit substation and LCU/Storage Building approximately 320 feet 4 - 750 kcmil copper conductors 600 V insulated per phase and 2 - 1/0 grounds in 2 - 6 inch PVC ducts, concrete encased.

G. ~~183-D Water Treatment Facility~~

- ~~1. Motor control center (MCC), 480 V ac, 600 A, 3-phase, 4-wire bus, 90 AT main circuit breaker, kWh demand meter. The MCC shall house the units shown in the Sketch ES-252-N5 plus a minimum of 25% space for future expansion.~~
- ~~2. Transformer, 480-120/240 V ac, single-phase, 50 kVA, dry type.~~
- ~~3. Transformer, 480-120/240 V ac, 3-phase, 30kVA, dry type.~~
- ~~4. Panelboard, 120/240 V ac, 200 A, single-phase.~~
- ~~5. Service distribution panelboard, 480 V ac, 100 A, 3-phase, 4-wire.~~
- ~~6. Wall mounted motor controllers, NEMA ICS 6 Type 1 enclosure, 480 V ac, 3-phase with MCP and control transformer.~~
- ~~7. Metering enclosure with kWh demand meter, 480 V ac.~~

Section 16740 Voice and Data Systems

1. Power conductors: Copper, Type THHN, THWN, or XHHW.
2. Communication cables: NFPA 70 (NEC) Table 800-50.
3. Conduit:
 - a. Rigid steel.
 - b. Intermediate metal.
 - c. Electrical metallic tubing (EMT).
 - d. PVC (Schedule 40).
 - e. Flexible metal.
 - f. Rigid aluminum and fitting.
4. PVC coated rigid steel conduit for below grade: NEMA RN 1, Type A-40.
5. Wireway: Steel, NEMA ICS 6 Type 3R surface lay-in wireway with hinged cover.
6. Safety switches: NEMA KS 1, fusible heavy duty, single-throw, 240 V, with Class R fuses, and housed in NEMA ICS 6, Type 3R enclosures.
7. Equipment enclosures: NEMA ICS 6, Type 3R or 4.

Appendix M

MONTGOMERY WATSON

APPENDIX M

ADVANCED CONCEPTUAL DESIGN REPORT

COST ESTIMATE

**PROJECT W252
PHASE II LIQUID EFFLUENT TREATMENT &
DISPOSAL**

HANFORD 200 AREA, RICHLAND, WASHINGTON

90% ADVANCED CONCEPTUAL DESIGN

JANUARY 26, 1995

CLIENT

**MONTGOMERY WATSON
671 E. Riverpark Lane, Suite 200
Boise, Idaho 83706-4000**

#2195.001

CONSULTANT

**PROJECT TIME & COST, INC.
Sixteenth Floor, Lenox Tower S
3390 Peachtree Road, N.E.
Atlanta, Georgia 30326-1108**

Project Time & Cost**Phase II Liquid Effluent Treatment & Disposal, W-252****90% Advanced Conceptual Design****January 1995, PT&C #2195.001****Summary Sheets (DOE_R01)****Note: All values are approximate.**

Cost Code	Description	Escalated Total Cost	Contingency %	Total	Total Dollars
000	Design & Management	6,701,000	21.4%	1,434,000	8,135,000
=====					
Total Design & Management		6,701,000	21.4%	1,434,000	8,135,000
=====					
460	Improvements To Land	81,000	29.2%	24,000	105,000
501	Buildings	859,000	29.2%	251,000	1,110,000
550	Other Structures	22,000	29.2%	6,000	28,000
600	Utilities	151,000	29.2%	44,000	195,000
700	Special Equip/Process Systems	7,463,000	29.2%	2,181,000	9,644,000
810	Demolition	44,000	29.2%	13,000	57,000
=====					
Total Cost Codes 460 Thru 810		8,620,000	29.2%	2,519,000	11,139,000
Total Estimated Construction Cost (TECC)		15,321,000	25.8%	3,953,000	19,274,000
900	Other Project Costs	5,749,000	7.8%	448,000	6,197,000
=====					
Total Other Project Costs		5,749,000	7.8%	448,000	6,197,000
Total Project Cost (TPC)		21,070,000	20.9%	4,401,000	25,471,000

M-3

Project Time & Cost

Phase II Liquid Effluent Treatment & Disposal, W-252

90% Advanced Conceptual Design

January 1995, PT&C #2195.001

Summary Sheets (DOE_R02)

WBS	Description	Estimate Subtotal	Onsite Indirects	Subtotal	Escalation %	Total	Contingency %	Total	Total Dollars
=====	=====	=====	=====	=====	=====	=====	=====	=====	=====
1111	242-A Evaporator	153,959	0	153,959	0.0%	0	10.00%	15,396	169,355
1112	244-AR Vault	39,004	0	39,004	0.0%	0	10.00%	3,900	42,904
1113	241-A Tank Farm Cooling Tower	22,764	0	22,764	0.0%	0	10.00%	2,276	25,040
1114	B-Plant & WESF	66,620	0	66,620	0.0%	0	10.00%	6,662	73,282
1115	284-E Powerplant	60,674	0	60,674	0.0%	0	10.00%	6,067	66,741
1116	283-E Water Treatment Facility	149,469	0	149,469	0.0%	0	10.00%	14,947	164,416
	Subtotal 111 Definitive Design - Cat 1	492,490	0	492,490	0.0%	0	10.00%	49,248	541,738
1120	All Facilities	1,889,338	0	1,889,338	0.0%	0	10.00%	188,934	2,078,273
	Subtotal 112 Definitive Design - Cat 2	1,889,338		1,889,338	0.0%	0	10.00%	188,934	2,078,273
	Subtotal 11 Definitive Design - Off-site	2,381,828	0	2,381,828	0.0%	0	10.00%	238,182	2,620,011
M-4	1211 242-A Evaporator	256,598	0	256,598	5.0%	12,830	35.00%	94,300	363,728
	1212 244-AR Vault	65,007	0	65,007	5.0%	3,250	35.00%	23,890	92,147
	1213 241-A Tank Farm Cooling Tower	37,940	0	37,940	5.0%	1,897	35.00%	13,943	53,780
	1214 B-Plant & WESF	111,033	0	111,033	5.0%	5,552	35.00%	40,805	157,390
	1215 284-E Powerplant	101,123	0	101,123	5.0%	5,058	35.00%	37,163	143,342
	1216 283-E Water Treatment Facility	249,115	0	249,115	5.0%	12,458	35.00%	91,550	353,121
	1218 OAC Exceptions	50,000	0	50,000	5.0%	2,500	35.00%	18,375	70,875
	Subtotal 121 Engr During Constr - Off-site	870,816	0	870,816	5.0%	43,541	35.00%	320,028	1,234,383
	1221 242-A Evaporator	49,114	0	49,114	8.5%	4,175	35.00%	18,651	71,940
	1222 244-AR Vault	22,647	0	22,647	8.5%	1,925	35.00%	8,600	33,172
	1223 241-A Tank Farm Cooling Tower	21,985	0	21,985	8.5%	1,869	35.00%	8,349	32,203
	1224 B-Plant & WESF	44,368	0	44,368	8.5%	3,771	35.00%	16,849	64,988
	1225 284-E Powerplant	57,528	0	57,528	8.5%	4,890	35.00%	21,846	84,264
	1226 283-E Water Treatment Facility	30,896	0	30,896	8.5%	2,628	35.00%	11,733	45,255
	Subtotal 122 Acceptance Insp - On-site	226,538	0	226,538	8.5%	19,256	35.00%	86,028	331,822
	Subtotal 12 Engineering/Inspection	1,097,354	0	1,097,354	5.7%	62,797	35.00%	406,054	1,566,205
	Subtotal 1 Engineering	3,479,182	0	3,479,182	1.8%	62,797	18.19%	644,236	4,186,216

Project Time & Cost

Phase II Liquid Effluent Treatment & Disposal, W-252

90% Advanced Conceptual Design

January 1995, PT&C #2195.001

Summary Sheets (DOE_R02)

WBS	Description	Estimate Subtotal	Onsite Indirects	Subtotal	Escalation %	Total	Contingency %	Total	Total Dollars
2101	Instrumentation	150,000	0	150,000	4.3%	6,450	13.00%	20,339	176,789
Subtotal 21	Procurement Onsite E/C	150,000	0	150,000	4.3%	6,450	13.00%	20,339	176,789
Subtotal 2	Procurement	150,000	0	150,000	4.3%	6,450	13.00%	20,339	176,789
3101	242-A Evaporator	90,750	0	90,750	5.0%	4,538	35.00%	33,351	128,639
3102	244-AR Vault	206,720	0	206,720	5.0%	10,336	31.00%	67,287	284,343
3103	241-A Tank Farm Cooling Tower	0	0	0	5.0%	0	30.00%	0	0
3104	B-Plant & WESF	15,560	0	15,560	5.0%	778	33.00%	5,392	21,730
3105	284-E Powerplant	0	0	0	5.0%	0	35.00%	0	0
Subtotal 31	Construction - Onsite E/C	313,030	0	313,030	5.0%	15,652	32.26%	106,030	434,712
3201	242-A Evaporator	2,475,226	0	2,475,226	5.0%	123,761	26.00%	675,737	3,274,724
3202	244-AR Vault	443,355	0	443,355	5.0%	22,168	26.00%	121,036	586,559
3203	241-A Tank Farm Cooling Tower	379,404	0	379,404	5.0%	18,970	26.00%	103,577	501,951
3204	B-Plant & WESF	1,094,767	0	1,094,767	5.0%	54,738	31.00%	356,346	1,505,851
3205	284-E Powerplant	1,011,227	0	1,011,227	5.0%	50,561	35.00%	371,626	1,433,414
3206	283-E Water Treatment Facility	2,491,153	0	2,491,153	5.0%	124,558	30.00%	784,713	3,400,424
3207	Construction Management	2,027,340		2,027,340	5.0%	101,367	30.00%	638,612	2,767,319
Subtotal 32	Construction - Fixed Price	9,922,471	0	9,922,471	5.0%	496,123	29.29%	3,051,647	13,470,241
Subtotal 3	Construction	10,235,501	0	10,235,501	5.0%	511,775	29.38%	3,157,677	13,804,953

M-5

Project Time & Cost

Phase II Liquid Effluent Treatment & Disposal, W-252

90% Advanced Conceptual Design

January 1995, PT&C #2195.001

Summary Sheets (DOE_R02)

WBS	Description	Estimate Subtotal	Onsite Indirects	Subtotal	Escalation %	Total	Contingency %	Total	Total Dollars
=====	=====	=====	=====	=====	=====	=====	=====	=====	=====
4110	Project Intergration - Def Design	227,338	0	227,338	0.0%	0	15.00%	34,100	261,438
	Project Intergration - Procurement	84,457	0	84,457	4.3%	3,832	15.00%	13,213	101,302
	Project Intergration - Construction	532,142	0	532,142	5.0%	26,807	15.00%	83,812	642,561
Subtotal 41	Project Intergration (Mgmt)	843,935	0	843,935	3.6%	30,239	15.00%	131,125	1,005,299
Subtotal 4	Project Intergration (Mgmt)	843,935	0	843,935	3.6%	30,239	15.00%	131,125	1,005,299
5110	Other Project Costs - Prior Years	2,764,945	0	2,764,945	0.0%	0	0.00%	0	2,764,945
5140	Other Project Costs - FY 1995	750,300	0	750,300	2.1%	15,756	15.00%	114,908	880,964
5150	Other Project Costs - FY 1996	772,800	0	772,800	5.6%	43,277	15.00%	122,412	938,489
5160	Other Project Costs - FY 1997	1,281,600	0	1,281,600	9.4%	120,470	15.00%	210,311	1,612,381
Subtotal 51	Other Project Costs	5,569,645	0	5,569,645	3.2%	179,503	7.79%	447,631	6,196,779
Subtotal 5	Other Project Costs	5,569,645	0	5,569,645	3.2%	179,503	7.79%	447,631	6,196,779
Project Total		20,278,263	0	20,278,263	3.9%	790,764	20.89%	4,401,008	25,470,036

DOE_R03

PROJECT

Hanford Site liquid wastes from the 100 and 200 Areas, including cooling water, steam condensate, raw water, and water treatment facility waste water, have historically been discharged directly to the soil column as a method of treatment or retention. This project seeks to modify existing facilities to discontinue the disposal of contaminated effluent into the soil column at Hanford.

This project is also referred to as Project W-252 and will involve work in the following areas:

200-Area

242-A Evaporator

241-A Tank Farm

244-AR Vault (may be deleted)

B-Plant including The Waste Encapsulation & Storage Facility (WESF)

284-E Powerhouse

283-E Water Treatment Facility (WTF)

The project includes the following types of modifications:

Installation of closed-loop cooling systems

Installation of level instrumentation and controls

Installation of new treatment process to clean water for the filter backwash system

The construction project will be competitively bid to major contractors.

OWNER

United States, Department of Energy
Richland Field Office

DESIGNERS

Montgomery Watson
Richland, Washington

DOE_R03

DOCUMENTS AND DRAWINGS

DOCUMENTS: WHC-SD-W252-ACD-001,REV.0, "Advanced Conceptual Design Report Phase II Liquid Effluent Treatment and Disposal, December 1994, Montgomery Watson.

WHC-SD-W252-CDR-01, REV.0, "Conceptual Design Report, Phase II Liquid Effluent Treatment and Disposal, June 1993
Kaiser Engineers.

DRAWINGS: Per drawing list ES-252-ACD-01 contained in the Advanced Conceptual Design Report.

OTHER: Hanford site visit on November 30, 1994.

Kick-off meeting at Stone & Webster's Richland office on December 1, 1994

Conversations with designers

Estimator judgement and assumptions

Previous cost estimate for "W-291 200 Area Effluent BAT/AKART Implementation" prepared by PT&C in March of 1994

MATERIAL PRICES

Unit costs represent current day pricing for the Hanford area. Vendor information supplied by the designers was used for the wet surface fluid coolers. We were unable to obtain additional vendor quotes without equipment sizes, specifications, etc. Additional quotes will be solicited for equipment items as the project progresses and more specific information is available.

LABOR RATES

Kaiser Engineers Hanford FY 1994 Craft Labor rates, effective 10/01/93, were used in the cost estimate. The rates were adjusted using Kaiser information dated 10/24/94.

GENERAL REQUIREMENTS/OVERHEAD

The contractor field overhead costs are detailed in the cost estimate.

DOE_R03**ESCALATION**

Escalation is based on updated August 1994 escalation indices (FY1997 Guidance) provided by the DOE-HQ Office of Field Management for use on all RL managed projects (received via Montgomery Watson). Escalation is included through the mid-point of each activity. These midpoints are based on a preliminary schedule provided by Montgomery Watson. See the estimate support for detailed escalation calculations.

ROUNDING

Rounding is performed by the MCACES Gold software. The user has no control over the rounding techniques.

PROJECT TIME & COST ESTIMATING TEAM

Project Leader	James Tyre
Architectural	Craig Hudson
Structural	Craig Hudson
Mechanical	Kevin Faller
Electrical	Darryl Wood
Civil	Randy Reiner, Patricia Cuartas

REMARKS / PROJECT NOTES

The costs for Acceptance Inspection, Project Integration and Other Project Costs, included in DOE_R01 and DOE_R02 (DOE Reports), were obtained from the CDR estimate (dated 3/17/94) prepared by Kaiser.

The cost for Procurement (WBS 2101) was provided by Montgomery Watson.

The costs for WBS 11 were provided by Montgomery Watson. The subtotal costs for WBS 11 are based on Montgomery Watson's "Revised Cost Proposal for Project W252 Definitive Design" to the U.S. Army Corps of Engineers, dated December 14, 1994. This proposal is for \$2,275,188. The U.S. Army Corps of Engineers added \$106,640 for their management and review and they selected the 10% contingency rate. The costs for WBS 1111, 1112, 1113, 1114, 1115 and 1116 were provided by Montgomery Watson. The costs for WBS 1120 is the difference between the subtotal for WBS 111 and the total from the "Revised Cost Proposal" and includes the U.S. Army Corps of Engineers costs.

Costs for WBS 121 were provided by Montgomery Watson. These costs are based on 10% of the estimated construction costs (WBS 310X plus 320X).

DOE_R03

PROJECT NOTES - CONTINUED

Costs for WBS 3207 were copied from the CDR estimate prepared by Kaiser. However, these costs were combined into one line instead of being distributed between the various facilities. These costs only appear in the DOE Reports (excluded from the MCACES estimate) since this is not part of the construction contractor's fixed price contract.

The contingency rates from the CDR estimate prepared by Kaiser were retained for this submittal except for the changes noted by hand (see copy of Kaiser information following these notes).

Costs detailed in the MCACES estimate includes only work required by the construction contractor. Work in radiation contaminated areas is not included in the detailed MCACES cost estimate since it is not part of the construction contractor's fixed price contract. It is our understanding that the work in "rad zones" will be completed by the on-site contractor. These costs only appear in the DOE Reports. The next three paragraphs include a general description of the work that is included in our allowances (also see support for "rad work").

Costs for WBS 3101 (242-A Evaporator) includes two piping connections to existing pipes (one in the new valve box and one at the existing strainer being removed). Work also includes installation of an expansion tank, glycol circulation pumps, sump pumps, floor drain and associated piping. This task is to be accomplished over a seven week period.

The cost for WBS 3102 (244-AR Vault area) was obtained from the CDR estimate prepared by Kaiser.

Costs for WBS 3104 (B-Plant & WESF) includes eight connections to existing pipe and installation of new piping within the "rad zone" (inside building). This task is to be accomplished over a two week period.

A productivity factor of 80% was applied to all labor costs to allow for the difficulty of the project and the remoteness of the site. This factor is "rolled into" the unit costs of each detail line item.

A contingency on construction items (WBS 3XXX) is included as a "design contingency". Construction contingency to cover the costs of change orders during construction is not included.

Costs for supervision of construction activities (SIOH) by COE personnel is not included. Costs for construction management by the on-site contractor is included (WBS 3207).

A 2.5% Business & Occupation tax is included in the estimate. This percentage may need revising once PT&C receives further guidance from the state of Washington. State and local sales taxes are not included since construction at Hanford is exempt.

It is our understanding that site access is unrestricted and an escort is not required since there is no classified or sensitive information stored in the proximity of the construction limits.

DOE_R03

The costs shown in the 242A Area for the fluid coolers is based on 30 MBTU/HR Capacity. If 33.6 MBTU/HR capacity is required instead, we would expect a cost increase of approximately \$305,000 (including, overheads, profit, B & O tax, contingency and escalation).

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-252 / ER4559
FILE NO. W252BAC1

** TEST - INTERACTIVE ESTIMATING **
PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL
CONCEPTUAL ESTIMATE, REVISION 1
DOE_R06 - CONTINGENCY ANALYSIS BASIS SHEET

PAGE 15 OF 31
DATE 03/17/94
BY DHS/FCD/DKH/JPM

REFERENCE: ESTIMATE BASIS SHEET PAGE 5 OF 31
COST CODE ACCOUNT SUMMARY PAGE 9 OF 31

THE U.S. DEPARTMENT OF ENERGY - RICHLAND ORDER 5700.3 "COST ESTIMATING, ANALYSIS AND STANDARDIZATION" DATED 3-27-85, PROVIDES GUIDELINES FOR ESTIMATE CONTINGENCIES. THE GUIDELINE FOR A CONCEPTUAL ESTIMATE SHOULD HAVE AN OVERALL RANGE OF 15 TO 40% .

CONTINGENCY IS EVALUATED AT THE THIRD COST CODE LEVEL AND SUMMARIZED AT THE PRIMARY AND SECONDARY COST CODE LEVEL OF THE DETAILED COST ESTIMATE.

DESIGN AND MANAGEMENT

020 TITLE II

WBS 1111 CONTINGENCY OF ^{10%}~~20%~~ HAS BEEN APPLIED TO DEFINITIVE DESIGN DUE TO THE UNCERTAINTIES OF POSSIBLE
THRU TECHNICAL ADVANCES WHICH MAY NECESSITATE MODIFICATIONS TO BAT/AKART, AND FOR POSSIBLE CHANGES
WBS 1120 TO CURRENT CONTRACTING STRATEGIES (PROCUREMENT AND CONSTRUCTION).

030 TITLE III

WBS 1211 THE ENGINEERING DURING CONSTRUCTION COSTS ARE MAINLY SCHEDULE DRIVEN, BUT A 35% CONTINGENCY HAS
THRU BEEN APPLIED TO COVER ITEMS WHICH COULD IMPACT THE SCHEDULE (EXTENDED PERIODS OF INCLEMENT
WBS 1218 WEATHER, TECHNOLOGY ADVANCES THAT MAY IMPACT BAT/AKART, COORDINATION WITH FACILITY OPERATIONS,
CHANGES TO EXISTING SECURITY PRACTICES, ETC.).

WBS 1221 THE ACCEPTANCE INSPECTION COSTS ARE MAINLY SCHEDULE DRIVEN, BUT A 35% CONTINGENCY HAS BEEN
THRU APPLIED TO COVER ITEMS WHICH COULD IMPACT THE SCHEDULE (EXTENDED PERIODS OF INCLEMENT WEATHER,
WBS 1227 TECHNOLOGY ADVANCES THAT MAY IMPACT BAT/AKART, COORDINATION WITH FACILITY OPERATIONS, CHANGES
TO EXISTING SECURITY PRACTICES, ETC.).

040 DESIGN MANAGEMENT

WBS 1120 CONTINGENCY OF ^{10%}~~20%~~ HAS BEEN APPLIED TO TITLE II DESIGN MANAGEMENT TO COINCIDE WITH CONTINGENCY
APPLIED TO DEFINITIVE DESIGN.

WBS 1211 CONTINGENCY OF 35% HAS BEEN APPLIED TO TITLE III DESIGN MANAGEMENT TO COINCIDE WITH CONTINGENCY
THRU APPLIED TO ENGINEERING DURING CONSTRUCTION.
WBS 1218

M-12

WHL-SD-W-252-AUDK-UU1, REV. U

050 CONSTRUCTION MANAGEMENT

WBS 3101 CONTINGENCIES RANGING FROM ~~30~~ ^{26%} TO 35% HAVE BEEN APPLIED TO CONSTRUCTION MANAGEMENT OF BOTH THE
THRU ONSITE CONSTRUCTION CONTRACTOR AND THE FIXED PRICE CONTRACTS TO COINCIDE WITH THEIR RESPECTIVE
WBS 3206 CONSTRUCTION CONTINGENCIES.

060 PROJECT MANAGEMENT

WBS 4110 CONTINGENCY OF 15% HAS BEEN APPLIED TO PROJECT INTEGRATION TO COVER ANY SCHEDULE DELAYS THAT MAY
THRU OCCUR DUE TO UNCERTAINTIES ASSOCIATED WITH DESIGN, PROCUREMENT AND/OR CONSTRUCTION.
WBS 4130

AVERAGE DESIGN AND MANAGEMENT CONTINGENCY - ~~25%~~ ^{21.4%}

PROCUREMENT

700 SPECIAL EQUIP/PROCESS SYSTEMS ^{13%}

WBS 2101 CONTINGENCY OF ~~20%~~ HAS BEEN APPLIED TO ALL PROCUREMENT DUE TO EQUIPMENT SELECTION FOR CONCEPTUAL
~~THRU~~ DESIGN IS PRELIMINARY AND COULD CHANGE DURING DEFINITIVE DESIGN.
~~WBS 2207~~

AVERAGE PROCUREMENT CONTINGENCY - ~~20%~~ ^{13%}

CONSTRUCTION

460 IMPROVEMENTS TO LAND

WBS 3101 CONTINGENCY OF 35% HAS BEEN APPLIED TO EXCAVATION DUE TO NO PROFILES AVAILABLE TO DETERMINE
WBS 3105 EXACT DEPTH REQUIRED FOR PROPER SLOPE FOR DRAIN PIPE, UNKNOWN SOIL CONDITIONS, AND TO ALLOW
FOR CHANGES TO PIPE ROUTING DUE TO UNDERGROUND INTERFERENCES.

WBS 3103 CONTINGENCY OF ~~30%~~ ^{30-33%} HAS BEEN APPLIED TO EXCAVATION DUE TO UNKNOWN SOIL CONDITIONS, AND TO ALLOW
WBS 3104 FOR CHANGES IN PIPE ROUTING DUE TO UNDERGROUND INTERFERENCES.

WBS 3201 CONTINGENCY OF ~~25%~~ ^{26%} HAS BEEN APPLIED TO EXCAVATION DUE TO UNKNOWN SOIL CONDITIONS, AND TO ALLOW
FOR CHANGES IN PIPE ROUTING DUE TO UNDERGROUND INTERFERENCES.

WBS 3202 CONTINGENCY OF ~~30%~~ ^{26%} HAS BEEN APPLIED TO CONCRETE PAD CONSTRUCTION DUE TO ACTUAL SIZE REQUIRED
THRU FOR EQUIPMENT INSTALLATION IS STILL TO BE DETERMINED.
WBS 3204

M-13

WHC-SD-W252-ACDR-001, Rev. 0

460 IMPROVEMENTS TO LAND (CONT)

- WBS 3205 CONTINGENCY OF 35% HAS BEEN APPLIED TO EXCAVATION DUE TO NO PROFILES AVAILABLE TO DETERMINE EXACT DEPTH REQUIRED FOR PROPER SLOPE FOR DRAIN PIPE, UNKNOWN SOIL CONDITIONS, AND TO ALLOW FOR CHANGES TO PIPE ROUTING DUE TO UNDERGROUND INTERFERENCES.
- WBS 3206 CONTINGENCY OF 30% HAS BEEN APPLIED TO EXCAVATION DUE TO UNKNOWN SOIL CONDITIONS, AND TO ALLOW FOR CHANGES IN PIPE ROUTING DUE TO UNDERGROUND INTERFERENCES.

501 BUILDINGS

- WBS 3101 CONTINGENCY OF 35% HAS BEEN APPLIED TO THE CONSTRUCTION OF A REPLACEMENT E/C FABRICATION SHOP DUE EXACT REQUIREMENT NOT AVAILABLE.
- WBS 3102 CONTINGENCY OF ^{31%}~~35%~~ HAS BEEN ALLIED TO TRANSITE REMOVAL AND REPLACEMENT DUE EXACT QUANTITY NOT YET DETERMINED.
- WBS 3201 CONTINGENCY OF ^{29%}~~35%~~ HAS BEEN APPLIED TO CONSTRUCTION OF PRE-ENGINEERED STEEL BUILDINGS DUE TO FINAL THRU REQUIREMENTS FOR SIZE AND FINISHED YET TO BE DETERMINED.
- WBS 3206
- WBS 3202 CONTINGENCIES RANGING FROM ^{29%}~~25%~~ TO ~~35%~~ HAVE BEEN APPLIED TO VARIOUS PORTIONS OF BUILDING CONSTRUCTION THRU DUE TO NO DETAILS AVAILABLE FOR FINAL PIPE AND/OR CONDUIT ROUTINGS.
- WBS 3204

550 OTHER STRUCTURES

- WBS 3201 CONTINGENCY OF ^{29%}~~35%~~ HAS BEEN APPLIED TO PROCUREMENT AND INSTALLATION OF DIESEL UNDERGROUND STORAGE & TANK DUE TO EXACT LOCATION NOT DETERMINED, AND UNKNOWN SOIL CONDITIONS FOR EXCAVATION.
- WBS 3204
- WBS 3206 CONTINGENCY OF 30% HAS BEEN APPLIED DUE TO RETROFIT WORK IN EXISTING 283-E WATER TREATMENT FACILITY.

600 UTILITIES

- WBS 3206 CONTINGENCY OF 30% HAS BEEN APPLIED TO CONNECTIONS TO EXISTING SANITARY WATER AND SEWER LINES BELOW GRADE DUE TO UNCERTAINTIES OF THE CONDITION OF THE EXISTING PIPES.

M-14

WHS-SD-W-252-A-UDN-001, REV. 1

700 SPECIAL EQUIPMENT/PROCESS SYSTEM

- WBS 3101 CONTINGENCY OF 35% HAS BEEN APPLIED TO THE UNDERGROUND PIPE INSTALLATION ALLOW FOR CHANGES IN PIPE ROUTING DUE TO UNDERGROUND INTERFERENCES, AND TO THE ABOVE GROUND PIPE INSTALLATION DUE TO UNCERTAINTIES OF WORKING AT HIGH ELEVATIONS AND WORKING IN AN EXISTING FACILITY.
- CONTINGENCY OF 35% HAS BEEN APPLIED TO THE FOLLOWING WORK ACTIVITIES DUE TO THE LACK OF DESIGN AVAILABLE FOR ESTIMATE PREPARATION: 1) SYSTEM TO PUMP TURBINE AND HVAC ROOMS CONDENSATE TO COOLING TOWERS MAKE-UP WATER, AND RADIATION MONITORING FOR CLOSED LOOP COOLING SYSTEM.
- WBS 3102 CONTINGENCY OF ³¹~~30~~% HAS BEEN APPLIED TO THE MODIFICATION AND INSTALLATION OF THE HEATER IN IN THE CONTAINMENT VAULT DUE TO THE UNCERTAINTIES OF WORKING IN A CONTAMINATED VAULT.
- WBS 3103 CONTINGENCY OF 30% HAS BEEN APPLIED TO THE TIE-IN AT THE TEDF LINE AND THE REWORK OF THE 30" CMP LINE DUE TO UNKNOWN RADIOLOGICAL CONDITIONS.
- WBS 3104 CONTINGENCY OF ³³~~30~~% HAS BEEN APPLIED TO WORK IN B-PLANT TO ALLOW FOR INTERFERENCES WITHIN THE BUILDING
- WBS 3105 CONTINGENCY OF 35% HAS BEEN APPLIED TO THE UNDERGROUND PIPE INSTALLATION TO ALLOW FOR CHANGES IN PIPE ROUTING DUE TO UNDERGROUND INTERFERENCES.
- CONTINGENCY OF 35% HAS BEEN APPLIED TO THE FOLLOWING WORK ACTIVITIES DUE TO THE LACK OF DESIGN AVAILABLE FOR ESTIMATE PREPARATION: 1) SYSTEM TO PUMP HVAC CONDENSATE FROM STAIRWELL NO. 1 TO COOLING TOWER MAKE-UP WATER, AND RADIATION MONITORING FOR CLOSED LOOP COOLING SYSTEM.
- WBS 3201 CONTINGENCY OF ²⁹~~25~~% HAS BEEN APPLIED TO INSTALLATION OF PIPE SYSTEMS TO ALLOW FOR CHANGES IN PIPE SIZING AND ROUTING DUE TO DESIGN EVOLUTION, AND DUE TO UNCERTAINTIES ASSOCIATE WITH EQUIPMENT THRU SIZES, SOIL CONDITIONS, ETC.
- WBS 3204 CONTINGENCY OF ²⁹~~35~~% HAS BEEN APPLIED TO INSTRUMENTATION CONNECTIONS FROM NEW SYSTEMS TO EXISTING CONTROL ROOM DUE TO NO DETAILS AVAILABLE FOR ESTIMATE PREPARATION.
- WBS 3205 CONTINGENCY OF 35% HAS BEEN APPLIED TO INSTALLATION OF PIPING SYSTEMS INSIDE THE 284-E POWERPLANT DUE TO INTERFERENCES THAT CAN BE EXPECTED IN WORKING INSIDE AN EXISTING BUILDING, AND DUE SCHEDULE DELAYS THAT MAY OCCUR IN COORDINATING WORK IN AN OPERATING FACILITY.
- CONTINGENCY OF 35% HAS BEEN APPLIED TO INSTRUMENTATION CONNECTIONS FROM NEW SYSTEMS TO EXISTING CONTROL ROOM DUE TO NO DETAILS AVAILABLE FOR ESTIMATE PREPARATION.
- WBS 3206 CONTINGENCY OF 30% HAS BEEN APPLIED TO CONSTRUCTION WORK ASSOCIATED WITH THE WATER TREATMENT FACILITIES DUE TO THE UNCERTAINTIES ASSOCIATED WITH SOIL CONDITIONS, COORDINATION OF WORK IN OPERATING FACILITIES, AND ALLOW FOR CHANGES IN PIPE ROUTING DUE TO INTERFERENCES.

M-15

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-252 / ER4559
FILE NO. W252BAC1

** TEST - INTERACTIVE ESTIMATING **
PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL
CONCEPTUAL ESTIMATE, REVISION 1
DOE_R06 - CONTINGENCY ANALYSIS BASIS SHEET

PAGE 19 OF 31
DATE 03/17/94
BY DHS/FCD/DKH/JPM

810 DEMOLITION

WBS 3101 CONTINGENCY OF 35% HAS BEEN APPLIED DUE THE UNCERTAINTIES ASSOCIATED WITH DEMOLITION OF PIPE AND ASBESTOS REMOVAL IN EXISTING FACILITIES.

AVERAGE CONSTRUCTION CONTINGENCY - ~~31%~~ 29.4%

900 OTHER PROJECT COSTS

WBS 5110 NO CONTINGENCY APPLIED TO PRIOR YEARS COSTS.

WBS 5130 CONTINGENCY OF 15% HAS BEEN APPLIED TO OTHER PROJECT COSTS FOR FUTURE YEARS TO
THRU ALLOW FOR TECHNOLOGY ADVANCES THAT MAY IMPACT DESIGN AND CONSTRUCTION SCHEDULES.
WBS 5160

AVERAGE OTHER PROJECT COSTS CONTINGENCY - ~~18%~~ 7.8%

AVERAGE PROJECT CONTINGENCY - ~~24%~~ 20.5%

M-16

WHC-SD-W252-ACDR-001, Rev. 0

Appendix N

MONTGOMERY WATSON

APPENDIX N

ADVANCED CONCEPTUAL DESIGN REPORT
CONSTRUCTION SCHEDULE

ACT. ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH	TOTL FLT	1996												1997	
					FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN		
6-100	Division 1 - General Requirements	1FEB96	28JUN96	144														
6-110	Division 2 - Site Work	1MAR96	30APR96	186														
6-120	Division 3 - Concrete	1APR96	28JUN96	144														
6-125	Division 4 - Masonry	3JUN96	28JUN96	144														
6-130	Division 5 - Metals	1JUL96	12JUL96	135														
6-135	Division 6 - Wood and Plastics	15JUL96	31JUL96	122														
6-140	Division 7 - Thermal and Moisture Protection	1AUG96	13AUG96	113														
6-150	Division 8 - Door and Windows	12AUG96	30AUG96	100														
6-160	Division 9 - Finishes	27DEC96	27JAN97	0														
6-180	Division 11 - Solids Contact Clarifier	1JUL96	30AUG96	100														
6-190	Division 11 - Pumps	1AUG96	30AUG96	100														
6-200	Division 11 - Samplers	2SEP96	11SEP96	93														
6-210	Division 11 - Flocculators 1 & 2	2SEP96	31OCT96	57														
6-215	Division 11 - Flocculators 3 & 4	1NOV96	31DEC96	17														
6-218	Division 13 - Filters 1 & 2	1JUL96	30SEP96	80														
6-219	Division 13 - Filters 3 & 4	1OCT96	31DEC96	17														
6-220	Division 15 - Mechanical	14AUG96	27DEC96	19														
6-230	Division 16 - Electrical	27SEP96	27DEC96	19														
6-240	Division 17 - Instrumentation	13SEP96	27DEC96	19														

Plot Date 12JAN95		203C	283-E WATER TREATMENT FACILITY AND 282-E RESERVOIR PROJECT 252 - CONSTRUCTION SCHEDULE	Sheet 1 of 1	MONTGOMERY WATSON			
Data Date 1FEB96					Date	Revision	Checked	Approved
Project Start 1FEB96								
Project Finish 27JAN97								
(c) Primavera Systems, Inc.								

Appendix O

MONTGOMERY WATSON

PROJECT TITLE:

W-252 PHASE II LIQUID TREATMENT AND DISP

FOR:

WESTINGHOUSE HAI

BY:

MONTGOMERY WATS

DRAWING LIST

GENERAL

DRAWING NO.

TITLE

ES-252-ACD-01	TITLE SHEET/LIST OF DRAWINGS/ABBREVIATIONS
ES-252-ACD-02	LEGEND PIPING AND INSTRUMENTATION
ES-252-ACD-03	OVERALL SITE PLAN
ES-252-ACD-04	CIVIL SITE PLAN - 242A EVAPORATOR
ES-252-ACD-05	242A PIPING -1
ES-252-ACD-06	242A PIPING -2
ES-252-ACD-07	242A PIPING -3
ES-252-ACD-08	242A CIVIL YARD PIPING -1
ES-252-ACD-09	242A CIVIL YARD PIPING -2
ES-252-ACD-10	242A P&ID CLOSED LOOP COOLING-1
ES-252-ACD-11	242A P&ID CLOSED LOOP COOLING-2
ES-252-ACD-12	242A P&ID CLOSED LOOP COOLING-3
ES-252-ACD-13	242A P&ID CLOSED LOOP COOLING-4
ES-252-ACD-14	242A P&ID CLOSED LOOP COOLING-5
ES-252-ACD-15	242A P&ID CLOSED LOOP COOLING-6
ES-252-ACD-16	B PLANT CIVIL SITE PLAN
ES-252-ACD-17	B PLANT YARD PIPING PLAN
ES-252-ACD-18	B PLANT YARD PIPING DETAILS
ES-252-ACD-19	B PLANT P&ID CLOSED LOOP COOLING SYSTEM-1
ES-252-ACD-20	B PLANT P&ID CLOSED LOOP COOLING SYSTEM-2
ES-252-ACD-21	B PLANT P&ID CLOSED LOOP COOLING SYSTEM-3
ES-252-ACD-22	B PLANT P&ID CLOSED LOOP COOLING SYSTEM-4
ES-252-ACD-23	B PLANT P&ID CLOSED LOOP COOLING SYSTEM-5
ES-252-ACD-24	241A AND 244-AR CIVIL SITE PLAN
ES-252-ACD-25	241A SITE PLAN AND DETAILS
ES-252-ACD-26	241A AND 244AR EFFLUENT P&ID
ES-252-ACD-27	244AR P&ID-1
ES-252-ACD-28	244AR P&ID-2
ES-252-ACD-29	283E AND 284E SITE PLAN
ES-252-ACD-30	284E PIPING-FIRST FLOOR
ES-252-ACD-31	284E P&ID CLOSED LOOP COOLING-1
ES-252-ACD-32	284E P&ID CLOSED LOOP COOLING-2
ES-252-ACD-33	284E P&ID CLOSED LOOP COOLING-3
ES-252-ACD-34	284E P&ID CLOSED LOOP COOLING-4
ES-252-ACD-35	284E P&ID CLOSED LOOP COOLING-5
ES-252-ACD-36	284E P&ID CLOSED LOOP COOLING-6
ES-252-ACD-37	282E P&ID RESERVOIR LEVEL CONTROL
ES-252-ACD-38	283E P&ID FLOCCULATION AND FILTERS
ES-252-ACD-39	283E P&ID SOLIDS WASTE HANDLING
ES-252-ACD-40	284E P&ID EFFLUENT FLOW METERING AND SAMPLING
ES-252-ACD-41	LCU BUILDING ARCHITECTURAL PLANS AND ELEVATIONS - 1
ES-252-ACD-42	LCU BUILDING ARCHITECTURAL PLANS AND ELEVATIONS - 2
ES-252-ACD-43	INSTRUMENTATION INTERFACE TELECOM BLOCK DIAGRAM

ABBREVIATION	DESCRIPTION
ACD	ADVANCED CONCEPTUAL DESIGN
DIA	DIAMETER
LCU	LOCAL CONTROL UNIT
MCC	MOTOR CONTROL CENTER
P & ID	PROCESS AND INSTRUMENTATION DIAGRAM
PS	PROCESS SEWER
P/S	PUMP STATION
PTESCS	PHASE TWO EFFLUENT COLLECTION SYSTEM
PVC	POLYVINYL CHLORIDE
RCP	REINFORCED CONCRETE PIPE
RW	RAW WATER
STL	STEEL
SW	SANITARY WATER
TEOF	TREATED EFFLUENT DISPOSAL FACILITY
UGND	UNDERGROUND

0-1

[illegible]

F

E

D

C

B

A

SYMBOLS

---	ELECTRICAL BINARY SIGNAL
---	ELECTRICAL
---	PIPING
---	EXISTING
---	ELECTRICAL
---	SOFTWARE
---	NEW EQUIPMENT

GLOBE VALVE

VALVE, NORMALLY CLOSED

GATE VALVE

BALL VALVE

CHECK VALVE

BUTTERFLY VALVE

3-WAY PNEUMATIC VALVE

TEMPERATURE CONTROL VALVE

FLOAT OPERATED VALVE

HAND ACTUATOR

DIAPHRAM ACTUATOR

SOLENOID ACTUATOR

MANUAL OVERRIDE HANDWHEEL
ON MOTOR OPERATED VALVE

FAIL AS IS

ORIFICE PLATE

PLUG

MOTOR

PUMP

HEAT EXCHANGER

PRESSURE CONTROL
VF

AAL	ANALYZER ALARM LOW	LAH	LEVEL ALARM HIGH HIGH
ASL	ANALYZER SWITCH LOW	LCV	LEVEL CONTROL VALVE
AAH	ANALYZER ALARM HIGH	LE	LEVEL ELEMENT
AE	ANALYZER ELEMENT (TYPE AS NOTED)	LIC	LEVEL INDICATION CONTROLLER
AI	ANALYZER INDICATOR (TYPE AS NOTED)	LIT	LEVEL INDICATION TRANSMITTER
AIT	ANALYZER INDICATING TRANSMITTER (TYPE AS NOTED)	LSL	LEVEL SWITCH LOW
AR	ANALYZER RECORDER (FOR TYPE NOTED)	LSLL	LEVEL SWITCH LOW LOW
ASH	ANALYZER SWITCH HIGH	LSH	LEVEL SWITCH HIGH
AT	ANALYZER TRANSMITTER (TYPE AS NOTED)	LSHH	LEVEL SWITCH HIGH HIGH
		LT	LEVEL TRANSMITTER
		O/C/R	OPEN/CLOSED/REMOTE
DPT	DIFFERENTIAL PRESSURE TRANSMITTER	PAL	PRESSURE ALARM LOW
DPI	DIFFERENTIAL PRESSURE INDICATOR	PAHL	PRESSURE ALARM HIGH LOW
DPSH	DIFFERENTIAL PRESSURE SWITCH HIGH	PCV	PRESSURE CONTROL VALVE
OPAH	DIFFERENTIAL PRESSURE ALARM HIGH	PIT	PRESSURE INDICATING TRANSMITTER
		PS	PRESSURE SWITCH
		PSH	PRESSURE SWITCH HIGH
FE	FLOW ELEMENT	PT	PRESSURE TRANSMITTER
FI	FLOW INDICATOR	RAH	RADIATION ALARM HIGH
FIG	FLOW INDICATION CONTROLLER	RAX	RADIATION MONITOR FAILURE
FR	MASTER RATE CONTROLLER	RE	RADIATION ELEMENT
FIT	FLOW INDICATING TRANSMITTER	RI	RADIATION INDICATOR
FOI	FLOW QUANTITY INDICATOR	RIT	RADIATION INDICATOR TRANSMITTER
FOS	FLOW QUANTITY SWITCH	TAH	TEMPERATURE ALARM HIGH
FR	FLOW RECORDER	TC	TEMPERATURE CONTROLLER
FT	FLOW TRANSMITTER	TCV	TEMPERATURE CONTROL VALVE
		TE	TEMPERATURE ELEMENT
HOR	HAND/OFF/REMOTE	TI	TEMPERATURE INDICATOR
HOAR	HAND/OFF/AUTO/REMOTE	TIT	TEMPERATURE INDICATION TRANSMITTER
HS	HAND SWITCH (TYPE AS NOTED)	TSH	TEMPERATURE SWITCH HIGH
KRI	RUN THE INDICATOR	UY	AUTOMATIC SIGNAL SELECTOR
KS	TRIP SWITCH	VE	VIBRATION ELEMENT
		VT	VIBRATION TRANSMITTER
LAL	LEVEL ALARM LOW	YA	DEVICE FAIL ALARM
LALL	LEVEL ALARM LOW LOW	YI	STATUS INDICATOR
LAH	LEVEL ALARM HIGH	YL	STATUS LIGHT
LAHL	LEVEL ALARM HIGH LOW		
		ZIT	POSITION INDICATION TRANSMITTER
		ZLC	POSITION LIGHT CLOSED
		ZLO	POSITION LIGHT OPEN
		ZSL	POSITION SWITCH CLOSED
		ZSH	POSITION SWITCH OPEN
		ZSOC	POSITION SWITCH OPEN AND CLOSED

SITE PLAN
200E AREA

PROJECT: W-252-ACD-03 DATE: 12/02/94 SHEET: 0		PROJECT: W-252-ACD-03 DATE: 12/02/94 SHEET: 0		PROJECT: W-252-ACD-03 DATE: 12/02/94 SHEET: 0	
PROJECT: W-252-ACD-03 DATE: 12/02/94 SHEET: 0		PROJECT: W-252-ACD-03 DATE: 12/02/94 SHEET: 0		PROJECT: W-252-ACD-03 DATE: 12/02/94 SHEET: 0	
PROJECT: W-252-ACD-03 DATE: 12/02/94 SHEET: 0		PROJECT: W-252-ACD-03 DATE: 12/02/94 SHEET: 0		PROJECT: W-252-ACD-03 DATE: 12/02/94 SHEET: 0	
PROJECT: W-252-ACD-03 DATE: 12/02/94 SHEET: 0		PROJECT: W-252-ACD-03 DATE: 12/02/94 SHEET: 0		PROJECT: W-252-ACD-03 DATE: 12/02/94 SHEET: 0	
PROJECT: W-252-ACD-03 DATE: 12/02/94 SHEET: 0		PROJECT: W-252-ACD-03 DATE: 12/02/94 SHEET: 0		PROJECT: W-252-ACD-03 DATE: 12/02/94 SHEET: 0	

0-3

SCALE IN FEET
0 500

SITE PLAN
242-A BUILDING

NUMBER	TITLE
DRAWING TRACKABILITY LIST

LEGEND:

- NEW CONSTRUCTION BELOW GROUND
- NEW CONSTRUCTION ABOVE GROUND
- EXISTING ROADS & FACILITIES
- EXISTING UGND LINES
- EXISTING FENCE LINES

40 0 40 80

SCALE IN FEET

O-4

DESIGNED T. PHILLIPS		DATE 06/07/94		SAFETY CLASS		CIVIL	
CHECKED WINGER		DATE 06/07/94		U.S. DEPARTMENT OF ENERGY			
CHECKED F. HINKER		DATE 06/14/94		Richland Operations Office			
SAFETY				Prepared for: U.S. ARMY CORPS OF ENGINEERS, Walla Walla District			
OWNER				By: MONTGOMERY WATSON			
DRAWN				CIVIL SITE PLAN			
EVALUATED				242-A EVAPORATOR			
LEAD ACDR, JENSEN				PROJECT W-252 PHASE II LIQUID TREATMENT & DISPOSAL			
BY		DATE		SCALE		JOB NO. 0484710.23	
FOR		DATE		SCALE		SHEET 1 OF 1	
APPROVED FOR IMPLEMENTATION		DATE		SCALE		SHEET 1 OF 1	
APPROVED FOR IMPLEMENTATION		DATE		SCALE		SHEET 1 OF 1	

CAD FILE ACD04.DWG

CAD CODE

2 PLOT SCALE: 1"=1'

1

REVISED 01/94

F

E

D

C

B

A

8

7

6

5

LCU/SUPPORT/SAMPLING BUILDING

NUMBER	TITLE
DRAWING INDEXABLE LIST

ENLARGED PLAN

O-5

DESIGNED T. PHILLIPS	DATE 08/07	SAFETY CLASS	CDT
CHECKED H. WINGER	DATE 08/07	U.S. DEPARTMENT OF ENERGY	
CHECKED F. HINKER	DATE 08/14	Richland Operations Office	
SAFETY		Prepared for U.S. ARMY CORPS OF ENGINEERS, White Waste District	
BY		By: MONTGOMERY WATSON	
DATE		242-A	
DATE		PIPING-1	
DATE		PROJECT W-252 PHASE II LIQUID TREATMENT & DISPOSAL	
DATE		TITLE: W-252	
DATE		F 242-A	
DATE		ES-252-ACD-05	
DATE		O	
DATE		SCALE 1/4" = 1'-0"	
DATE		JOB NO. 0484710.23	
DATE		SHEET 1 OF 1	
DATE		REVISED 01/93	

REV NO.	DESCRIPTION	REV IN DATE	REV APPROVALS	APPROVED FOR IMPLEMENTATION
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

CAD FILE ACD05.DWG

CAD CODE

2 PLOT SCALE: 1=1

1

REVISED 01/93

A SECTION
 ACO-05 1/4"=1'-0"

NAME	TITLE
DRAWING TRACKABILITY LIST

SECTION
ACD-05 1/4"=1'-0"

D SECTION
1/2" = 1'-0"

PLAN
(TOP REMOVED)

2 DETAIL
ACD-05 1/2" x 1'-0"

0-6

DESIGNED T. PHILLIPS	DATE	SAFETY CLASS	EXT
DRIVEN D.H. WINGER	06/07	U.S. DEPARTMENT OF ENERGY	
DESIGNED F. HINKER	06/07	Richardson Operations Office	
SAFETY		ARMY CORPS OF ENGINEERS, Walla Walla District	
CHIEF		By: MONTGOMERY WATSON	
DESIGN		242-A	
LEAD ENGINEER JENSEN	06/07	PIPING-2	
		PROJECT W-252 PHASE II LIQUID TREATMENT & DISPOSAL	
		SIZE	WALL THICKNESS
		1/4" - 1" - 0"	0.063" - 0.125"
APPROVED FOR IMPLEMENTATION		ES-252-ACD-0610	
BY	DATE	SCALE	JOB NO. SHEET
		1/4" = 1'-0"	0484710.23 1 OF 1

1 DETAIL
 ACD-08 SCALE: 1/4"=1'-0"
 FOR EXISTING PIPING SEE:
 H-2-69335
 H-2-69345
 H-2-99032

A SECTION
 SCALE: 1/4"=1'-0"

NAME	TITLE
	DRAWING TRACKABILITY LIST

2 DETAIL
ACD-08 SCALE: 1/4"=1'-0"
FOR EXISTING PIPING SEE:
H-2-69345
H-2-69346

SECTION
SCALE: 1/4"=1'-0"

4 DETAIL
ACD-08 SCALE: 3/8"=1'-0"
FOR EXISTING PIPING SEE:
H-2-99041

NORTH

3 DETAIL
ACD-08 SCALE: 3/8"=1'-0"

F SECTION
SCALE: 1/4"=1'-0"

B SECTION
SCALE: 3/8"=1'-0"

0-7

DESIGNED BY: T. PHILLIPS	DATE: 05/27/92	SAFETY CLASS: 1	EST: 1
DRAWN BY: D. WINGER	DATE: 05/27/92	U.S. DEPARTMENT OF ENERGY	
CHECKED BY: F. HINKER	DATE: 05/27/92	Richard Operations Office	
SAFETY: 1	DATE: 05/27/92	Prepared for: U.S. ARMY CORPS OF ENGINEERS, Walle Walle District	
BY: 1	DATE: 05/27/92	By: MONTGOMERY WATSON	
QUAL. CHIEF: 1	DATE: 05/27/92	242-A	
LEAD CHIEF: R. JENSEN	DATE: 05/27/92	PIPING-3	
APPROVED FOR CONSTRUCTION: 1	DATE: 05/27/92	PROJECT W-252 PHASE II LIQUID TREATMENT & DISPOSAL	
BY: 1	DATE: 05/27/92	SIZE: 242-A	
FOR: 1	DATE: 05/27/92	ES-252-ACD-07 0	
SCALE: 1/4"=1'-0"	DATE: 05/27/92	JOB NO. 0484710.23 SHEET 1 OF 1	
REVISED: 01/93	DATE: 05/27/92	REVISED: 01/93

O-8

DESIGNED T. PHILLIPS		DATE 06/20/92	SAFETY CLASS	DR
DRAWN D.H. WINGER		DATE 06/20/92	U.S. DEPARTMENT OF ENERGY	
CHECKED F. HINKER		DATE 06/24/92	Richland Operations Office	
SAFETY		Prepared for: U.S. ARMY CORPS OF ENGINEERS, Walla Walla District		
DWG NO.		By: MONTGOMERY WATSON		
QUAL. CHECK		242-A		
LEAD ENGINEER JENSEN		DATE 06/25/92	YARD PIPING-1	
PROJECT W-252 PHASE II LIQUID TREATMENT & DISPOSAL		F 242-A		
APPROVED FOR IMPLEMENTATION		ES-252-ACD-08 0		
BY		SCALE 1"=10'-0"		
FOR		JOB NO. 0484710.23		
REV. NO.		SHEET 1 OF 1		

REV. NO.	DESCRIPTION	REV. BY	DATE	APP. FOR
1	ACD08.DWG

MATCH LINE - FOR CONT SEE DWG ES-252-ACD-08

NUMBER	TITLE
	DRAWING TRACKABILITY LIST

O-9

DESIGNED T. PHILLIPS	DATE 05/89	SAFETY CLASS	001
DRAWN ECHM., WINGER	05/89	U.S. DEPARTMENT OF ENERGY	
CHECKED F. HINKER	05/89	Richland Operations Office	
SAFETY		Prepared for: U.S. ARMY CORPS OF ENGINEERS, Walle Walle District	
DATE		By: MONTGOMERY WATSON	
SCALE		242-A	
LEAD OPER. JENSEN	05/89	YARD PIPING-2	
PROJECT W-252 PHASE II LIQUID TREATMENT & DISPOSAL		REV NO	
SIZE 1"=10'-0"		JOB NO. 0484710.25	
F 242-A		ES-252-ACD-09 0	
SCALE 1"=10'-0"		SHEET 1 OF 1	
DATE		REVISED 01/90

- NOTES:**
1. FOR LEGEND & SYMBOLS SEE ES-252-ACD-2.
 2. * INDICATES VENDOR FURNISHED.
 3. FOR INTERLOCK LOGIC DESCRIPTION SEE ES-252-ACD-15.
 4. FLANGED SPOOLS PROVIDED ON PUMP SUCTION FOR TEMP. STARTUP STRAINERS.
 5. FLANGED CONNECTIONS PROVIDED FOR FLUSHING/ CLEANING OF EXISTING PIPING AND EQUIPMENT.

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						MEMO FOR MR. BENNETT		12/19/78	
						SUBJECT:		Prepared for U.S. ARMY CORPS OF ENGINEERS, Waco Work District By MONTGOMERY WATSON	
						DATE:		242A P&ID	
						DRAWN BY:		CLOSED LOOP COOLING-I	
						CHECKED BY:			
						APPROVED BY:			
						DATE:		12/15/74	
						BY:			
						PROJECT:		WAT-252 PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL	
						F 242-A		ES-252-ACD-I 0	
						DATE:		NOV 1202.0610	
						BY:			
						DATE:

NOTES:

1. FOR LEGEND & SYMBOLS SEE ES-252-ACD-2.
2. * INDICATES VENDOR FURNISHED.
3. FOR INTERLOCK LOGIC DESCRIPTION SEE ES-252-ACD-15.
4. FLANGED SPOOLS PROVIDED ON PUMP SUCTION FOR TEMP. STARTUP STRAINERS.
5. FLANGED CONNECTIONS PROVIDED FOR FLUSHING/ CLEANING OF EXISTING PIPING AND EQUIPMENT.

0-11

DESIGNED: D. GORDON		DATE: 12/7/94		SHEET NO. 3		REV: 0000	
CHECKED: F. HINKER		DATE: 12/14/94		U.S. DEPARTMENT OF ENERGY			
PROJECT: 252				Richmond Operations Office			
PREPARED FOR: U.S. ARMY CORPS OF ENGINEERS, Water Works District				By: MONTGOMERY WATSON			
DRAWN: L. BENNETT		DATE: 12/15/94		242A P&ID			
PROJECT: 252				CLOSED LOOP COOLING-2			
REVISIONS		DESCRIPTION		DATE		BY	
1		INITIALS		DATE		BY	
2		INITIALS		DATE		BY	
3		INITIALS		DATE		BY	
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5		INITIALS		DATE		BY	
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PLOT SCALE:

NOTES:

1. FOR LEGEND & SYMBOLS SEE ES-252-ACD-2.
2. * INDICATES VENDOR FURNISHED.
3. FOR INTERLOCK LOGIC DESCRIPTION SEE ES-252-ACD-15.
4. FLANGED SPOOLS PROVIDED ON PUMP SUCTION FOR TEMP. STARTUP STRAINERS.
5. FLANGED CONNECTIONS PROVIDED FOR FLUSHING/ CLEANING OF EXISTING PIPING AND EQUIPMENT.

O-12

DESIGNED BY: D. GORDON 12/7/94	DATE: 12/7/94	OF: 0000
CHECKED BY: W. WILCOXSON 12/7/94	DATE: 12/7/94	
APPROVED BY: F. HENNER 12/14/94	DATE: 12/14/94	
DESIGNED BY: L. BENNETT 12/15/94	DATE: 12/15/94	
U.S. DEPARTMENT OF ENERGY Richland Operations Office Prepared for: U.S. ARMY CORPS OF ENGINEERS, Wabigo Wabigo District By: MONTGOMERY WATSON		
242A P&ID CLOSED LOOP COOLING-3		
PHASE 252 PHASE 2 LIQUID EFFLUENT TREATMENT AND DISPOSAL		
FILE NO. F	REV. NO. 0	DATE 1202.0610
BY: NONE	DATE: 1202.0610	OF: 0

PLOT SCALE:

ISSUED D. GORDON 12/7/94 <small>DATE</small>		WORK LEADS 3		DST 0000	
PLAN ENCL D. WILCOXSON 12/7/94		U.S. DEPARTMENT OF ENERGY Richland Operations Office			
FIELD E. HINKER 12/14/94		Prepared for U.S. ARMY CORPS OF ENGINEERS, Wado Ward Districts By: MONTGOMERY WATSON			
SWFT: 0		242A P&ID			
SWP: 0		CLOSED LOOP COOLING-4			
DWG ENCL 0					
LAW ENCL L. BENNETT 12/15/94					
APPROVED FOR SUBMITTAL		PROJECT W-252 PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL			
REV. 1 12/14/94		REV. 1 12/14/94		REV. 1 12/14/94	
F 242-A		0000		ES-252-ACD-13	
REV. 2 12/20/94		REV. 2 12/20/94		REV. 2 12/20/94	
REV. 3 12/20/94		REV. 3 12/20/94		REV. 3 12/20/94

NOTES:

1. REMOVE VALVE INTERNALS. REPLACE VALVE BONNET WITH BLANK.

0-14

COGNED <u>G. GORDON</u> <u>12/7/94</u> ^{WML} JOHN EMP# <u>D. WILCOXSON</u> <u>12/7/94</u> RECD BY <u>F. HINKER</u> <u>12/14/94</u> SAFETY ☐ EMP ☐ PAID EMP ☐ LAB CHG# <u>L. BENNETT</u> <u>12/15/94</u>		IMPACT LEVEL <u>3</u> GFI <u>0000</u> U.S. DEPARTMENT OF ENERGY Richmond Operations Prepared for: U.S. ARMY CORPS OF ENGINEERS, West York District? By: <u>MONTGOMERY WATSON</u> <u>242A P&ID</u> <u>CLOSED LOOP COOLING 5</u>	
PROJECT <u>W-252 PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL</u> -E- <u>BLIC W-1</u> -E- <u>BLIC W-2</u> -E- <u>BLIC W-3</u> F# <u>242-A</u> **** ES-252-ACD-14 ① LAB <u>NONE</u> JOB NO. <u>K02.0610</u> 12/14/94 12/14/94		BY <u>APPROVED FOR IMPLEMENTATION</u> DATE _____ _____

INTERLOCK LOGIC

NOTES:

- FOR LEGEND & SYMBOLS SEE ES-252-ACD-2
- * INDICATES VENDOR FURNISHED.
- FOR INTERLOCK LOGIC DESCRIPTION SEE ES-252-ACD-15.
- FLANGED SPOOLS PROVIDED ON PUMP SUCTION FOR TEMP. START UP STAINERS.
- FLANGED CONNECTIONS PROVIDED FOR FLUSHING/ CLEANING OF EXISTING PIPING AND EQUIPMENT.

O-15

DESIGNED BY J. JACKSON 12/7/94		CHECKED BY D. WILCOXSON 12/7/94		U.S. DEPARTMENT OF ENERGY	
DRAWN BY F. HINKER 12/14/94		APPROVED BY L. BENNETT 12/15/94		Richland Operations Office	
PROJECT: 252 PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL		242A P&ID		Prepared for: U.S. ARMY CORPS OF ENGINEERS, Vicksburg District	
242A P&ID		CLOSED LOOP COOLING-6		By: MONTGOMERY WATSON	
F 242-A		ES-252-ACD-15		0	
DATE: 1202.0610		DATE: 1202.0610		DATE: 1202.0610

PLAN
NT AREA

SCALE IN FEET
50' 0 50'

O-16

DESIGNED BY D. MAGLEDC	DATE 12/1/94	PROJECT NO. 3	REV. 0000
FOR P. NAYLOR	DATE 12/1/94	U.S. DEPARTMENT OF ENERGY Richmond Operations Office Prepared for: U.S. ARMY CORPS OF ENGINEERS, 4th World District By: WILLIAM WATSON	
CHECKED BY F. HOKER	DATE 12/15/94	B-PLANT CIVIL SITE PLAN	
DATE 12/15/94	BY L. BENNETT	PROJECT: W-252 PHASE LIQUID EFFLUENT TREATMENT AND DISPOSAL	
APPROVED FOR CONSTRUCTION		DATE 12/15/94	BY 0
DATE 12/15/94		DATE 12/15/94	DATE 12/15/94

FILE NO.	DATE	BY	REVISION	DATE	BY	REVISION	DATE	BY	REVISION
15-55	10-JAN-1995								
DATE 10-2-1991/252-001/253-001-001

NEW FLUID COOLERS
(SEE ACD-13)

EXISTING DIRT R

NEW LCU/SUPPORT/
SAMPLING BUILDING

45°

N42875
W54525

CONTINUED ON
ES-252-ACD-16

N42667

10'-0" 10'-0"

BELOW GROUND ABOVE GROUND

282-BA

N42500

282-B

W54400

NUMBER	TITLE
	DRAWING TRACEABILITY LIST

- MAKUP WATER
- COOLING WATER (TO COOLERS)
- COOLING WATER (FROM PUMPS)

0-17

EXTENDED T. PHILLIPS		DATE	SAFETY CLASS	BY
BEN CHAM. WINGER		DATE	U.S. DEPARTMENT OF ENERGY	
CHECKED F. HINKER		DATE	Richland Operations Office	
		DATE	Prepared for: U.S. ARMY CORPS OF ENGINEERS, Walla Walla District	
		DATE	By: MONTGOMERY WATSON	
SAFETY				
CLASS				
QUAL. ENGR.				
LEAD ENGR. JENSEN		DATE	B-PLANT	
		DATE	YARD PIPING PLAN	
PROJECT W-252 PHASE II LIQUID TREATMENT & DISPOSAL				
SIZE	SCALE	DATE	DATE	DATE
F 200-E	1"=20'-0"	ES-252-ACD-17	0	
APPROVED FOR SUBMITTAL		JOB NO. 0484710.23 SHEET 1 OF 1		
DATE		REVISIONS 01/90		

NO.	REV.	DESCRIPTION	REV. BY	DATE	APP. FOR	DATE
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B SECTION
1/2"=1'-0"

D SECTION
ACD-17 1/2"=1'-0"

COOLER BYPASS

C SECTION
1/2"=1'-0"

O-18

DESIGNED T. PHILLIPS		DATE	SAFETY CLASS	CHK
CHECKED H. WINGER		DATE	U.S. DEPARTMENT OF ENERGY	
CHECKED F. HINKER		DATE	Richland Operations Office	
SAFETY		DATE	Prepared for: U.S. ARMY CORPS OF ENGINEERS, Water Waste District	
DRAWN		DATE	By: MONTGOMERY WATSON	
DUAL CHECK		DATE	B-PLANT	
LEAD ENGINEER R. JENSEN		DATE	YARD PIPING DETAILS	
PROJECT W-252 PHASE II LIQUID TREATMENT & DISPOSAL				
SIZE	TITLE	DATE	SCALE	REV
F	200-E	ES-252-ACD-18	0	
APPROVED FOR IMPLEMENTATION		JOB NO. 0484710.23		
DATE	DATE	SHEET 1 OF 1		
PLOT SCALE: 1=1		REVISOR

STANDARD D. GORDON 12/17/94		WNET LEVEL 3		OF 0000	
JAN INP/D. WILCOXSON 12/17/94		U.S. DEPARTMENT OF ENERGY			
ACC'D F. HINKER 12/14/94		Richmond, Virginia Office			
SAFETY		Prepared for U.S. ARMY CORPS OF ENGINEERS, Water Model District			
INSTR		By: MONTGOMERY WATSON			
PANEL INP/D		B PLANT P&ID			
LAB INP/D L. BENNETT 12/15/94		CLOSED LOOP COOLING SYSTEM-I			
PROJECT-252 PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL					
REV		CLASS		REV	
B-PLANT		0000		ES-252-ACD-19	
DATE		SCALE		NONE	
APPROVAL FOR SUBMITTATION		JOB NO.		1202.0610	
BY		DATE		1/11/95	
BY		DATE		1/11/95

DESIGNED D. GORDON 12/7/94		SHEET NO. 3		JOB NO.	
DRAWN BY D. WILCOXSON 12/7/94		U.S. DEPARTMENT OF ENERGY			
CHECKED F. HINKER 12/14/94		Prepared for: U.S. ARMY CORPS OF ENGINEERS, Water Works Division By: MONTGOMERY WATSON			
TITLE:		B PLANT P&ID			
DATE:		CLOSED LOOP COOLING SYSTEM-2			
JOB NO.:					
JOB NAME L. BENNETT 12/15/94					
PROJECT - 252 PHASE B LIQUID EFFLUENT TREATMENT AND DISPOSAL					
SCALE: B-S-C		REV. NO.		REV. DATE	
B-PLANT		0000		ES-252-ACD-20 0	
SCALE NONE		JOB NO. 1202.0600		SHEET NO. 3	
APPROVED FOR CONSTRUCTION					
BY		DATE

ES-252-ACD-22

RECD D. GORDON 12/7/94 FOR INFO D. WILCOXSON 12/14/94 BY F. HINKER 12/14/94 DTG: 0 MAP: 0 DIAL: 0 LAB: W. L. BENNETT 12/15/94		AMST: 12/15/94 3 DTG: 0000 U.S. DEPARTMENT OF ENERGY Regional Operations Office Prepared for: U.S. ARMY CORPS OF ENGINEERS, Water Waste District By: MONTGOMERY WATSON B PLANT P&ID CLOSED LOOP COOLING SYSTEM-3	
PROJECT: -252 PHASE B LIQUID EFFLUENT TREATMENT AND DISPOSAL F- B-PLANT SCALE: NONE DATE:		SHEET NO.: 0000 SHEET NO.: 1202.060 ES-252-ACD-21 0

NOTES:

1. FOR LEGEND & SYMBOLS SEE ES-252-ACD-2.
2. * INDICATES VENDOR FURNISHED.
3. FOR INTERLOCK LOGIC DESCRIPTION SEE ES-252-ACD-23.
4. FLANGED SPOOLS PROVIDED ON PUMP SUCTION FOR TEMP. START UP STRAINERS.
5. FLANGED CONNECTIONS PROVIDED FOR FLUSHING/ CLEANING OF EXISTING PIPING AND EQUIPMENT.
6. OFF-LINE RAD MONITORING ASSEMBLY SIMILAR TO SCHEMATIC SHOWN ON ES-252-ACD-14.

O-22

DESIGNER D. GORDON	DATE 12/1/94	PROJECT LEVEL 3	GE 0000
BY D. WILCOXSON	12/1/94	U.S. DEPARTMENT OF ENERGY Richland Operations Office	
CHECKED F. HANXER	12/14/94	Prepared for U.S. ARMY CORPS OF ENGINEERS, Wabash District By: MONTGOMERY WATSON	
DATE 12/1/94	12/1/94	B PLANT P&ID CLOSED LOOP COOLING SYSTEM-4	
LEG DRA L. BENNETT	12/15/94	PROJECT-252 PHASE I LIQUID EFFLUENT TREATMENT AND DISPOSAL	
REV NO.	DESCRIPTION	REV BY	DATE
1	1252m2c.dgn	1	12/15/94
2	1252m2c.dgn	2	12/15/94
3	1252m2c.dgn	3	12/15/94
4	1252m2c.dgn	4	12/15/94
5	1252m2c.dgn	5	12/15/94
6	1252m2c.dgn	6	12/15/94
7	1252m2c.dgn	7	12/15/94
8	1252m2c.dgn	8	12/15/94
9	1252m2c.dgn	9	12/15/94
10	1252m2c.dgn	10	12/15/94
11	1252m2c.dgn	11	12/15/94
12	1252m2c.dgn	12	12/15/94
13	1252m2c.dgn	13	12/15/94
14	1252m2c.dgn	14	12/15/94
15	1252m2c.dgn	15	12/15/94
16	1252m2c.dgn	16	12/15/94
17	1252m2c.dgn	17	12/15/94
18	1252m2c.dgn	18	12/15/94
19	1252m2c.dgn	19	12/15/94
20	1252m2c.dgn	20	12/15/94
21	1252m2c.dgn	21	12/15/94
22	1252m2c.dgn	22	12/15/94
23	1252m2c.dgn	23	12/15/94
24	1252m2c.dgn	24	12/15/94
25	1252m2c.dgn	25	12/15/94
26	1252m2c.dgn	26	12/15/94
27	1252m2c.dgn	27	12/15/94
28	1252m2c.dgn	28	12/15/94
29	1252m2c.dgn	29	12/15/94
30	1252m2c.dgn	30	12/15/94
31	1252m2c.dgn	31	12/15/94
32	1252m2c.dgn	32	12/15/94
33	1252m2c.dgn	33	12/15/94
34	1252m2c.dgn	34	12/15/94
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37	1252m2c.dgn	37	12/15/94
38	1252m2c.dgn	38	12/15/94
39	1252m2c.dgn	39	12/15/94
40	1252m2c.dgn	40	12/15/94
41	1252m2c.dgn	41	12/15/94
42	1252m2c.dgn	42	12/15/94
43	1252m2c.dgn	43	12/15/94
44	1252m2c.dgn	44	12/15/94
45	1252m2c.dgn	45	12/15/94
46	1252m2c.dgn	46	12/15/94
47	1252m2c.dgn	47	12/15/94
48	1252m2c.dgn	48	12/15/94
49	1252m2c.dgn	49	12/15/94
50	1252m2c.dgn	50	12/15/94
51	1252m2c.dgn	51	12/15/94
52	1252m2c.dgn	52	12/15/94
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61	1252m2c.dgn	61	12/15/94
62	1252m2c.dgn	62	12/15/94
63	1252m2c.dgn	63	12/15/94
64	1252m2c.dgn	64	12/15/94
65	1252m2c.dgn	65	12/15/94
66	1252m2c.dgn	66	12/15/94
67	1252m2c.dgn	67	12/15/94
68	1252m2c.dgn	68	12/15/94
69	1252m2c.dgn	69	12/15/94
70	1252m2c.dgn	70	12/15/94
71	1252m2c.dgn	71	12/15/94
72	1252m2c.dgn	72	12/15/94
73	1252m2c.dgn	73	12/15/94
74	1252m2c.dgn	74	12/15/94
75	1252m2c.dgn	75	12/15/94
76	1252m2c.dgn	76	12/15/94
77	1252m2c.dgn	77	12/15/94
78	1252m2c.dgn	78	12/15/94
79	1252m2c.dgn	79	12/15/94
80	1252m2c.dgn	80	12/15/94
81	1252m2c.dgn	81	12/15/94
82	1252m2c.dgn	82	12/15/94
83	1252m2c.dgn	83	12/15/94
84	1252m2c.dgn	84	12/15/94
85	1252m2c.dgn	85	12/15/94
86	1252m2c.dgn	86	12/15/94
87	1252m2c.dgn	87	12/15/94
88	1252m2c.dgn	88	12/15/94
89	1252m2c.dgn	89	12/15/94
90	1252m2c.dgn	90	12/15/94
91	1252m2c.dgn	91	12/15/94
92	1252m2c.dgn	92	12/15/94
93	1252m2c.dgn	93	12/15/94
94	1252m2c.dgn	94	12/15/94
95	1252m2c.dgn	95	12/15/94
96	1252m2c.dgn	96	12/15/94
97	1252m2c.dgn	97	12/15/94
98	1252m2c.dgn	98	12/15/94
99	1252m2c.dgn	99	12/15/94
100	1252m2c.dgn	100	12/15/94

INTERLOCK LOGIC

NOT USED

VALVE LV- OPENS WHEN:
A) LEVEL IN TANK TK-1 BELOW LOW SETPOINT
VALVE LV- CLOSSES WHEN:
A) LEVEL IN TANK TK-1 ABOVE HIGH SETPOINT

SAMPLER PUMP S-1 STARTS WHEN EITHER OF THE FOLLOWING OCCURS:
A) OPERATOR TURNS LOCAL HANDSWITCH HS-S1
B) HS-S1 IN REMOTE AND PLC SOFTWARE FLOW INDICATES PREDETERMINED FLOW DISCHARGE
C) PLC SOFTWARE TIMER OR LOGICAL TIMER HI
SAMPLER PUMP S-1 STOPS WHEN EITHER OF THE FOLLOWING OCCURS:
A) OPERATOR TURNS LOCAL HANDSWITCH HS-S1
B) FLOW TOTALIZER RESETS

FLUID COOLER FAN STARTS WHEN EITHER OF THE FOLLOWING OCCURS:
A) OPERATOR TURNS HANDSWITCH TO START AT MCC AND HOLDS IN THAT POSITION (LOW SPEED)
B) HANDSWITCH AT MCC IS IN AUTO AND OPERATOR AT LCU/LOI GENERATES START/AUTO SIGNAL AND TEMPERATURE IS ABOVE LOW SETPOINT (FAN START AT LOW SPEED) AND IF TEMPERATURE IS RISING THEN FAN REACHES HIGH SPEED. THE FAN CONTINUES TO OPERATE ON AUTOMATIC TEMPERATURE CONTROL.

FLUID COOLER FAN STOPS WHEN EITHER OF THE FOLLOWING OCCURS:
A) OPERATOR TURNS HANDSWITCH TO STOP AT MCC
B) HANDSWITCH AT MCC IS IN AUTO AND OPERATOR AT LCU/LOI GENERATES STOP SIGNAL OR TEMPERATURE REACHES LOW SETPOINT.

NOT USED

PUMP P-101(002) STARTS WHEN EITHER OF THE FOLLOWING OCCURS:
A) OPERATOR TURNS HS-P-101(002) TO START AND HOLDS IN THAT POSITION
B) HS-P-101(002) IS IN AUTO AND OPERATOR AT LCU/LOI GENERATES START/AUTO SIGNAL AND PUMP DIAGNOSTIC PARAMETERS (VIBRATION, BEARING TEMPERATURE) ARE BELOW SETPOINT AND PUMP ALTERNATOR PERMISSIVE ENABLE IS ON

PUMP P-101(002) STOPS WHEN EITHER OF THE FOLLOWING OCCURS:
A) OPERATOR TURNS HS-P-101(002) TO STOP
B) OPERATOR AT LCU/LOI GENERATES STOP
C) ONE OF THE PUMP DIAGNOSTIC PARAMETERS EXCEEDS THE SETPOINT (OPERATOR RESET REQUIRED PRIOR TO ANOTHER ATTEMPT TO START)

PUMP P-105 (006) STARTS WHEN EITHER OF THE FOLLOWING OCCURS:
A) OPERATOR TURNS HANDSWITCH HS-P-105 (006) TO START AND HOLDS IN THAT POSITION
B) HANDSWITCH HS-P-105 (006) IS IN AUTO AND OPERATOR AT LCU/LOI GENERATES START/AUTO AND LEVEL IN TANK TK-3 IS ABOVE LOW LEVEL AND ALTERNATOR PERMISSIVE IS ON PUMP P-105 (006)
C) ON HIGH LEVEL, PUMP SEQUENCING IS DISABLED AND STANDBY PUMP START

PUMP P-105 (006) STOPS WHEN EITHER OF THE FOLLOWING OCCURS:
A) OPERATOR TURNS HANDSWITCH HS-P-105 (006) TO STOP
B) LEVEL IN TANK REACHES LOW LEVEL
C) OPERATOR AT LCU/LOI GENERATES STOP SIGNAL

NOT USED

PUMP P-103 (004) STARTS WHEN HV-TK-2 IS OPEN AND EITHER OF THE FOLLOWING OCCURS:
A) OPERATOR TURNS HANDSWITCH HS-P-103 (P-104) TO START AND HOLDS IN THAT POSITION
B) HANDSWITCH HS-P-103 (P-104) IS IN AUTO AND ALTERNATOR PERMISSIVE EXISTS FOR P-103 (P-104) AND LEVEL IN TANK TK-2 IS ABOVE LOW LEVEL AND OPERATOR AT LCU/LOI GENERATES START/AUTO SIGNAL
C) ON HIGH LEVEL, PUMP SEQUENCING IS DISABLED AND STANDBY PUMP START

PUMP P-103 (004) STOPS WHEN EITHER OF THE FOLLOWING OCCURS:
A) OPERATOR TURNS HANDSWITCH HS-P-103 (P-104) TO STOP
B) LEVEL IN TANK TK-2 IS BELOW LOW LEVEL
C) OPERATOR AT LCU/LOI GENERATES STOP SIGNAL

OLLOWING OCCURS:

START

TALIZER

ELAPSED

OLLOWING OCCURS:

STOP

0-23

DESIGNED BY: D. GORDON		DATE: 12/7/94	PROJECT LEVEL: 3	REV: 0000
DRAWN BY: D. WILCOXSON		DATE: 12/7/94	U.S. DEPARTMENT OF ENERGY	
CHECKED BY: F. HENNER		DATE: 12/14/94	Richland Operations Office	
DATE: 0			Prepared for: U.S. ARMY CORPS OF ENGINEERS, Waka Waka District	
DATE: 0			By: MONTGOMERY WATSON	
DATE: 0			B-PLANT P&ID	
DATE: 0			CLOSED LOOP COOLING SYSTEM-5	
DATE: 0			PROJECT W-252 PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL	
FILE	REV. NO.	FILE NO.	REV. NO.	REV. NO.
F	B-PLANT	0000	ES-252-ACD-23	0
SCALE	NONE	DATE	1202.0610	1

FILE	REV. NO.	FILE NO.	REV. NO.	REV. NO.
1252m2.dgn	2.0	2.0	2.0	2.0

PLOT SCALE:

O-25

DESIGNED BY	D. MAGLEDC	DATE	12/1/94	PROJECT LEVEL	3	REV	0000
DESIGNED BY	P. HAYLOR	DATE	12/1/94	U.S. DEPARTMENT OF ENERGY			
DESIGNED BY	F. HARKER	DATE	12/15/94	Richmond Operations Office			
Prepared for U.S. ARMY CORPS OF ENGINEERS, Richmond District				By: MONTGOMERY WATSON			
241-A							
SITE PLAN AND DETAILS							
PROJECT: W-252 PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL							
NO.	241-A	DATE	12/15/94	SCALE	AS SHOWN	REV	0
APPROVED FOR RELEASE/REVISION				DATE			
FILED				DATE			
FILED				DATE			

PLOT SCALE:

2

0.0000

NOTE:

- L RADIATION, CONDUCTIVITY AND pH HIGH LEVEL TRIP OUTPUTS ARE CONNECTED TO INTERLOCK I2 ON DWG TO CLOSE VALVE HV-HE-1

INTERLOCK LOGIC DESCRIPTION

SAMPLER PUMP P-A STARTS WHEN EITHER OF THE FOLLOWING OCCURS:

- A) OPERATOR TURNS LOCAL HANDSWITCH HS-SJ-1 TO START
- B) HS-SJ-1 IN REMOTE AND DCS SOFTWARE FLOW TOTALIZER INDICATES PREDETERMINED FLOW DISCHARGED
- C) DCS SOFTWARE TIMER OR LOGICAL TIMER HAS ELAPSED

SAMPLER PUMP P-A STOPS WHEN EITHER OF THE FOLLOWING OCCURS:

- A) OPERATOR TURNS HANDSWITCH HS-SJ-1 TO STOP
- B) FLOW TOTALIZER RESETS

244AR/241-A EFFLUENT MONITORING SYSTEM

O-26

DESIGNED BY D. GORDON		DATE 12/17/94		SHEET 3 OF 4	
DRAWN BY D. WILCOXSON		DATE 12/14/94		U.S. DEPARTMENT OF ENERGY	
CHECKED BY F. HOKER		DATE 12/14/94		Richland Operations Office	
APPROVED BY L. BENNETT		DATE 12/15/94		Prepared for U.S. ARMY CORPS OF ENGINEERS, Wabash District	
PROJECT W-252 PHASE 1 LIQUID EFFLUENT TREATMENT AND DISPOSAL		241A AND 244AR EFFLUENT P&ID		ES-252-ACD-26	
SHEET NO. 241-A		SHEET NO. 244-AR		SHEET NO. 0	
DATE 12/02/06		DATE 12/02/06		DATE 12/02/06

FOR CONTINUATION
SEE DWG ES-252-ACD-26

NAME	
DATE

NOTES:

1. FOR LEGEND AND SYMBOLS, SEE DWG ES-252-ACD-2.
2. FOR LOGIC DESCRIPTION, SEE ES-252-ACD-28.

0-27

DESIGNED BY J. JACKSON		DATE 12/17/94	PROJECT LEVEL 3	REV 0000
DRAWN BY F. HINKER		DATE 12/14/94	U.S. DEPARTMENT OF ENERGY Richland Operations Office Prepared for U.S. ARMY CORPS OF ENGINEERS, Wabash District By: MONTGOMERY WATSON	
CHECKED BY L. BENNETT		DATE 12/15/94	244AR P&ID - 1	
PROJECT: ES-252 PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL		FILE: F 244-AR	REV: 0000	ES-252-ACD-27
SCALE: NONE		DATE: 1202.0510	SHEET: 1 OF 1	

NO.	REV.	DESCRIPTION	REV. BY	DATE	FOR APPROVAL	APPROVED FOR
1	0	es252m7a.dgn	J. JACKSON	12/17/94

INTERLOCK LOGIC

PUMP P-103 (104) STARTS WHEN EITHER OF THE FOLLOWING OCCURS:

- OPERATOR TURNS HS-PI03 (PI04) TO START AND HOLDS IN THAT POSITION
- HS-PI03 (PI04) IN AUTO AND OPERATOR AT LCU/LOI GENERATES START/AUTO SIGNAL AND SHELL SIDE FLOW (FI-1) IN CONDENSATE HEAT EXCHANGER HE-115 ESTABLISHED AND PUMP SEQUENCING PERMISSIVE IS AVAILABLE.

PUMP P-103 (104) STOPS WHEN EITHER OF THE FOLLOWING OCCURS:

- OPERATOR TURNS HS-PI03 (PI04) TO STOP
- OPERATOR AT LCU/LOI GENERATES STOP SIGNAL
- SHELL SIDE FLOW IN HE-1 REACHES LOW SETPOINT

VALVE HV-HE-1 OPENS WHEN EITHER OF THE FOLLOWING OCCURS:

- OPERATOR TURNS HS-HE-1 TO OPEN AND HOLDS IN THAT POSITION
- HS-HE-115 IN AUTO AND OPERATOR AT LCU/LOI GENERATES OPEN/AUTO SIGNAL AND SHELL SIDE LIQUID TEMPERATURE TI-HE-1 IS BELOW HIGH TEMPERATURE SETPOINT.

VALVE HV-HE-1 CLOSES WHEN EITHER OF THE FOLLOWING OCCURS:

- OPERATOR TURNS HS-HE-1 TO CLOSE
- OPERATOR AT LCU/LOI GENERATES CLOSE SIGNAL
- SHELL SIDE LIQUID TEMPERATURE IS ABOVE HIGH TEMPERATURE SETPOINT

PUMP P-101 (102) STARTS WHEN HV-HE 115 IS OPEN AND EITHER OF THE FOLLOWING OCCURS:

- OPERATOR TURNS HANDSWITCH HS-PI01 (PI02) TO START AND HOLDS IN THAT POSITION
- HS-PI01 (102) IN AUTO AND OPERATOR AT LCU/LOI GENERATES START/AUTO SIGNAL AND PUMP SEQUENCING PERMISSIVE IS AVAILABLE AND LEVEL IN TANK T-11 INDICATED BY LI-T-1 IS ABOVE LOW LEVEL
- ON HIGH LEVEL, PUMP SEQUENCING IS DISABLED AND STANDBY PUMP STARTS

PUMP P-101 (PI02) STOPS WHEN EITHER OF THE FOLLOWING OCCURS:

- OPERATOR TURNS HS-PI01 (PI02) TO STOP
- OPERATOR AT LCU/LOI GENERATES STOP SIGNAL
- LEVEL LI-T-1 IS AT LOW LEVEL

O-28

DESIGNED BY J. JACKSON	DATE 12/17/94	REVIEWED BY D. WILCOXSON	DATE 12/17/94	PROJECT NO. ES-252	PHASE B	LIQUID EFFLUENT TREATMENT AND DISPOSAL
DESIGNED BY F. HINER	DATE 12/14/94	REVIEWED BY F. HINER	DATE 12/14/94	PROJECT NO. ES-252	PHASE B	LIQUID EFFLUENT TREATMENT AND DISPOSAL
DESIGNED BY L. BENNETT	DATE 12/15/94	REVIEWED BY L. BENNETT	DATE 12/15/94	PROJECT NO. ES-252	PHASE B	LIQUID EFFLUENT TREATMENT AND DISPOSAL
U.S. DEPARTMENT OF ENERGY Richmond Operations Office Prepared for U.S. ARMY CORPS OF ENGINEERS, Waco Water District By MONTGOMERY WATSON				244AR P&ID - 2		
F 244AR				ES-252-ACD-28		
DATE NONE				DATE 1202.0630		

NO.	REV.	DESCRIPTION	REV.	DATE	APP. FOR SUPPL.	FOR DATE
1	1	ES-252-W-28	1	12/17/94		
2	1	ES-252-W-28	1	12/17/94		
3	1	ES-252-W-28	1	12/17/94		
4	1	ES-252-W-28	1	12/17/94		
5	1	ES-252-W-28	1	12/17/94		
6	1	ES-252-W-28	1	12/17/94		
7	1	ES-252-W-28	1	12/17/94		
8	1	ES-252-W-28	1	12/17/94		
9	1	ES-252-W-28	1	12/17/94		
10	1	ES-252-W-28	1	12/17/94

LEGEND	
	NEW CONSTRUCTION
	EXISTING ROADS AND FACILITIES
	EXISTING UGND LINES
	EXISTING FENCE LINE

0-29

SITE PLAN

KAISER

DESIGNED BY D. MAGLEIC	DATE 12/1/94	PROJECT NO. 3	REV. 0000
FOR DATA P. NAYLOR	DATE 12/1/94	U.S. DEPARTMENT OF ENERGY Richmond Operations Office Prepared for: U.S. ARMY CORPS OF ENGINEERS, Water Works District By: MONTGOMERY WATSON	
DESIGNED BY F. HINKER	DATE 12/15/94	283-E AND 284-E SITE PLAN	
FOR DATA L. BENNETT	DATE 12/15/94	PROJECT W-252 PHASE LIQUID EFFLUENT TREATMENT AND DISPOSAL	
FOR DATA F. HINKER	DATE 12/15/94	PROJECT NO. 283-E	REV. 0000
FOR DATA F. HINKER	DATE 12/15/94	PROJECT NO. 284-E	REV. 0000
FOR DATA F. HINKER	DATE 12/15/94	PROJECT NO. ES-252-ACD-29	REV. 0
FOR DATA F. HINKER	DATE 12/15/94	PROJECT NO. AS SHOWN	REV. 0

PLOT SCALE:

2

00000

NAME	TITLE

BRANDER TRACKABILITY LIST

O-30

AN

NUMBER	DESCRIPTION
1	TO BOILER STOKER JACKETS (TYP)
2	TO FORCED DRAFT FAN (TYP)
3	MAKEUP WATER SUPPLY TIE-IN POINT
4	EXISTING 12\"/>

DESIGNED T. PHILLIPS	DATE 06/07/00	SAFETY CLASS	ENV
DRAWN D. WINGER	DATE 06/07/00	U.S. DEPARTMENT OF ENERGY	
CHECKED F. HINKER	DATE 06/14/00	Richland Operations Office	
PROJECT		Prepared for U.S. ARMY CORPS OF ENGINEERS, Walle Walle District	
DRAWN		By: MONTGOMERY WATSON	
DUAL DCR		284-E	
DRAWN R. JENSEN		PIPING	
DATE 06/15/00		FIRST FLOOR	
PROJECT W-252 PHASE II LIQUID TREATMENT & DISPOSAL		REV NO.	
FILE W-252		DRAW NO.	
F 284-E		ES-252-ACD-30	
SCALE 1/16"=1'-0"		JOB NO. 0484710.23	
APPROVED FOR IMPLEMENTATION		REV NO.	
BY DATE		1 OF 1	
CAD FILE ACD30.DWG		REVISED 01/00

O-31

NOTES:

1. FOR LEGENDS & SYMBOLS SEE ES-252-ACD-2
2. ASTERISK (*) INDICATES VENDOR FURNISHED
3. FOR INTERLOCK DESCRIPTION SEE ES-252-ACD-36.
4. FLANGED SPOOLS PROVIDED ON PUMP SUCTION FOR TEMPERATURE STARTUP STRAINERS

DESIGNED BY J. JACKSON	DATE 12/1/94	PROJECT NO. 3	REV. 0000
CHECKED BY D. WILCOXSON		U.S. DEPARTMENT OF ENERGY	
APPROVED BY F. HINKER		Richland Operations Office	
SAFETY 0		Prepared for U.S. ARMY CORPS OF ENGINEERS, Water Works District	
DATE 12/14/94		By: MONTGOMERY WATSON	
LAW ENFORCEMENT 0		284E P&ID	
LAW ENFORCEMENT 0		CLOSED LOOP COOLING-I	
PHASE II W-252 PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL			
F 284-E		ES-252-ACD-31	
NONE		1202.0610

NOTES:

1. FOR LEGENDS & SYMBOLS SEE ES-252-ACD-2
2. ASTERISK (*) INDICATES VENDOR FURNISHED
3. FOR INTERLOCK DESCRIPTION SEE ES-252-ACD-36
4. FLANGED SPOOLS PROVIDED ON PUMP SUCTION TEMPERATURE STARTUP STRAINERS

O-32

DESIGNED BY: D. CORDON	DATE: 12/7/94	PROJECT LEVEL: 3	OF: 0000
FOR: D. WILCOXSON	DATE: 12/7/94	U.S. DEPARTMENT OF ENERGY Richland Operations Office	
BY: F. HENKER	DATE: 12/14/94	Prepared for: U.S. ARMY CORPS OF ENGINEERS, Wabash District By: MONTGOMERY WATSON	
CHECKED BY: L. BENNETT	DATE: 12/15/94	284E P&ID CLOSED LOOP COOLING-2	
PROJECT: W-252 PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL		REV. NO. 0	
FILE: 284-E	DATE: 12/15/94	REV. NO. 0	REV. NO. 0
FILE: 1252inf0000	FILE: 284EACD32	FILE: 1202.0610	FILE: 1

1. FOR LEGENDS & SYMBOLS SEE ES-252-ACD-2
2. ASTERISK (*) INDICATES VENDOR FURNISHED
3. FOR INTERLOCK DESCRIPTION SEE ES-252-ACD-36
4. FLANGED SPOOLS PROVIDED ON PUMP SUCTION FOR
TEMPERATURE STARTUP STRAINERS

ASSIGNED D. GORDON	DATE 12/7/94	PROJECT NO. 3	CITY *****
SUB ENGINEER D. WILCOXSON	DATE 12/7/94	U.S. DEPARTMENT OF ENERGY Richmond Operations Office	
DRAWN BY F. HINKER	DATE 12/14/94	Prepared for U.S. ARMY CORPS OF ENGINEERS, World Wara District By: MONTGOMERY WATSON	
SHEET# 0		284E P&ID	
TANK #		CLOSED LOOP COOLING-3	
DATE ENG'D			
SUB ENGINEER L. BENNETT	DATE 12/15/94		
PROJECT W-252 PHASE B LIQUID EFFLUENT TREATMENT AND DISPOSAL			
FILE NO.	REV. NO.	REV. NO.	REV. NO.
F 284-E	*****	ES-252-ACD-33	0
SCALE NONE	1 inch = 120' 0.610	1 sheet	of 1

DESIGNED D. GORDON	DWG.	SHEET NO. 3	DAY ****
PLANNED BY D. WILCOXSON	DATE 12/1/94	U.S. DEPARTMENT OF ENERGY Richland Operations Office	
CHECKED F. HINKER	DATE 12/14/94	Prepared for U.S. ARMY CORPS OF ENGINEERS, Water waste District By: MONTGOMERY WATSON	
TITLE		284E P&ID CLOSED LOOP COOLING - 4	
BY			
SCALE			
LAB ENG'D L. BENNETT	DATE 12/15/94		
PROJECT W-252 PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL			
REV	DESCRIPTION	DATE	BY
F	284-E	****	0
SCALE	NONE	JOB NO. 1202.0600	% 100 %

0-35

CLERK D. CORDON	12/17/94	UNIT LEVEL 3	REF 0000
JOHN DUND, WILCOXSON	12/17/94	U.S. DEPARTMENT OF ENERGY	
HELEN F. HICKER	12/14/94	Regional Contracting Office	
		Prepared for U.S. ARMY CORPS OF ENGINEERS, Forto Wade District	
		By: MONTGOMERY WATSON	
		284E P&ID	
		CLOSED LOOP COOLING-5	
		UNIT 4 W-252 PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL	
		F	284-E
		ES-252-A	ACD-35
		120°	DE10

	F
	E
	D
	C
	B
	A

NOT USED

- A) OPERATOR TURNS HS-P-101(102) TO STOP
- B) OPERATOR AT LCU/LOI GENERATES STOP
- C) ONE OF THE PUMP DIAGNOSTIC PARAMETERS EXCEED THE SETPOINT (OPERATOR RESET REQUIRED PRIOR TO ANOTHER ATTEMPT TO START)

PUMP P-105 (006) STARTS WHEN EITHER:

- A) OPERATOR TURNS HS-P105 (P105) TO THAT POSITION
- B) HS-P105 (P106) IN AUTO AND SIG GENERATES START/AUTO SIGNAL WHEN SEQUENCING ENABLE IS ON

A) OPERATOR TURNS HANDSWITCH TO STOP AT MCC
 B) HANDSWITCH AT MCC IS IN AUTO AND OPERATOR AT LCU/LOI GENERATES STOP SIGNAL
 C) TEMPERATURE REACHES LOW SETPOINT

PUMP P-105 (106) STOPS WHEN EITHER (

- A) OPERATOR TURNS HS-P105 (P
- B) OPERATOR AT LCU/LOICENER
- C) PUMP SUCTION PRESSURE P1

PRESSURE SETPOINT

PUMP P-103 (04) STARTS WHEN EITHER:
A) OPERATOR TURNS HS-P-103 (1)
THAT POSITION

A) OPERATOR TURNS HS-P-103 (THAT POSITION

B) HS-P-103 (1104) IS IN AUTO AND GENERATES START/AUTO SIGNAL (VIBRATION, BEARING TEMPERATURE, SETPOINT AND PUMP ALTERN

PUMP P-103 (04) STOPS WHEN EITHER (

PUMP P-103 (104) STOPS WHEN EITHER (

- A) OPERATOR TURNS HS-P-103 (
- B) OPERATOR AT LCU/LOGIC CENTER
- C) ONE OF THE PUMP DIAGNOSTIC SETPOINT (OPERATOR RESET ATTEMPT TO START)
- D) TANK TK-1 LEVEL SWITCH LSL

PUMP P-107 (108) STARTS WHEN EITHER OF THE FOLLOWING OCCURS:

- A) OPERATOR TURNS HS-P107 (P108) TO START AND HOLDS IN THAT POSITION
- B) HS-P107 (P108) IS IN AUTO AND OPERATOR AT LCU/LOI GENERATES START/AUTO SIGNAL AND LEVEL (LI-TK3) IS NOT AT LOW LEVEL AND PUMP ALTERNATOR PERMISSIVE ENABLE IS ON

SAMPLER PUMP ON/OFF CONTROL - LO.

A) OPERATOR TURNS HS-PIOT (PI08) TO STOP

VALVE LCV OPENS WHEN:
A) TANK LEVEL IS BELOW LOW
THAT POSITION

LEVEL LCV CLOSES WHEN:

A) TANK LEVEL IS ABOVE HIGH

NOT USED

VALVE LCV OPENS WHEN EITHER OF THE FOLLOWING OCCUR:

- A) OPERATOR TURNS HS- TO
- B) EXISTING FIRE CONTROL TANK IS

VALVE LCV CLOSES WHEN EITHER OF

- A) OPERATOR TURNS HS- TO CL
- B) EXISTING BLOWDOWN TANK LE
- C) HEAT EXCHANGER OUTLET IS

VALVE TCV OPENS WHEN THE FOLL
A) OPERATOR TURNS HS- TO

VALVE TCV CLOSING WHEN THE FOLLOWING OCCUR:

- A) OPERATOR TURNS HS- TO CLOSE
- B) DRAIN LINE TEMP SWITCH TRIP

1

O-37

DESIGNED BY J. JACKSON		DATE 12/7/94	PROJECT W-252 PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL	
CHECKED BY D. WILCOXSON		DATE 12/7/94	U.S. DEPARTMENT OF ENERGY	
DESIGNED BY F. HINKER		DATE 12/14/94	Richland Operations Office	
SAFETY			Prepared for U.S. ARMY CORPS OF ENGINEERS, Wabash District	
BY			By: MONTGOMERY WATSON	
DATE			282E P&ID	
DRAWN BY L. BENNETT		DATE 12/15/94	RESERVOIR LEVEL CONTROL	
REV		DESCRIPTION	REV	DATE
1		000005.dgn	23BENACD24JAHN	
DATE			DATE	
F		282-E	DATE	ES-252-ACD-37
NONE			1202.0610

EQUIPMENT ASSOCIATED WITH MAIN EQUIPMENT NO. HAVE SAME SUFFIX

0-38

DESIGNED BY: D. GORDON 12/7/94		PROJECT LEVEL: 3		DATE: 0000	
DRAWN BY: D. WILCOXSON 12/7/94		U.S. DEPARTMENT OF ENERGY			
CHECKED BY: F. HENNER 12/14/94		Richland Operations Office			
		Prepared for: U.S. ARMY CORPS OF ENGINEERS, Wako Wako District			
		By: MONTGOMERY WATSON			
DATE: 0000		283E P&ID			
DRAWN BY: L. BENNETT 12/15/94		FLOCCULATION AND FILTERS			
PROJECT: F 283-E		SHEET NO.: 0000		ES-252-ACD-38	
DATE: 0000		SHEET NO.: 0000		0

NOTES:

0-39

PREPARED FOR: U.S. ARMY CORPS OF ENGINEERS, Waco, Waco District BY: MONTGOMERY WATSON	
283E P&ID SOLIDS WASTE HANDLING	
DRAWN BY: L. BENNETT DATE: 12/15/94	PROJECT: ES-252-ACD-39 SHEET: 0 SCALE: NONE JOB NO: 1202.0580

NO.	REV.	DESCRIPTION	REV. DATE	REV. APPROVALS	APPROVED FOR DATE
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INTERLOCK LOGIC DESCRIPTION

SAMPLER P-4 STARTS WHEN EITHER OF THE FOLLOWING OCCURS:

- A) OPERATOR TURNS LOCAL HANDSWITCH HS-P-4 TO START
- B) HS-P-4 IN REMOTE AND DCS SOFTWARE FLOW TOTALIZER INDICATES PREDETERMINED FLOW DISCHARGED
- C) DCS SOFTWARE TIMER OR LOGICAL TIMER HAS ELAPSED

SAMPLER P-4 STOPS WHEN EITHER OF THE FOLLOWING OCCURS:

- A) OPERATOR TURNS HANDSWITCH HS-P-4 TO STOP
- B) FLOW TOTALIZER RESETS

PUMP P-3 RUNS WHEN EITHER OR THE FOLLOWING OCCURS:

- A) WHEN LOCAL HS IS IN 'HAND' POSITION
- B) WHEN LCU HS IS IN 'RUN' POSITION WHEN LOCAL HS IS IN 'REMOTE'
- C) AND LEVEL IS ABOVE V-NOTCH

PUMP P-3 STOPS WHEN EITHER OF THE FOLLOWING OCCURS:

- A) LOCAL HS IN 'OFF'
- B) LOCAL HS IN 'AUTO' AND LEVEL DROPS BELOW V-NOTCH

O-40

DESIGNED BY: D. GORDON 12/7/94		SHEET NO. 3		OF 0000	
DRAWN BY: D. WILCOXSON 12/7/94		U.S. DEPARTMENT OF ENERGY			
CHECKED BY: F. HANER 12/14/94		Nuclear Operations Office			
PROJECT: ES-252 PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL		Prepared for: U.S. ARMY CORPS OF ENGINEERS, Vicksburg District			
BY: L. BENNETT 12/15/94		By: MONTGOMERY WATSON			
TITLE: 284E P&ID		EFFLUENT FLOW METERING AND SAMPLING			
PROJECT NO.: ES-252		SHEET NO.: 284E		OF 0000	
DATE: 12/02/06		REVISED: 12/02/06		BY: 1

SECTION
SCALE IN FEET
12" 0 5'

FLOOR PLAN
LCU BUILDING
241-A TANK FARM AND 244-AR VAULT

SCALE IN FEET
12" 0 5'

SIDE ELEVATION

SCALE IN FEET
12" 0 5'

END ELEVATION

SCALE IN FEET
12" 0 5'

SECTION
SCALE IN FEET
12" 0 1' 2' 3' 4'

NAME	
DATE

D ELEVATION

SCALE IN FEET

0 5'

SECTION

SCALE IN FEET
12" 0

SIDE ELEVATION

SCALE IN FEET

0 1 2 3 4 5

O-41

DESIGNED	D. MAGLEJCIC	SHEET NO.		SHEET LEVEL	3	EAT	0000
SEAL DRUP	P. NAYLOR	12/19/94		U.S. DEPARTMENT OF ENERGY NUCLEAR REGULATORY COMMISSION			
DESIGN	F. FINKER	12/16/94		Prepared for ULS ADPMT GROUP OF ENGINEERS, P.O. BOX 1 DISTRICT BY J. MATHIEGHEIT WATSON			
CHECKED	*						
DATE							
SCALE							
APPROVED FOR SUBMITTAL	L. BENNETT	12/16/94		LCU BUILDING ARCHITECTURAL PLANS AND ELEVATIONS - I			
PROJECT - W-252 PHASE BLOOD EFFLUENT TREATMENT AND DISPOSAL							
NO.	REV.	DATE	NO.	REV.	DATE	NO.	REV.
W-252	*****		ES-252	ACD-4I		0	
FIRM - AEC CONSULTING		MAP NO.		1702.0630		SHEET 3 OF 1

SECTION B
SCALE IN FEET
0 5

FLOOR PLAN
COMPRESSOR COOLER BUILDING
242-A EVAPORATOR

SCALE IN FEET
0 5

SECTION B
SCALE IN FEET
0 5

0-42

DESIGNED BY D. MAGLEDC		SCALE 3		SHEET 0000	
DRAWN BY P. NAYLOR 12/1/94		U.S. DEPARTMENT OF ENERGY			
CHECKED BY F. HARKER 12/15/94		Richmond Operations Office			
PROJECT NO. 0		Prepared for U.S. ARMY CORPS OF ENGINEERS, New Orleans District			
SHEET NO. 0		By: MONTGOMERY WATSON			
DATE 0		LCU BUILDING			
SHEET NO. 0		ARCHITECTURAL PLANS AND ELEVATIONS - 2			
CHECKED BY L. BENNETT 12/15/94		PROJECT: W-252 PHASE B LIQUID EFFLUENT TREATMENT AND DISPOSAL			
DATE 0		SHEET NO. 0		SHEET NO. 0	
APPROVED FOR CONSTRUCTION		F W-252		ES-252-ACD-42	
DATE 0		SCALE AS SHOWN		JOB NO. 1202.0610	
DATE 0		SHEET 1		OF 1	

TITLE		NUMBER		DATE		REVISIONS		DATE		BY		CHECKED		DATE		BY		CHECKED		DATE		BY	
16.05		18-JAN-1995																					
FILE		/usr2/proj/252acd/252acd42.dgn		JOB CODE		0		DATE		0		DATE		0		DATE		0		DATE		0	

PLOT SCALE:

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ABBREVIATIONS

- GPLI -GENERAL PURPOSE LAN INTERFACE
- LAN -LOCAL AREA NETWORK
- LCU -LOCAL CONTROL UNIT
- LOI -LOCAL OPERATOR INTERFACE
- MODEM -MODULATOR/DEMODULATOR
- OCS -OPERATOR CONTROL STATION

NOTE:

1. DURING DEFINITIVE DESIGN PHASE EVALUATION WILL BE MADE TO COMBINE INTERFACE COMPONENTS - LCU, MODEM & GPLI WITH W-049H/C-018H SYSTEM WHICH MIGHT RESULT IN COST SAVINGS.

0-43

DESIGNED BY J. JACKSON 12/1/94		PROJECT LEVEL 3		SHEET 0000	
FOR LEO D. WILCOXSON 12/7/94		U.S. DEPARTMENT OF ENERGY			
CHECKED BY F. HINKER 12/14/94		Richland Operations Office			
		Prepared for U.S. ARMY CORPS OF ENGINEERS, Wabbe Wabbe District			
		By: MONTGOMERY WATSON			
INSTRUMENTATION INTERFACE TELECOM BLOCK DIAGRAM					
PROJECT W-252 PHASE II LIQUID EFFLUENT TREATMENT AND DISPOSAL					
SCALE NONE		SHEET NO. 7000		JOB NO. ES-252-ACD-43	
DATE		BY		REV. NO. 0	

NO.	REV.	DESCRIPTION	REV.	DATE	REV.	DATE
1	1	1w252ya.dgn	2	2/28/95	3	3/24/95