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241SY102 RETRIEVAL SYSTEM PROJECT W-211 INITIAL
TANK RETRIEVAL SYSTEMS

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Engineer/Constructor Description of Work for Tank 241-SY-102 Retrieval System, Project W-211, Initial Tank Retrieval Systems

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Abstract: This document provides a description of work for the design and construction of a waste retrieval system for Tank 241-SY-102. The description of work includes a working estimate and schedule, as well as a narrative description and sketches of the waste retrieval system. The working estimate and schedule are within the established baselines for the Tank 241-SY-102 retrieval system. The technical baseline is provided in Functional Design Criteria, WHC-SD-W211-FDC-001, Revision 2.

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ENGINEER/CONSTRUCTOR DESCRIPTION OF WORK
TANK 241-SY-102 RETRIEVAL SYSTEM

PROJECT W-211
INITIAL TANK RETRIEVAL SYSTEMS

Prepared for
Westinghouse Hanford Company

February 1996
(Issue D)

Subcontract WHC-380393

Prepared by
ICF Kaiser Hanford Company
Richland, Washington

W211DOW

W211DOW
ENGINEER/CONSTRUCTOR DESCRIPTION OF WORK
FOR
TANK 241-SY-102 RETRIEVAL SYSTEM
PROJECT W-211
INITIAL TANK RETRIEVAL SYSTEMS

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Double-Shell Tank Retrieval Projects

2/27/96
Date

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Appendix B.	Cost Estimate Summary
Appendix C.	Project Summary Schedule
Appendix D.	Tank Data Sheet
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ACRONYMS AND ABBREVIATIONS

ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ALC	air lift circulator
ATP	acceptance test procedure
CCTV	closed-circuit television
CDR	conceptual design report
CFR	Code of Federal Regulations
DACS	data acquisition and control system
DOE	U.S. Department of Energy
DST	double-shell tank
EA	environmental assessment
EIS	environmental impact statement
EPA	Environmental Protection Agency
FDC	functional design criteria
FHA	fire hazards analysis
HDW-EIS	Hanford Defense Waste Environmental Impact Statement
HVAC	heating, ventilating, and air-conditioning
ICE	instrumentation/control/electrical
ICF KH	ICF Kaiser Hanford Company
I/O	input/output
ITRS	Initial Tank Retrieval Systems
LANL	Los Alamos National Laboratory
LCCA	life cycle cost analysis
MCC	motor control center
MOV	motor operated valve
NaOH	sodium hydroxide
NEC	National Electrical Code
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
PC	personal computer
PIV	post indicator valve
PLC	programmable logic controller
PNNL	Pacific Northwest National Laboratory
PSAR	preliminary safety analysis report

ACRONYMS AND ABBREVIATIONS (Continued)

PSE	preliminary safety evaluation
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RCS	Retrieval Control System
RFAR	radio fire alarm reporter
RL	U.S. Department of Energy, Richland Operations Office
SA	safety assessment
SAR	safety analysis report
SEL	Safety Equipment List
SIS-EIS	Safe Interim Storage Environmental Impact Statement
SST	single-shell tank
TEC	total estimated cost
TMACS	Tank Monitoring and Control System
TWRS	Tank Waste Remediation System
TWRS-EIS	Tank Waste Remediation System Environmental Impact Statement
VFD	variable frequency drive
WAC	Washington Administrative Code
WBS	work breakdown structure
WHC	Westinghouse Hanford Company

ENGINEER/CONSTRUCTOR DESCRIPTION OF WORK

TANK 241-SY-102 RETRIEVAL SYSTEM

PROJECT W-211 INITIAL TANK RETRIEVAL SYSTEMS

1.0 INTRODUCTION

1.1 BACKGROUND

Project W-211, "Initial Tank Retrieval Systems," (ITRS) is a fiscal year 1994 Major Systems Acquisition that will provide systems for retrieval of radioactive wastes from ten double-shell tanks (DSTs) at the U.S. Department of Energy (DOE) facility on the Hanford Site in Richland, Washington. The contents of these tanks are a combination of supernatant liquids and settled solids that must be mixed prior to transferring the waste to alternative storage, evaporation, pretreatment, or immobilization-treatment facilities. The ITRS will install systems to mobilize the settled solids and transfer wastes out of the tanks. The ITRS supports tank waste treatment and disposal by providing feed to processing plants, allows for consolidation of tank solids to create additional DST storage capacity, and supports continued safe storage of tank waste.

The original ITRS scope included waste retrieval systems for Tanks SY-101, SY-103, AW-101, AN-103, AN-104, AN-105, AN-106, AZ-102, AY-102, and AP-101. At the outset of the project, SY-101 was the first tank scheduled for retrieval because of the desire to passively mitigate the tank's flammable gas safety issue by retrieval and dilution. In support of the expedited schedule for the Tank SY-101 retrieval system, a conceptual design report (CDR) was prepared for that tank in September 1993 (CDR-001, ref 1), followed by a CDR for the remaining nine tanks in March 1994 (CDR-002, ref 2). Upon receipt of Key Decision 1, Title I design was initiated for the Tank SY-101 retrieval system. This design was integrated with equipment already installed by the

mitigation program, whereby the existing mitigation pump provided the waste mixing function and project W-211 provided for waste removal and dilution.

Upon completion of Tank SY-101 Title I design (TDR-001, ref 3) in March 1995, it was apparent that a decision was imminent to continue active mitigation of SY-101 with the mitigation pump instead of pursuing passive mitigation by retrieval and dilution. In order to place the project in a better position to support the likely new priorities for waste consolidation and privatized processing plant feed, TDR-001 was expanded by Supplement 1 (ref 4) to include generic bounding retrieval system features to provide a preliminary design basis for Title II design for any DST. Supplement 2 to TDR-001 (ref 5) was prepared to update the ten-tank ITRS scope and estimated cost by incorporating the design improvements developed during the Title I and Supplement 1 efforts.

In October 1995, the decision was finalized to continue with active mitigation of Tank SY-101 and defer retrieval until needed to provide processing plant feed. This decision was coupled with cancellation of Project W-236A, "Multi-Function Waste Tank Facility." To safely manage tank space without the new project W-236A DSTs, a "path-forward" task force recommended that Tanks SY-102, AW-105, and AZ-102 be retrieved in the near-term to consolidate tank waste, thereby creating additional DST storage capacity. In accordance with this recommendation, Tanks 106-AN and 101-AP were replaced with Tanks SY-102 and AW-105 in the project W-211 scope. Because of the need to retrieve Tank SY-102 before the planned receipt of SST complexed waste in 1998, Tank SY-102 is now the first tank scheduled to receive a project W-211 retrieval system.

1.2 PURPOSE

The purpose of this document is to describe the definitive design and construction work relating to Tank 241-SY-102 to be performed by the onsite engineer/constructor. Definitive design (Title II) started in January 1996.

2.0 SUMMARY

2.1 TECHNICAL SUMMARY

The portion of project W-211 described in this document applies to the retrieval of waste from Tank 241-SY-102. The tank contents will be mixed by two mixer pumps installed in the tank. After the tank contents are mixed, the waste will be diluted as required and pumped to the cross-site transfer line installed by project W-058, "Cross-Site Transfer Line."

The scope of work for Tank 241-SY-102 includes the design, procurement, and installation of the following items:

- Two mixer pumps for mobilizing the settled solids.
- A transfer system for transferring waste from the tank.
- An ICE Building to house electrical and instrumentation equipment and the operator stations.
- An operator station that includes functions to monitor, alarm, and control the retrieval systems for each tank.
- *Instrumentation to measure the physical characteristics of the waste prior to and during transfers.*
- Interfacing with existing instrumentation that is critical to the transfer process.
- Piping jumpers inside Valve Pits A and B.

- Equipment and containers for removal, cleaning, decontamination, transport, storage, and burial of in-tank components and soil. The existing flexible receiver equipment will be used to remove in-tank components.
- Utility tie-ins for retrieval operations (electrical power, water, and telecommunications).
- Site preparation and modifications to accommodate the removal and installation of equipment.
- A replacement thermocouple tree that will withstand mixer pump jet forces.
- In-tank CCTV system.
- A dilution system to bring waste properties into compliance with transfer line specifications. (For Tank 241-SY-102, this will be provided by project W-058.)
- Flush capability for the transfer piping (provided by project W-058).

The actual operation of the retrieval system will be performed by tank farm operations and is not within the ITRS scope of work.

2.2 COST SUMMARY

The total estimated cost (TEC) for the Tank 241-SY-102 waste retrieval system is \$20.18 million, including escalation and 23% contingency (see Appendix B. Major cost elements are shown in Table 1.

TABLE 1

MAJOR COST ELEMENTS	
Activity	Amount (million)
Title II Design	\$3.41
Title III Design	1.36
Procurement	3.36
Construction	12.05
Total	\$20.18

Costs for project management, permitting and safety, other project cost (OPC) activities are not included in the table. They can be found in the project W-211 ten-tank total project cost (TPC) estimate (ref 17, dated January 5, 1996).

2.3 SCHEDULE SUMMARY

The overall project schedule extends from the start of Title II design on January 22, 1996 to the start of retrieval operations in August 1998 (see Appendix C). Schedule milestones are shown in Table 2. Key Decision 2 was approved on January 19, 1996.

TABLE 2

SCHEDULE MILESTONES	
Activity	Date
Key Decision 2, Notice to Proceed, Title II	January 22, 1996
Issue Procurement Specs	March 29, 1996
Intermediate Design Package	October 21, 1996
Key Decision 3A (C-2), Start Construction	January 2, 1997
Title II Design Complete	March 31, 1997
Key Decision 3B (C-1)	April 28, 1997
Construction Complete	March 31, 1998
Start Operations	August 28, 1998

3.0 TECHNICAL BASELINE

The portion of project W-211 outlined in this document provides a waste retrieval system for Tank 241-SY-102. Modifications to the existing Central Pump Pit 241-SY-02A and Valve Pits 241-SY-A and 241-SY-B, and the addition of the mixer pumps, a transfer system, ICE Building, caustic supply system (by project W-058), and related site infrastructure will be required. The technical requirements for the design and installation of this equipment are established in the Functional Design Criteria (ref 13). Quality assurance requirements are described in the Title I report (ref 3) and the Quality Assurance Program Plan (ref 14).

Two new mixer pumps will be installed on slab foundations at grade above Risers 5A and 5B. Each pump will be a duplicate of the mixer pump being installed by Project W-151, "Tank 101-AZ Waste Retrieval System," in Tank 241-AZ-101. Each pump will be capable of pumping waste at a flow of approximately 5,182 gpm through each of two, horizontally opposed discharge nozzles. The main performance requirement of the pumps is to achieve a maximum $U_o D$ of $29.4 \text{ ft}^2/\text{sec.}$, where $U_o D$ is a measure of the energy of the waste stream leaving the discharge nozzle. This level of mixing energy is designed to mobilize most of the settled solids. Each mixer pump will be equipped with a 300-hp motor and AFC to permit operation from 25% to 100% of full speed. The mixer pumps will rotate slowly to sweep the bottom of the tank.

The new transfer pump to be installed in Central Pump Pit 241-SY-02A will be capable of transferring slurry at a rate of 140 gpm from the tank to the project W-058 booster pump in the 6251-A Diversion Box. While in-tank dilution is planned for Tank 241-SY-102, the pump will allow for future in-line dilution at the pump intake. A piping jumper and instrumentation within the pit will provide recirculation of the waste to determine transferability by measurement of flow and pressure and the ability to route waste to Valve Pits 241-SY-A and 241-SY-B for further analysis and ultimate cross-site

transfer. All electrical equipment located inside the central pump pit will be suitable for the approved NEC classification of the pit.

Valve Pits 241-SY-A and 241-SY-B jumpers will be reconfigured to provide new instrumentation and a routing for cross-site transfer. The existing intra-farm transfer capabilities will be maintained. Once the waste is determined to be transferable in Central Pump Pit 241-SY-02A, it will be routed to Valve Pit 241-SY-A. The waste routing will still be in a recirculation mode to the tank through Valve Pit 241-SY-B where the temperature, pressure, flow, viscosity, and density will be measured. When the waste characteristics meet cross-site transfer requirements, the waste will be routed into the cross-site transfer line. All electrical equipment located inside the pit will be suitable for the approved NEC classification of the pit.

The ICE Building will provide the control center for all retrieval operations and the electrical distribution equipment that will supply power to the new pumps and equipment.

A caustic supply system will be provided for dilution of the tank waste. For Tank 241-SY-102, project W-211 will utilize the caustic mixing system now being designed by project W-058. This system will utilize an existing 47,000-gal storage tank and provide diluent at the tank waste temperature at a pH of 11 to avoid thermal shock and unwanted chemical reactions. The system will also provide heated diluent for pre-heating the cross-site transfer line before a transfer and for flushing the cross-site transfer line after a transfer.

Other site improvements include transfer lines for diluent between Valve Pits A and B, electrical and instrumentation distribution systems, and utility upgrades.

3.1 WBS 5.A.1, TITLE II: DESIGN

An engineering work plan has been prepared for Title II for Tank 241-SY-102 (ref 6). The plan includes an engineering statement of work; an engineering cost estimate; and a *working design schedule* that is integrated into the baseline schedule for engineering, procurement, and construction.

3.2 WBS 5.A.2, TITLE III: ENGINEERING SERVICES DURING CONSTRUCTION

Planning for Tank 241-SY-102 Title III will begin in spring 1996. The planning will be based on Tank 241-SY-101 Title III detailed planning.

3.3 WBS 5.A.3, PROCUREMENT

WHC will procure long-lead items such as mixer pumps and transfer pumps with variable frequency drives (VFDs), control system, CCTV, burial boxes, and thermocouples. Two of the original five specifications are not required for Tank 241-SY-102: P-2, Booster Pump, has been deleted, and P-4, Boiler, is deferred to the second tank, Tank 241-AW-105. The following procurement actions are planned for Tank 241-SY-102:

3.3.1 P-1 Transfer Pump

The transfer pump will be a vertical turbine type similar to existing models used in the tank farms. It will be designed to provide a maximum of 140 gpm of waste slurry to the project W-058 booster pump in the 6241-A Diversion Box and will have a 40-hp motor controlled by a VFD.

3.3.2 P-3 Control System

The control system includes hardware such as programmable logic controllers (PLCs), ICE Building instrument enclosures, alarm annunciators and operator interfaces, Tank 241-SY-102 and caustic dilution system instrument enclosures, and instrument terminal boxes for the valve pits, central pump pit, and mixer pumps. The applications software programmed by ICF KH will be included. Though estimated as part of the P-3 specification, certain pieces of

conventional off-the-shelf equipment may be purchased directly by WHC for ICF KH use.

3.3.3 P-5 Mixer Pumps

Project W-211 will use the project W-151 mixer pump design and procurement specification for Tank 241-SY-102. The project W-151 mixer pump is presently undergoing run-in testing at the Hanford Site. The pumps will be designed for a flow of approximately 10,364 gpm of waste at a design point of 20% volume solids and will have 300-hp motors.

3.3.4 Burial Containers

Project W-211 will require the procurement of flexible receiver bags for use on the existing flexible receiver system, and burial containers for the following contaminated equipment to be removed from the tank:

- One transfer pump
- One slurry feed pump
- Two airlift circulators (ALCs)
- One thermocouple

Procurement of these containers will be based on the existing project W-151 design; no procurement specification (P-Spec) will be prepared. Standard burial containers will also be provided for contaminated construction debris and consumable items such as rags and tools.

3.3.5 Thermocouples

Project W-211 will remove a thermocouple tree from Tank 241-SY-102 because it would not be able to withstand the forces imparted by impingement of the mixer pump jet. The thermocouple tree will be replaced with a functional equivalent designed by ICF KH for operation in the mixer pump environment. Fabrication specifications will be placed on the drawings.

3.3.6 CCTV

The project will provide a CCTV camera to allow viewing and video recording of the retrieval operation. The camera will be designed and furnished by WHC, with utility design and installation by ICF KH.

3.4 WBS 5.A.4, CONSTRUCTION

Construction will be divided into two packages: in-farm construction and the ICE Building. In-farm construction, which involves tank-intrusive demolition and work in contaminated areas, will be performed by ICF KH construction forces. Installation of the ICE Building, which is outside the SY Tank Farm fence, will be by an offsite fixed-price contractor.

3.4.1 WBS 5.A.4.1, In-Farm Construction

3.4.1.1 General Support

ICF KH construction forces will provide general construction support including erecting and dismantling of greenhouses, providing shielding, handling of low-level waste generated during construction, and mobilization.

3.4.1.2 Sitework

Sitework includes the removal of equipment from the tank, replacement of the thermocouple tree, and installation of yard piping (process and utility) and conduit inside the SY Tank Farm perimeter fence.

Equipment will be removed from Tank 241-SY-102 because, in most cases, it will not be able to withstand the mixer pump jet forces or because it will interfere with installation of the project W-211 equipment. Equipment to be removed consists of a transfer pump from Riser 3, a slurry feed pump from Riser 24, two air lift circulators from Riser 12, and a thermocouple from Riser 4. A sludge weight assembly must be lifted out of the way of the mixer pump discharge path.

The existing flexible receiver system used to remove in-tank equipment under project W-151 will be used to remove equipment from Tank 241-SY-102. The system includes a high pressure spray wash to remove contamination as the component is withdrawn from the tank; a bag deployment device to deploy the receiver bag as the component is lifted up through it; and a bag crimping device that gathers and seals the lower end of the bag to prevent escape of contamination. The bagged component will be set down horizontally on a carriage and slid into a shielded storage/burial container that will be transported on a trailer to the Central Waste Receiving Facility for storage. Experience with project W-151 indicates that decontamination of the flexible receiver system after use will be required. Maximum use will be made of existing components such as the flexible receiver system (spray ring, hot water generator, bag deployment, and crimping devices), carriage, and transport trailer. The bags and containers will be purchased by project W-211.

The thermocouple tree will be replaced with a sturdier, functionally equivalent model that is able to operate in the mixer pump environment. Recent experience has shown that installation time in the farm can be substantially reduced by extensive mock-up testing and training at the Cold Test Facility (CTF), therefore, this is planned for project W-211. Training time also allows for time to modify work procedures, develop special remote tools, or to create temporary shielding to minimize radiation exposure to the craft workers.

Removal of the slurry feed pump from Pit 02E will require decontamination of the pit. Methods similar to those used successfully for pit decontamination on Project W-320, "Tank 241-C-106 Sluicing," will be used.

Existing Line SL-180 between Valve Pits A and B will be removed and replaced. The diluent supply line to Valve Pit A will be installed by project W-058. The process piping will provide for recirculation of the slurry from the valve pits back to the tank until the slurry meets cross-site transfer line specifications and can be transferred.

Reference Drawings:

ES-211SY2-C1	Area Map and Drawing List
ES-211SY2-C2	Civil Site Plan
ES-211SY2-C3	Civil Enlarged Plan and Sections
ES-211SY2-M3	Piping Tank 241-SY-102 Plan
ES-211SY2-N1	Electrical Site Plan, Tank 241-SY-102
ES-211SY2-N2	Electrical One Line Diagram

In the cost estimate, sitework includes the following items:

- Thermocouple removal from tank, including provision for construction craft training at the CTF.
- New thermocouple installation, including craft training at the CTF.
- Lifting of the sludge weight assembly to avoid interference with mixing operations.
- Utility piping, including the installation of a new 1-1/2-in. raw water line to the mixer pumps for seal lubrication.
- Process piping which is the replacement of line SL-180.

3.4.1.3 Mixer Pumps

The Tank 241-SY-102 design is based on use of the project W-151 mixer pump which is a high capacity, low-head pump for mobilizing, dispersing, and blending the settled solids. Two mixer pumps will be provided, each with a 300-hp motor and VFD, for operation at 25% to 100% of full speed.

The inlet and outlet of each pump will be close to the bottom of the tank to facilitate mobilization of the settled solids. Nozzles will be provided at the

pump suction for initial lowering of the pump into the solids and for clearing any waste lumps that may be obstructing the pump inlet.

Each pump will be supported structurally by a platform, which in turn is supported by a slab foundation at grade. Beneath the platform, a spray wash assembly will mount directly onto the riser flange without the need to cut the riser. An expansion joint will be attached to the spray wash system flange and to the underside of the platform to provide a seal between the tank and ambient air. Above the platform will be the turntable assembly and its drive motor, and the pump motor itself. The turntable will allow 180 degrees of rotation about a vertical axis, so that the two opposed nozzles will sweep a complete circle.

At the beginning of installation, an impact load limiter will be placed between the top of the pump support platform and the mixer pump and then removed as one of the final steps of installation, i.e., when the pump is mounted to the support platform. During pump removal, the impact load limiter will be re-installed. The mixer pump support platform will be designed to be compatible with the flexible receiver device that will be employed during pump removal.

Signals from the mixer pump will be routed to a field terminal box and then to the ICE Building through the field I/O instrument enclosure. The mixer pumps and turntable motors will be controlled by VFDs in the ICE Building. The PLC in the ICE Building will send and receive signals to and from the VFDs for controlling and monitoring the motor speed, starting, and stopping. Instrumentation will be provided to measure the temperature and vibration of the mixer pump motor bearings, and turntable position.

Reference Drawings:

ES-211SY2-M1 Piping Process Flow Diagram, Trans/Diluent/Flush/Recirc.
ES-211SY2-M3 Piping Tank 241-SY-102 Enlarged Plan, Sect & Detail

In the cost estimate, installation of two mixer pumps in Tank 241-SY-102 consists of the following:

- **Mixer Pump Platforms**

Mixer pumps will be installed on slabs at grade. This WBS element includes excavation, forming and pouring the foundations, fabrication of the mixer pump support platforms, and installation of the platforms.

- **Spray Ring Installation**

High pressure spray rings will be fabricated and installed on the top of each of the two mixer pump risers for future decontamination of the mixer pumps that are withdrawn from the tank. High pressure wash water will be provided by the existing flexible receiver system.

- **Mixer Pump Installation**

The two mixer pumps will be supported by the platforms. This WBS includes craft training at the CTF.

- **Seal Lubrication System**

The mixer pumps require pressurized water to lubricate mechanical seals and bearings on the mixer pumps. A 1/2-in. line will be installed from a new mixer pump water supply enclosure to each of the mixer pumps since there is inadequate space in the existing 241-SY-271 Building for the required instruments, filters, and valves.

- **Electrical**

Electrical provides 480 V power to the mixer pump and turntable motors through armored cables in Yellow Jacket (or equivalent) cable protectors.

Electrical also provides for instrumentation field element hookup; wiring to the instrument terminal boxes; and wiring from the terminal boxes to the Tank 241-SY-102 instrument enclosure which will also be run at grade in cable protectors.

3.4.1.4 Central Pump Pit 241-SY-02A

Central Pump Pit 241-SY-02A will house the transfer pump and associated jumper arrangements to allow waste retrieval from the tank and to provide recirculation back to the tank or transfer to Valve Pit 241-SY-A.

The transfer pump will be a vertical turbine type similar to existing models used in the tank farms. The pump will have inlet bowl dilution capabilities and a return line for recirculation. The return leg will terminate at a height designed to maximize uniform mixing. Provisions will be made for attachment of a high-pressure spray wash system during pump removal for decontamination.

The pump will be designed to withstand the impingement forces of the mixer pump discharge, thereby not overstressing the tank riser; will be designed to provide 140 gpm to the project W-058 booster pump; will have a VFD to allow controlled startup and flow; and will be fabricated from stainless steel.

The jumpers in the pit will be designed to allow startup of the pump and waste recirculation back to the tank prior to sending it to Valve Pit 241-SY-A. Recirculation will allow the instruments to determine if the pump is operating correctly and to verify that the waste can be pumped to Valve Pit 241-SY-A without the possibility of plugging the transfer line.

Electrically actuated MOVs will be installed in the jumpers to allow remote routing of the waste. Standard PUREX type connectors will be used for the remote installation and removal of the jumpers. The waste will be transferred to Valve Pit 241-SY-A through an existing 3-in. transfer line. The lines will have flushing capabilities, and backflushing will be accomplished through the

pump. The piping jumpers in the pit will be constructed of stainless steel to facilitate decontamination. The jumpers, including the instrumentation, will be balanced for remote installation and removal.

Signals associated with Central Pump Pit 241-SY-02A will be routed to and from the pit through the AC and DC instrumentation terminal boxes located next to the pit. The transfer pump will be controlled by an adjustable frequency controller located in the ICE Building. The PLC in the ICE Building will send and receive signals to and from the adjustable frequency controller for controlling and monitoring the motor speed, starting and stopping, and other control signals as necessary. *Instrumentation will be provided to measure the power/ampereage drawn by the pump motor.*

Two MOVs with position indication devices will be installed to control and monitor the direction of waste discharged from the transfer pump. The MOVs allow the transfer pump to recirculate between the pit and the tank or transfer waste to Valve Pit 241-SY-A.

Pressure and flow measurement devices will be provided in the discharge line of the transfer pump to allow monitoring of the transfer pump for proper operation before the waste is transferred to Valve Pit 241-SY-A.

Reference Drawings:

ES-211SY2-M2, Sh 2	Piping/Instr. P&ID, Tank 241-SY-102
ES-211SY2-M4	Jumper Arrangement, Central Pump Pit
ES-211SY2-M8	Assembly, 142-SY-102 Transfer Pump

In the cost estimate, work at the central pump pit includes the following:

- **Demolition**

The interior of the pit will be subjected to a high-pressure washdown and wipe. Jumpers removed from the pit will be bagged and transported to *temporary storage*.

- **Cover Blocks**

The existing two-part cover block will be removed for disposal and a new cover block will be fabricated.

- **Equipment Removal**

One transfer pump will be removed from Riser 3 and one slurry feed pump from Riser 24; two ALCs will be removed from Riser 12. The existing flexible receiver system will be used to contain the devices as they are withdrawn from the tank. Then, each piece of bagged equipment will be placed on a carriage, slid into a burial container, and transported to the Central Waste Receiving Facility. Project W-211 will purchase flexible receiver bags, carriages, and storage/burial containers. The flexible receiver system and transport trailer already exist.

- **Jumper Fabrication**

Three 3-in. jumpers will be fabricated for the central pump pit: H-5-1, J-3-5, and G-6. Nozzle H will allow addition of diluent and intra-farm recirculation from the valve pit back to the tank. Nozzle J will allow for waste transfer. The two jumpers will be interconnected in the pit to allow for in-tank recirculation. Blank connectors will be provided for future in-line dilution should the need arise.

- **Jumper Installation**

This WBS provides for installation of piping and electrical jumpers. Electrical jumpers will provide power to MOVs and instruments.

- **Transfer Pump Installation**

This WBS includes installation and support for the transfer pump.

- **Electrical**

Electrical includes 480 V power for the transfer pump motor that will be through *armored cable in Yellow Jacket (or equivalent) cable protectors* at grade. Electrical also includes conduit and wiring from the tank farm instrument enclosure to the pit terminal boxes, connection of the *instrumentation field elements*, and power for operation of the CCTV camera.

- **Nitrogen System**

This is a bottle nitrogen system to supply a dry-running mechanical seal on the transfer pump.

3.4.1.5 Valve Pits A and B

Valve Pit A

The jumper arrangement in Valve Pit 241-SY-A will allow for waste transfer to Valve Pit 241-SY-B and *caustic solution routing for transfer line flushing* or in-tank dilution at the transfer pump. Jumper configuration will maintain current SY Tank Farm transfer system routings.

The existing two-part cover block will be replaced with a two-part, intrusion-resistant cover block design similar to those used at other tank farms. The *new cover block* will require additional penetrations for remote valve handles. Preliminary shielding calculations based on the source term for Tank 241-SY-102 waste have determined that an equivalent of 24 in. of concrete is required to meet the requirement of a 0.2 mrem/hr radiation field around the structure. The new cover blocks for Valve Pit 241-SY-A will have a minimum thickness of 24 in. The existing pit walls are 12 in. thick.

A concrete curb and steel plates will be placed around the pit perimeter to meet the shielding thickness requirements for the pit walls.

All signals associated with Valve Pit 241-SY-A will be routed to and from the pit through a new instrumentation enclosure in the vicinity of Valve Pit 241-SY-A. Several MOVs with position-indicating devices will be installed in the jumpers to control and monitor the direction of waste flow. The jumper arrangements and MOVs will allow various transfer routings within the SY Tank Farm. The instrumentation signal processing devices for the equipment in Central Pump Pit 241-SY-02A and Valve Pits 241-SY-A and 241-SY-B will be housed in the Tank 241-SY-102 instrument enclosure. The enclosure will house the remote I/O devices that are connected to the instrumentation and control devices. The enclosure will be environmentally controlled for operation of the electrical equipment inside.

Valve Pit B

Valve Pit 241-SY-B will contain the instrument tree that monitors the waste properties to ensure compliance with the requirements necessary for transfer from the SY Tank Farm.

The existing two-part cover block will be replaced with a two-part intrusion-resistant cover block design similar to those used at other tank farms. The new cover block will require additional penetrations for remote valve handles.

Preliminary shielding calculations based on the source term for Tank 241-SY-102 waste have determined that an equivalent of 24 in. of concrete is required to meet the requirement of a 0.2 mrem/hr radiation field around the structure. The new cover blocks for Valve Pit 241-SY-B will have a minimum thickness of 24 in. The existing pit walls are 12 in. thick. A concrete curb and steel plates will be placed around the pit perimeter to meet the shielding thickness requirements for the pit walls.

Stainless steel jumpers will be utilized to transport waste. They will be attached using the PUREX type connectors to the existing nozzles. The jumpers, including the instrumentation, will be balanced for remote installation and removal.

All signals associated with Valve Pit 241-SY-B will be routed to and from the pit through the instrumentation enclosure located in the vicinity of Valve Pit 241-SY-A. Instrumentation to measure waste temperature, flow, pressure, density, and viscosity will be installed in the discharge line to ensure that waste properties are met before transfer from the SY Tank Farm. Several MOVs with position-indicating devices will be installed in jumpers to control and monitor the direction of waste and caustic solution flow.

Reference Drawings:

ES-211SY2-M1	Piping Process Flow Diagram Trans/Diluent/Flush/Recirc
ES-211SY2-M2, Sh 3	Piping/Instr. P&ID, Valve Pit 241-SY-A
ES-211SY2-M2, Sh 4	Piping/Instr. P&ID, Valve Pit 241-SY-B
ES-211SY2-M5	Jumper Arrangement, Valve Pit 241-SY-A, Plan & Section
ES-211SY2-M6	Jumper Arrangement, Valve Pit 241-SY-B, Plan & Section

In the cost estimate, Valve Pits A and B will require the following modifications and installation:

- **Excavation and Backfill**

Valve Pit A will be excavated for the replacement of line SL-180.

- **Demolition**
Cover blocks will be removed for disposal, and pits will be given a high-pressure washdown to reduce exposure. Replacement cover blocks will be fabricated.
- **Jumper Fabrication — A Pit**
Eight jumpers are required for Valve Pit A. Fabrication of a trunnion guide assembly for remotely locating the jumpers at the proper nozzles is included.
- **Jumper Installation - A Pit**
The trunnion guide and jumpers will be installed in Pit A. Electrical connections to field elements are included.
- **Jumper Fabrication - B Pit**
Ten jumpers will be required for the B Pit.
- **Jumper Installation - B Pit**
Mechanical and electrical installation of B Pit jumpers will be performed.
- **Electrical**
Wiring between the tank instrument enclosure and the pit AC and DC terminal boxes, and the hookup of field elements are included.
- **ICE Building Electrical**
This WBS provides for termination of 480 V feeders and connections for mixer and transfer pumps power supplies, and connections for instrumentation and MOVs.

- **Acceptance Test Procedures**

The estimate includes allowances for acceptance testing of construction forces work in the central pump pit, valve pits, mixer pumps, and ICE Building.

- **Burnout**

An allowance for burnout is provided based on the assumption that the pits can be decontaminated to a background radiation level of 15 mR or less.

3.4.2 WBS 5.A.4.2, ICE Building

An ICE Building will be provided for the SY Tank Farm. The building will house the VFDs for the pumps in the mixing and transfer system, various electrical equipment, the PLC, and the operator control stations.

The ICE Building will be a 24- by 32-ft preengineered, rigid-frame, metal building located outside the SY Tank Farm perimeter fence. The clearance height to the lowest roof structure will be 10 ft above the finished floor elevation of 672 ft 10 in.

The foundation system will consist of individual footings and piers with a continuous perimeter foundation wall. Footings will be placed at a depth not to exceed that of the turned down slab edge at the existing instrument house and will be tied together by the 8-in. perimeter foundation wall. Footings will be steel reinforced concrete approximately 3 ft 6 in. square by 1 ft 4 in. thick. The floor slab will be a steel reinforced 6-in. thick concrete slab-on-grade.

The exterior building surface will be constructed with a factory-finished galvanized sheet metal skin system (24-gauge minimum thickness) with exposed fasteners and attached to a steel rigid-frame structure. The galvanized steel components of the ICE Building will be factory prepainted to extend the life of the galvanized coating.

The roof structure will have exposed rafters and beams and insulation covered purlins. Exposed steel framing members will be factory prime painted. Sheet metal exterior walls and roofing, standard steel doors and frames, and the building perimeter foundation will be insulated to meet ASHRAE Standard 90 thermal transmittance criteria. Standard steel doors and frames will be fitted with site compliant locksets, hinges, closers, weatherseals, thresholds, and astragal for double door stiles.

Interior wall surfaces will be covered by vinyl scrim faced R-11 fiberglass blanket insulation and will be protected from the floor to 8 ft above the floor by a prefinished metal liner. A separate operations room, separate from the electrical room, will be provided.

The concrete floor will be covered with vinyl floor tiles and bordered by a 4-in. high topset rubber base. The new monitoring stations will be equipped with ergonomically-designed stools or chairs for operator use.

The ICE Building will house the adjustable frequency drives, manual transfer switches, MCCs, PLC cabinet, instrument power conditioners, monitoring stations, fire protection panel, and mini-power center. A 480 V, 3-phase, 60-Hz electrical supply will feed the MCC in the ICE Building. No emergency or backup power is required for the building.

The retrieval control system will monitor and control retrieval operations in the SY Tank Farm. The retrieval control system will include a PLC with associated I/O devices and an operator interface station. The PLC and the operator interface station will be located in the operations room in the ICE Building. The PLC will monitor and control the operations associated with waste retrieval from the tank. Signals will be fed to the PLC through remote I/O devices at various locations in the SY Tank Farm. Communications between the remote I/O devices will be through a high-speed data highway.

The operator interface station will consist of two operator stations with industrial PCs. Either PC will allow the operator to monitor process parameters controlled or monitored by the PLC, initiate required control functions, annunciate alarm conditions, and view trending information. The PCs will retain a historical database of trending information that can be downloaded for further analysis. Graphical screens will be designed to provide a visual indication of the transfer system. The system will have a misrouting prevention control that provides alarms and interlocks to prevent improper operation of the system.

The retrieval control system will have the following interfaces with other systems to ensure proper coordination during retrieval operations:

- The communications protocol of the PLC will allow for communications with the project W-058 cross-site transfer line. The exact nature of the information to be communicated between the two systems will be determined as the projects progress.
- An interface with TMACS may be set up if necessary. This communications link would be similar to those already established for TMACS.

Fire protection for the ICE Building will comply with DOE Order 6430.1A, RLIP 5480.7, and applicable codes and standards. An automatic fire alarm and sprinkler system will be installed in the ICE Building. The fire alarm system will include manual pull stations at each exit, smoke detection, sprinkler system waterflow alarms, sprinkler system control valve tamper supervision, and audible and visual alarm warning devices. Fire alarms will be connected to an RFAR box to transmit alarms to the Hanford Fire Department.

Sufficient space separation between existing buildings and the ICE Building will meet the required space separation for exposure protection in compliance with

NFPA 80A. Exits, exit signs, and emergency lighting will be provided to comply with NFPA 101. A new fire hydrant will be installed. At least two fire hydrants will protect the ICE Building, and hose lays from hydrants to all portions of the ICE Building will be no more than 300 ft. Concrete-filled barrier posts set in compacted soil will be provided to prevent damage to the fire hydrants and PIV.

The ICE Building will have a 7.5-ton packaged heat pump unit installed as the main heating and cooling system. The heating and cooling system for the ICE Building will be ducted for air distribution into high heat areas. A second HVAC unit will be dedicated to the operations room.

Reference Drawings:

ES-211SY2-C4	Civil ICE Building Plan, Section and Elevations
ES-211SY2-K1	HVAC Tank SY-102 ICE Building Plan and Elevation
ES-211SY2-N3	Electrical ICE Building Equipment Layout
ES-211SY2-N4	Electrical ICE Building Grounding Layout
ES-211SY2-N5	Electrical ICE Building Lighting Layout
ES-211SY2-N6	Electrical ICE Building Conduit Layout
ES-211SY2-Y1	Instrumentation SY-102 Control System Cable Block Diagram

In the cost estimate, the following WBS elements comprise the ICE Building:

- **Sitework**
Approximately 125 ft of insulated 6-in. steam line (no asbestos) will be removed and disposed of as municipal waste.
- **Structure**
This element includes forming and pouring the foundation and embedded conduits, and erection of the ICE Building shell.

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

Two HVAC units will be installed in the ICE Building; one for the operator control room and one for the electrical room.

- **Fire Protection**

The offsite contractor will design and install a fire alarm and fire protection system complete from the raw water supply tie-in to the sprinkler heads.

- **Electrical**

This WBS includes conventional lighting and convenience power for the ICE Building, including provision for telephone and HLAN hookups. It provides for running 480 V wiring from the tie-in point in the existing 252-S Building to the ICE Building.

3.4.3 WBS 5.A.4.3 Caustic Supply System

Tank 241-SY-102 will utilize the diluent supply system to be installed for project W-058, which requires caustic solution at a pH of 11. An existing 47,000-gal storage tank will be used.

3.4.4 WBS 5.A.4.4 Burial

This WBS provides for burial of one transfer pump and one slurry feed pump, two ALCs, and a thermocouple, as well as waste from pit decontamination and low-level waste from cover blocks and general construction work in the farm.

4.0 ASSUMPTIONS AND UNCERTAINTIES

This section addresses the *assumptions and uncertainties* from CDR-001 (ref 1), CDR-002 (ref 2) and the Title I Summary Design Report (ref 3) as they relate to the Tank 241-SY-102 retrieval system. Those that have not changed are included by reference and those that have changed are discussed more fully.

4.1 CONCEPTUAL DESIGN REPORT 001

4.1.1 Uncertainties from the Safety Assessment

Open issue items from the SA (ref 7) that could affect Tank 241-SY-102 design are shown in quotes below, followed by a short discussion of each:

- **"Completion of Criticality Safety Reviews Prior to Operation of Transfer System"**

Criticality will be addressed for Tank 241-SY-102. PNNL is currently working on this question. No design impacts are anticipated.

- **"Finalization of Seismic, Pump Disintegration, and Load Drop Calculations Utilizing the "As-Built" Component Weights and Configurations"**

Impact limiters will be used on the slab-mounted mixer pumps. Seismic and load drop calculations will be finalized for the transfer and mixer pumps during the design of same.

- **"Finalization of Line Plugging, Diluent Addition, Explosive Gas Mixtures, and Fluid Addition Studies to Determine if Unacceptable Risks Exist"**

A process instrumentation loop test being conducted by PNNL will provide a good amount of empirical data on how the solids content and viscosity of the waste affect line plugging and pumpability. Simulants that exhibit actual tank waste characteristics will be used.

- **"Inventory and Remove Incompatible Materials from Pits"**

There will be no aluminum or any other material used in the pump pits above the tank that could cause a chemical reaction if dropped into the waste.

- **"Perform Cooling Requirements Review per Section 4.4.2.5.2"**

Thermal modeling of Tank 241-SY-102 has demonstrated that a tank cooling system is unnecessary (ref 9) to compensate for heat addition from mixer pump operation. Preliminary results indicate that the Tank 241-SY-102 mixed mean waste temperatures will increase in a slow, controlled, and easily observable manner, and that tank cooling is not required if mixing operations are controlled either automatically by the RCS or administratively.

4.1.2 Other Uncertainties

Other pertinent uncertainties and assumptions from CDR-001 are:

- **Equipment Removal**

Estimating the cost of removing existing equipment can be done with a much greater degree of confidence because of the lessons learned from projects W-151 and W-320.

- **Interfaces**

Project W-058 is now in construction and will interface with project W-211 in two general areas: the valve pits and the control system. Project W-211 piping will tie-in with the project W-058 cross site transfer lines in Valve Pits 241-SY-A and 241-SY-B. The preparation of as-built drawings for the nozzles provided by project W-058 constrains the design of the project W-211 jumpers that will connect to the project W-058 nozzles. Project W-211 will subsequently install its own jumpers in the pump and valve pits. It may be possible to locate the control center for project W-058 in the SY ICE Building provided by project W-211. There will be a document that discusses interfaces in greater detail (ref 10).

Project W-211 will use some of the equipment designed by project W-151, such as that for contaminated equipment removal. In addition, the mixer pump specification developed for project W-151 will be used as a basis for Tank 241-SY-102 mixer pump procurement.

- **Backup Power**

A backup power source is not planned for project W-211.

4.2 CONCEPTUAL DESIGN REPORT 002

The following uncertainties are discussed in Section XVI of CDR-002.

- **Safety Classification**

The PSE (ref 11) and the SEL (ref 12) were developed concurrently with CDR-002. The safety classifications remain the same. The pump and valve pit are listed as Safety Class 1 for operation (cover blocks must be in place while waste is being transferred through the pit piping). The cover blocks are listed as Safety Class 2 for construction (must be of sufficient strength to undergo stresses of lifting and placing over pits, especially the tank pit covers). The mixer pump pits and their covers are Safety Class 2, and the mixer pumps and instrumentation are Safety Class 3.

- **Use of Supernatant for Dilution**

This uncertainty was not addressed in CDR-001. From page 293 of CDR-002: "Supernatant from adjacent tanks in the tank farm will be assessed for its quality and available volume for its potential use as diluent feed in lieu of raw water." "To achieve waste minimization, utilization of the supernatant from other tanks should be analyzed ... " Using supernatant from either Tank 241-SY-101 or Tank 241-SY-103 for dilution of Tank 241-SY-102 is not planned.

4.3 TITLE I DESIGN SUMMARY REPORT

4.3.1 Project Assumptions/Uncertainties

The assumptions identified below were set forth in section 2.7 of the Title I report.

- 2.7.2.2 Cross connection control is still not a requirement. There are no hazardous materials in the ICE Building that could contaminate the water supply.
- 2.7.2.3 The existing raw water supply is still assumed to be sufficient for fire protection.
- 2.7.2.4 The SY Tank Farm construction areas will be characterized for hazardous classification of the materials that will be handled and buried before construction begins.
- 2.7.2.5 The 6-in. steam line will be removed by project W-211 if it is not removed by the time construction begins.
- 2.7.2.6 The ICE Building is outside the farm and therefore design will be outsourced and construction will be under a fixed-price contract.
- 2.7.2.8 As-building the nozzle locations for the central pump pit and the two valve pits will be done when project W-058 opens the pits in mid-1996. If as-built dimensions are required for jumper design sooner than mid-1996, pit photogrammetry and existing jumper as-builts will be used to locate pipe nozzles. The same applies to the central pump pit. This type of as-built work will be funded separately by WHC.

- 2.7.3 Safety Assessment/Safety Class Uncertainties
Miscellaneous equipment not directly addressed in the PSEL is assumed to be classified Safety Class 3.

Aluminum will not be used in the central pump pit.

4.3.2 Engineering Assumptions

Engineering assumptions are identified in Appendix C of the Title I report (ref 3). An updated list of engineering assumptions applicable to Tank 241-SY-102 are in Appendix A of the Engineering Work Plan (ref 6).

5.0 REFERENCES

1. Conceptual Design Report, "Initial Tank Retrieval Systems," Project W-211, prepared by Kaiser Engineers Hanford Company, Document No. WHC-SD-W211-CDR-001, Rev. 0, September 1993.
2. Conceptual Design Report, "Initial Tank Retrieval Systems," Project W-211, prepared by Kaiser Engineers Hanford Company, Document No. WHC-SD-W211-CDR-002, Rev. 0, February 1994.
3. Title I Design Summary Report, "Initial Tank Retrieval Systems," Project W-211, prepared by ICF Kaiser Hanford Company, Document No. WHC-SD-W211-TDR-001, Rev. 0, February, 1995.
4. Engineering Report, "Supplement 1 to Title I Design Summary Report, Initial Tank Retrieval Systems," Project W-211, prepared by ICF Kaiser Hanford Company, Document No. WHC-SD-W211-TDR-001, Rev. 0A, November 1995.

5. Engineering Report, "Supplement 2 to Title I Design Summary Report, Initial Tank Retrieval Systems," Project W-211, prepared by ICF Kaiser Hanford Company, Document No. WHC-SD-W211-TDR-001, Rev. 0B, November 1995.
6. Engineering Work Plan, "Initial Tank Retrieval Systems, Engineering Work Plan, Title II Services, Tank 241-SY-102," Project W-211, prepared by ICF Kaiser Hanford Company, Document No. W211EWP, Rev. 0, February 1996.
7. Safety Assessment, "Initial Tank Retrieval Systems," Project W-211, prepared by Westinghouse Hanford Company, Document No. WHC-SD-W211-SAD-001, Rev. A, June 1, 1995.
8. Technical Report, "The Effect of Dilution on the Gas Retention Behavior of Tank 241-SY-101 Waste," prepared by Pacific Northwest National Laboratory, Document No. PNL-10781/UC-2030.
9. Engineering Report, "Tank 241-SY-102 Waste Cooling Evaluation," Project W-211, prepared by ICF Kaiser Hanford Company, Document No. WHC-SD-W211-ER-002, Rev. 0, December 1995.
10. Engineering Report, "Interfaces for Tank 241-SY-102 Retrieval System," Project W-211, prepared by ICF Kaiser Hanford Company, February 1996, (draft).
11. Preliminary Safety Evaluation, "Initial Tank Retrieval Systems," Project W-211, prepared by Westinghouse Hanford Company, Document No. WHC-SD-W211-PSE-001, January 1994.

12. Safety Equipment List, "Initial Tank Retrieval Systems," Project W-211, prepared by Westinghouse Hanford Company, Document No. WHC-SD-SEL-W211-002, Rev. 0, January 1994.
13. Functional Design Criteria, "Initial Tank Retrieval Systems," Project W-211, prepared by Westinghouse Hanford Company, Document No. WHC-SD-W211-FDC-001, Rev. 2, January 1996.
14. Quality Assurance Program Plan, "Initial Tank Retrieval Systems," Project W-211, prepared by Westinghouse Hanford Company, Document No. WHC-SD-W211-QAPP-001, Rev. 1, December 1995.
15. Project Management Plan, "Initial Tank Retrieval System," Project W-211, prepared by Westinghouse Hanford Company, Document, Rev. 2, February 1996.
16. Preliminary Fire Hazards Analysis, "Initial Tank Retrieval Systems," Project W-211, prepared by Westinghouse Hanford Company, Document No. WHC-SD-W211-TI-002, Rev. 1, December 1995.
17. Conceptual Cost Estimate, "Initial Tank Retrieval System, File No. W211BAF2, Rev. 2, January 5, 1996.

APPENDIX A

Work Breakdown Structure

Project Summary Work Breakdown Structure

2/22/96

Project W-211, Initial Tank Retrieval Systems

A-1

Contractor Work Breakdown Structure

2/22/96

A-2

WHC-SD-W211-RD-001, Rev. 0

APPENDIX B

Cost Estimate Summary

ICF KAISER HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-211/P3H81B
FILE NO. W211BAF3

** TEST - INTERACTIVE ESTIMATING **
INITIAL TANK RETRIEVAL SYSTEM
CONCEPTUAL - TANK SY 102
DOE_R01 - PROJECT COST SUMMARY

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BY FCD/DEA/RDP/BAL/JED

COST CODE =====	DESCRIPTION =====	ESCALATED TOTAL COST =====	CONTINGENCY X =====	TOTAL =====	TOTAL DOLLARS =====
020	TITLE II	2,840,000	20	570,000	3,410,000
030	TITLE III (ADJUSTED TO MEET DOE 5100.4)	1,130,000 30,000	20	230,000	1,360,000 30,000
TOTAL DESIGN		4,000,000	20	800,000	4,800,000
460	IMPROVEMENTS TO LAND	100,000	30	30,000	130,000
501	BUILDINGS	430,000	27	120,000	550,000
550	OTHER STRUCTURES	2,320,000	24	560,000	2,880,000
600	UTILITIES	140,000	28	40,000	180,000
700	SPECIAL EQUIP/PROCESS SYSTEMS	8,780,000	23	2,030,000	10,810,000
810	DEMOLITION (ADJUSTED TO MEET DOE 5100.4)	650,000 -20,000	31	200,000 20,000	850,000
TOTAL CONSTRUCTION		12,400,000	23	3,000,000	15,400,000
TOTAL DESIGN & CONSTRUCTION COST (TEC)		16,400,000	23	3,800,000	20,200,000

TYPE OF
ESTIMATE

CONCEPTUAL

FEBRUARY 20, 1996

REMARKS:

ARCHITECT
ENGINEER

OPERATING
CONTRACTOR

(ROUNDED/ADJUSTED TO THE NEAREST " 10,000 / 100,000 " - PERCENTAGES NOT RECALCULATED TO REFLECT ROUNDING)

WHC-SD-W211-RD-001, Rev. 0

ICF KAISER HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-211/P3M81B
FILE NO. W211BAF3

** TEST - INTERACTIVE ESTIMATING **
INITIAL TANK RETRIEVAL SYSTEM
CONCEPTUAL - TANK SY 102
DOE_R02 - WORK BREAKDOWN STRUCTURE SUMMARY

PAGE 2 OF 12
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WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION % TOTAL	SUB TOTAL	CONTINGENCY % TOTAL	TOTAL DOLLARS
5A11	IN-FARM CONSTRUCTION (C1)	1129887	0	1129887	2.03	22940	1152827	1383388
5A12	ICE BUILDING (C2)	100022	0	100022	2.04	2036	102058	122464
5A13	CAUSTIC SUPPLY SYSTEM (C3)	2896	0	2896	2.04	59	2955	3546
5A14	ADVANCED PROCUREMENT SPECS	111680	0	111680	1.92	2148	113828	135437
5A15	DISC 21-34 SUPPORT ACTIVITIES	265008	0	265008	2.03	5379	270387	324466
5A16	DISC 35-65 SUPPORT ACTIVITIES	1162680	11434	1174114	2.03	23836	1197949	1437538
SUBTOTAL 5A1 TITLE II - 102 SY		2772173	11434	2783607	2.03	56398	2840004	3406839
5A21	ENGINEERING SUPPORT	394126	0	394126	5.32	20968	415094	498112
5A22	ACCEPTANCE INSPECTION	321838	0	321838	5.32	17122	338960	406752
5A23	PROJECT SUPPORT	357296	0	357296	5.32	19009	376305	451566
SUBTOTAL 5A2 TITLE III - 102 SY		1073260	0	1073260	5.32	57099	1130359	1356430
5A31	TRANSFER PUMPS - P1 102 SY	614556	0	614556	3.40	20895	635451	794314
5A33	RETR'VL CONTROL SYS - P3 102 SY	295278	0	295278	3.40	10039	305317	366381
5A35	MIXER PUMPS - P5 102 SY	1117156	0	1117156	3.40	37983	1155139	1386167
5A36	BURIAL CONTAINERS	407068	0	407068	3.40	13840	420908	547181
5A37	THERMOCOUPLES/CCTV	195576	0	195576	3.40	6650	202226	262894
SUBTOTAL 5A3 PROCUREMENT -		2629634	0	2629634	3.40	89407	2719041	3356937
5A41	IN-FARM CONSTRUCTION (CF) - 102 SY	8042486	0	8042486	5.18	416225	8458711	10511569
5A42	ICE BUILDING #1 (FP) - 102 SY	442410	107907	550317	5.32	29277	579594	734572
5A44	BURIAL - 102 SY	641896	0	641896	5.32	34149	676045	811254
SUBTOTAL 5A4 CONSTRUCTION -		9126792	107907	9234699	5.19	479651	9714350	12057395
SUBTOTAL 5A TANK - 102 SY		15601859	119341	15721200	4.34	682555	16403754	20177601
SUBTOTAL 5 CONSTRUCTION		15601859	119341	15721200	4.34	682555	16403754	20177601
PROJECT TOTAL		15,601,859	119,341	15,721,200	4.34	682,555	16,403,754	20,177,601

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WHC-SD-W211-RD-001, Rev. 0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-211/P3M81B
FILE NO. W211BAF3

**** IEST - INTERACTIVE ESTIMATING ****
INITIAL TANK RETRIEVAL SYSTEMS
CONCEPTUAL TANK 102-SY
DOE_R03 - ESTIMATE BASIS SHEET

PAGE 3 OF 12
DATE 02/20/96 08:59:36
BY FCD/DEA/RPD/BAL/JED

1. DOCUMENTS AND DRAWINGS

=====

DOCUMENTS:

DRAWINGS: TK SY-102 (5A):

CIVIL/STRUCTURAL ES-211SY2-C1, C2, C3 & C4; PIPING ES-211SY2-M1, M2 (SH.1 THRU 5), M3, M4, M5 & M6; HVAC ES-211SY2-K1
ELECTRICAL ES-211SY2-W1, W2 (SH.1 & 2), W3, W4, W5 & W6; INSTRUMENTATION ES-211SY2-Y1.

2. MATERIAL PRICES

=====

UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL. VENDOR INFORMATION WAS OBTAINED FROM CDR-002, TDR-001 REVS. 0,
0A AND 0B FOR THE FOLLOWING ITEMS:

1. PROGRAMMABLE CONTROLLER SYSTEM & COMPONENTS	8. LEVEL TRANSMITTER
2. FLUID MASS FLOW METER	9. ENCLOSURES & ACCESSORIES
3. THERMOCOUPLE ASSEMBLIES	10. POWER SUPPLY
4. PH TRANSMITTER ASSEMBLIES	11. MIXER PUMPS
5. VISCOSITY METER/TRANSMITTER	12. TRANSFER PUMPS
6. PRESSURE TRANSMITTER	
7. VORTEX FLOWMETER/TRANSMITTER	

3. LABOR RATES

=====

- A.) ICF-KH HOURLY RATES ARE BASED ON THE 1996 FISCAL YEAR BUDGET LIQUIDATION RATES AS ISSUED BY KEH FINANCE
(EFFECTIVE 10-01-95). SEE ALSO THE FY 1996 PLANNING RATES * (REPORT BGH87012).
- B.) BASE CRAFT RATES ARE AS ISSUED BY KEH FINANCE (EFFECTIVE 10-01-95). RATES INCLUDE FRINGE BENEFITS, LABOR INSURANCE, TAXES,
TRAVEL, DEPARTMENTAL OVERHEADS AND G&A.
- * SEE HANFORD SOFT REPORTING, FDS BUDGET GUIDELINE HANDBOOK, SECTION 2 - COMPANY INFORMATION, FY 1996 PLANNING RATES.

4. GENERAL REQUIREMENTS/TECHNICAL SERVICES/OVERHEADS

=====

- A.) ONSITE CONSTRUCTION FORCES GENERAL REQUIREMENTS, TECHNICAL SERVICES AND CRAFT OVERHEAD COSTS ARE INCLUDED AS A
COMPOSITE PERCENTAGE BASED ON THE ICF-KH ESTIMATING FACTOR, REVISION 1, FY96, DATED 10/01/95 THE TOTAL COMPOSITE
PERCENTAGE APPLIED TO ONSITE CONSTRUCTION FORCES LABOR, FOR THIS PROJECT, IS 52% FOR SHOP WORK AND FIELD WORK,
WHICH IS REFLECTED IN THE "OH&P/B&I" COLUMN OF THE ESTIMATE DETAIL.
- B.) FIXED PRICE CONTRACTOR OVERHEAD, PROFIT, BOND AND INSURANCE COSTS HAVE BEEN APPLIED AT THE FOLLOWING PERCENTAGES
AND ARE REFLECTED IN THE "OH&P/B&I" COLUMN OF THE ESTIMATE DETAIL:
- LABOR - 25-35% MATERIAL - 25-35% EQUIPMENT USAGE - 0% EQUIPMENT - 0% SUBCONTRACTS - 10%
- C.) THE SPECIAL WORK PROCEDURE (SWP) MARKUP FOR THIS PROJECT HAS BEEN APPLIED AT 40%. THIS IS USED TO COMPENSATE FOR
PRODUCT LOST DUE TO WORKING IN THE TANK FARM. PRODUCTIVITY IS LOST FOR SAFETY MEETINGS, PREJOB REVIEW, DRESS, SURVEY
OUT, TRANSPORTATION TO AND FROM FARM, AND LOADING OF TOOLS FOR TRANSPORT. ALONG WITH THESE ACTIVITIES, THERE ARE
OTHER RELAYS THAT ARE NOT ACCOUNTED FOR BY THIS PERCENTAGE: LATE ARRIVALS OF HPTS AND OPERATORS, ACCESS THROUGH
THE WRAM SYSTEMS, LARGE CREW (CHANGE TRAILER LIMITATIONS), CONFLICTS WITH WHC OPERATIONS, INITIAL PREJOB BRIEFINGS
WHICH CAN TAKE UP TO ONE HOUR, REASSIGNMENT OF PERSONNEL WHICH WILL CAUSE A REVIEW OF INITIAL PREJOB BRIEFING AND
QUESTIONS, LACK OF TRANSPORTATION, CHANGES IN FARM CONDITIONS, SAFETY CONCERNS, AND WEATHER.

5. ESCALATION

=====

ESCALATION PERCENTAGES WERE CALCULATED FROM THE AUGUST 1995 UPDATE OF THE ECONOMIC ESCALATION PRICE CHANGE INDICES FOR DOE
CONSTRUCTION PROJECTS AS PUBLISHED BY THE "OFFICE OF INFRASTRUCTURE ACQUISITION" FM-50.

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WHC-SD-W211-RD-001, Rev. 0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-211/PB9T14
FILE NO. W211BAF3

** TEST - INTERACTIVE ESTIMATING **
INITIAL TANK RETRIEVAL SYSTEMS
CONCEPTUAL TANK 102-SY
DOE_R03 - ESTIMATE BASIS SHEET

PAGE 4 OF 12
DATE 02/20/96 08:59:36
BY FCD/JJM/JPH/KLR/LGH

6. ROUNDING

=====

U.S. DEPARTMENT OF ENERGY - DOE ORDER 5100.4 PAGE 1-32 SUBPARAGRAPH (M), REQUIRES ROUNDING OF ALL GENERAL PLANT PROJECTS (GPP'S) AND LINE ITEM (LI) COST ESTIMATES. REFERENCE: DOE 5100.4, FIGURE 1-11, DATED 10-31-84.

7. REMARKS

=====

*** ESTIMATE IS BASED ON NO MORE THAN 1 TRANSFER HAPPENING CONCURRENTLY. *****

TK SY-102 (5A): PROCUREMENT & CONSTRUCTION

1. ASSUME 125 LF OF 6" STEAM LINE AT SY FARM WILL BE REMOVED BY FP CONTRACTOR.
2. ASSUME FIXED PRICE CONSTRUCTION AND CONSTRUCTION FORCES WORK WILL NOT REQUIRE ESCORTS.
3. ASSUME QC FOR THE WORK PERFORMED BY THE FIXED PRICE CONTRACTOR WILL BE PROVIDED BY THE FP CONTRACTOR.
4. ASSUME 100% WELD X-RAY FOR M-25 PIPING
5. ASSUME 10% WELD X-RAY FOR M-26A PIPING
6. ASSUME 5% WELD X-RAY FOR JUMPER PIPING
7. ASSUME NO PIPE WELD X-RAY FOR PIPING PERFORMED BY FIXED PRICE CONTRACTOR: FIXED PRICE CONTRACTOR WILL DYE-PEN 10% OF ALL WELDS.
8. ESTIMATE INCLUDES PUMP RUN IN COST AT MASF, SEE WBS 5A31A1 AND 5A35A1. COST IS BASED ON INFORMATION FROM PRO. W-151.

TK SY-102 (5A): ENGINEERING

A.) CIVIL/STRUCTURAL:

1. ALL DEMOLITION WORK IS BY THE ONSITE E/C.

B.) MECHANICAL:

1. IT WAS ASSUMED THAT EXISTING RETRIEVAL EQUIPMENT PURCHASED BY PROJECTS W-151, W-320 AND/OR MITIGATION PROGRAM WILL BE UTILIZED FOR TANK 102-SY.
2. BURIAL CONTAINERS WERE PROCURED FOR THE FOLLOWING ITEMS REMOVED FROM TK. SY-102.
 - a. THERMOCOUPLE
 - b. TRANSFER PUMP AND SLURRY FEED PUMP
 - c. AIR LIFT CIRCULATORS (2)
3. ALL REMOVED JUMPERS WILL BE WRAPPED IN PLASTIC AND PLACED IN STORAGE FOR LATER USE.

C.) ELECTRICAL:

1. THE INSTALLATION OF ELECTRICAL EQUIPMENT, WIRE, CABLE, CONDUIT, AND ACCOMPANYING FITTINGS IN THE ICE BUILDING #1 WILL BE INSTALLED BY THE ONSITE E/C TO MAINTAIN CONTINUITY WITH WORK PERFORMED IN TANK FARM AREA.
2. FOR SY-102 ELECTRICAL SUPPLY IS BY PROJECT W-322.

D.) ENGINEERING:

1. THIS DESIGN WILL REUSE THE W-151 DESIGNED EQUIPMENT. NO ALLOWANCE HAS BEEN MADE FOR DESIGN CHANGES SHOULD THE W-151 DESIGN BE MODIFIED.
2. PLEASE REFER TO ENGINEERING STATEMENT OF WORK FOR SY-102 ASSUMPTIONS, UNKNOWN, AND UNCERTAINTIES.

E.) RETRIEVAL EQUIPMENT:

1. THIS PROJECT IS PROVIDING BURIAL (HIC) CONTAINERS FOR REMOVAL OF EXISTING EQUIPMENT ONLY. THE PUMPS AND THERMOCOUPLES INSTALLED BY THE PROJECT WILL NOT BE REMOVED AT THE COMPLETION OF THE INITIAL TRANSFER.
2. BURIAL CONTAINER COSTS FOR THERMOCOUPLE TREE, AIR LIFT CIRCULATORS AND TRANSFER AND SLURRY PUMPS WERE PROVIDED BY WHC.
3. THE TRAILER THAT WILL TRANSPORT BURIAL CONTAINERS WILL BE PURCHASED BY 101-SY PORTION OF THE W-211 PROJECT.

F.) BURNOUT:

- EXPOSURE RATES FOR BURNOUT REVISED TO 15 MR AT VALVE AND TRANSFER PITS PER DSI FROM WHC DATED 8/19/93.

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WHC-SD-W211-RD-001, Rev. 0

ICF KAISER HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-211/P3M81B
FILE NO. W2118AF3

** TEST - INTERACTIVE ESTIMATING **
INITIAL TANK RETRIEVAL SYSTEM
CONCEPTUAL - TANK SY 102
DOE_R04 - COST CODE ACCOUNT SUMMARY

PAGE 5 OF 12
DATE 02/20/96 15:14:03
BY FCD/DEA/RDP/BAL/JED

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION % TOTAL	SUB TOTAL	CONTINGENCY % TOTAL	TOTAL DOLLARS
=====	=====	=====	=====	=====	=====	=====	=====	=====
020	TITLE II							
5A11	IN-FARM CONSTRUCTION (C1)	1129887	0	1129887	2.03	22940	1152827	20 230565 1383388
5A12	ICE BUILDING (C2)	100022	0	100022	2.04	2036	102058	20 20411 122464
5A13	CAUSTIC SUPPLY SYSTEM (C3)	2896	0	2896	2.04	59	2955	20 591 3546
5A14	ADVANCED PROCUREMENT SPECS	111680	0	111680	1.92	2148	113828	19 21606 135437
5A15	DISC 21-34 SUPPORT ACTIVITIES	265008	0	265008	2.03	5379	270387	20 54077 324466
5A16	DISC 35-65 SUPPORT ACTIVITIES	1162680	11434	1174114	2.03	23836	1197949	20 239591 1437538
TOTAL 020	TITLE II	2772173	11434	2783607	2.03	56398	2840004	20 566841 3406839
030	TITLE III							
5A21	ENGINEERING SUPPORT	394126	0	394126	5.32	20968	415094	20 83019 498112
5A22	ACCEPTANCE INSPECTION	321838	0	321838	5.32	17122	338960	20 67792 406752
5A23	PROJECT SUPPORT	357296	0	357296	5.32	19009	376305	20 75261 451566
TOTAL 030	TITLE III	1073260	0	1073260	5.32	57099	1130359	20 226072 1356430
460	IMPROVEMENTS TO LAND							
5A41	IN-FARM CONSTRUCTION (CF) - 102 SY	99381	0	99381	5.32	5287	104668	30 31400 136068
TOTAL 460	IMPROVEMENTS TO LAND	99381	0	99381	5.32	5287	104668	30 31400 136068
501	BUILDINGS							
5A42	ICE BUILDING #1 (FP) - 102 SY	331218	81481	412699	5.32	21955	434654	27 118749 553399
TOTAL 501	BUILDINGS	331218	81481	412699	5.32	21955	434654	27 118749 553399
550	OTHER STRUCTURES							
5A41	IN-FARM CONSTRUCTION (CF) - 102 SY	2201822	0	2201822	5.32	117138	2318960	24 557640 2876598
TOTAL 550	OTHER STRUCTURES	2201822	0	2201822	5.32	117138	2318960	24 557640 2876598

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WHC-SD-W211-RD-001, Rev. 0

ICF KAISER HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-211/P3M81B
FILE NO. W211BAF3

** TEST - INTERACTIVE ESTIMATING **
INITIAL TANK RETRIEVAL SYSTEM
CONCEPTUAL - TANK SY 102
DOE_R04 - COST CODE ACCOUNT SUMMARY

PAGE 6 OF 12
DATE 02/20/96 15:14:04
BY FCD/DEA/RDP/BAL/JED

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION % TOTAL	SUB TOTAL	CONTINGENCY % TOTAL	TOTAL DOLLARS
600 UTILITIES								
5A41	IN-FARM CONSTRUCTION (CF) - 102 SY	83887	0	83887	5.32	4463	30	114855
5A42	ICE BUILDING #1 (FP) - 102 SY	40626	9994	50620	5.32	2693	25	66641
TOTAL 600 UTILITIES		124513	9994	134507	5.32	7156	28	181496
700 SPECIAL EQUIP/PROCESS SYSTEMS								
5A31	TRANSFER PUMPS - P1 102 SY	614556	0	614556	3.40	20895	25	794314
5A33	RETR'VL CONTROL SYS - P3 102 SY	295278	0	295278	3.40	10039	20	366381
5A35	MIXER PUMPS - P5 102 SY	1117156	0	1117156	3.40	37983	20	1386167
5A36	BURIAL CONTAINERS	407068	0	407068	3.40	13840	30	547181
5A37	THERMOCOUPLES/CCTV	195576	0	195576	3.40	6650	30	262894
5A41	IN-FARM CONSTRUCTION (CF) - 102 SY	5039418	0	5039418	5.13	258486	23	6536823
5A42	ICE BUILDING #1 (FP) - 102 SY	66796	16432	83228	5.32	4428	25	109569
5A44	BURIAL - 102 SY	641896	0	641896	5.32	34149	20	811254
TOTAL 700 SPECIAL EQUIP/PROCESS SYSTEM		8377744	16432	8394176	4.60	386470	23	10814583
810 DEMOLITION								
5A41	IN-FARM CONSTRUCTION (CF) - 102 SY	617978	0	617978	4.99	30851	31	847225
5A42	ICE BUILDING #1 (FP) - 102 SY	3770	0	3770	5.33	201	25	4963
TOTAL 810 DEMOLITION		621748	0	621748	4.99	31052	31	852188
=====								
PROJECT TOTAL		15,601,859	119,341	15,721,200	4.34	682,555	23	20,177,601

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WHC-SD-W211-RD-001, Rev. 0

ICF KAISER HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-211/P3M81B
FILE NO. W211BAF3

** TEST - INTERACTIVE ESTIMATING **
INITIAL TANK RETRIEVAL SYSTEM
CONCEPTUAL - TANK SY 102
DOE_R05 - ESTIMATE SUMMARY BY CSI DIVISION

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DATE 02/20/96 15:14:17
BY FCD/OEA/RDP/BAL/JED

CSI	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION % TOTAL	SUB TOTAL	CONTINGENCY % TOTAL	TOTAL DOLLARS
=====	=====	=====	=====	=====	=====	=====	=====	=====
CONSTRUCTION								
01	GENERAL REQUIRMENTS	2346610	0	2346610	5.32	124840	21	3000784
02	SITWORK	469303	4771	474074	5.24	24849	29	645845
03	CONCRETE	354746	4704	359450	5.32	19124	33	504592
07	MOISTURE AND THERMAL	747	184	931	5.37	50	35	1323
08	DOORS, WINDOWS AND G	6084	1497	7581	5.32	403	35	10778
09	FINISHES	7949	1955	9904	5.32	527	35	14082
11	EQUIPMENT	2138780	0	2138780	3.40	72718	23	2727662
12	FURNISHINGS	8800	2165	10965	5.32	583	35	15590
13	SPECIAL CONSTRUCTION	53571	6235	59806	5.32	3182	33	83546
15	MECHANICAL	2973236	4850	2978086	4.96	147746	26	3948851
16	ELECTRICAL	1397389	81546	1478935	4.64	68678	25	1934596
20	BURNOUT	1999211	0	1999211	5.32	106358	20	2526683
21	CIVIL	288264	0	288264	2.52	7251	20	353458
22	ENVIRON ENGRG	29543	0	29543	3.08	910	20	36544
23	ARCHITECTUAL	29832	0	29832	3.76	1121	20	37142
26	FIRE PROT/SAFETY	36157	0	36157	3.22	1164	20	44784
27	PIPING/VESSEL	514430	0	514430	2.70	13878	20	633972
28	HVAC	37172	0	37172	3.48	1295	20	46157
29	INSTRUMENT	603354	0	603354	2.57	15485	20	742604
31	ELECTRICAL	342107	0	342107	2.70	9220	20	421593
32	SPECIF	25343	0	25343	2.31	586	20	31115
33	SPCLTY ENGRG	47791	0	47791	2.03	970	20	58514
34	CATHODIC PROTECTION	49626	0	49626	3.32	1650	20	61530
35	DESIGN ADMIN	436270	0	436270	2.42	10572	20	536210
40	PROJECT MANAGER	353827	0	353827	2.66	9411	20	435886
41	WORD PROCESSING	5395	0	5395	2.71	146	20	6651
44	ACCEPTNCE INSPECTION	343964	0	343964	5.11	17571	20	433842
45	PROJECT PLANNING	178486	0	178486	2.54	4539	20	219629
46	ESTIMATES	90552	0	90552	2.42	2190	20	111290
49	SUB/PROC	35828	0	35828	5.04	1807	20	45162
60	CF ADMINISTRATION	51726	0	51726	2.03	1050	20	63331
61	CM ADMINISTRATION	14902	0	14902	2.03	303	20	18245
62	SURVEY	17621	0	17621	2.03	358	20	21574
65	RECORDS MGMT/TURNOVER	65688	0	65688	3.86	2536	20	81869
66	AS-BUILDING	128455	0	128455	5.32	6834	20	162347
70	WORK ORDER	119100	11434	130534	2.03	2650	20	159820
TOTAL CONSTRUCTION		15,601,859	119,341	15,721,200	4.34	682,555	23	20,177,601

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ICF KAISER HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-211/P3M818
FILE NO. W211BAF3

** TEST - INTERACTIVE ESTIMATING **
INITIAL TANK RETRIEVAL SYSTEM
CONCEPTUAL - TANK SY 102
DOE_ROS - ESTIMATE SUMMARY BY CSI DIVISION

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BY FCD/DEA/RDP/BAL/JED

CSI DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	TOTAL	CONTINGENCY %	TOTAL	TOTAL DOLLARS
=====	=====	=====	=====	=====	=====	=====	=====	=====

15,601,859	119,341	15,721,200	4.34	682,555	23	3,773,863	20,177,601
=====	=====	=====	=====	=====	=====	=====	=====

PROJECT TOTAL

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-211/P89T14
FILE NO. W211BAF3

** TEST - INTERACTIVE ESTIMATING **
INITIAL TANK RETRIEVAL SYSTEMS
CONCEPTUAL TANK 102-SY
DOE_R06 - CONTINGENCY ANALYSIS BASIS SHEET

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DATE 02/20/96 08:59:46
BY FCD/DEA/RDP/BAL/JED

REFERENCE: ESTIMATE BASIS SHEET
COST CODE ACCOUNT SUMMARY

PAGES 3 - 4 OF 12
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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.

020 TITLE II

5A1 TITLE II 102 SY

A 20% CONTINGENCY WAS APPLIED DUE TO UNCERTAINTIES IN CHANGES TECHNOLOGY OVER THE LIFE OF THE PROJECT; INSTALLATION AND UTILIZATION OF EQUIPMENT TO BE INSTALLED BY OTHER PROJECTS, (eg. W-322, W-151, W-320); TANK WASTE CHARACTERIZATION (i.e. DOME LOADING, TANK TEMPERATURES, CHEMICAL AND PHYSICAL PROPERTIES, OPERATING CONDITIONS etc.); ACCURACY OF VALVE PIT NOZZLE AS-BUILT DIMENSIONS; AVAILABILITY OF W-058 NOZZLE AS-BUILT DIMENSIONS; CHANGES IN SAFETY REQUIREMENTS; SCOPE OF CTF AND MASF TRAINING/TESTING; AND DIFFERENCE BETWEEN AS-BUILT AND FIELD WALKDOWN INFORMATION.

030 TITLE III

5A2 TITLE III 102 SY

A 20% CONTINGENCY WAS APPLIED DUE TO UNCERTAINTIES IN TITLE II DESIGN (ABOVE); QUALITY, COMPLETENESS AND TIMELINESS OF RECEIPT OF VENDOR SUBMITTALS; AVAILABILITY AND ACCURACY OF EXISTING TANK FARM DRAWINGS; NEED FOR REVISED CONSTRUCTION METHODS TO MINIMIZE DOSE; REQUIREMENTS FOR H-14 ESSENTIAL DRAWINGS; AND SCOPE OF ACCEPTANCE/INSPECTION AND AS-BUILDING WORK.

AVERAGE ENGINEERING CONTINGENCY 20 %.

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WHC-SD-W211-RD-001, Rev. 0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-211/P89T14
FILE NO. W211BAF3

** TEST - INTERACTIVE ESTIMATING **
INITIAL TANK RETRIEVAL SYSTEMS
CONCEPTUAL TANK 102-SY
DOE_R06 - CONTINGENCY ANALYSIS BASIS SHEET

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BY FCD/DEA/RDP/BAL/JED

460 IMPROVEMENTS TO LAND
TOTAL 460 IMPROVEMENTS TO LAND 30% .
501 BUILDINGS
TOTAL 501 BUILDINGS 27% .
550 OTHER STRUCTURES
TOTAL 550 OTHER STRUCTURES 24% .
600 UTILITIES
TOTAL 600 UTILITIES 28% .
700 SPECIAL EQUIPMENT/PROCESS SYSTEMS
TOTAL 700 SPECIAL EQUIP/PROCESS SYSTEMS 23% .
810 DEMOLITION
TOTAL 810 DEMOLITION 31%

TOTAL PROJECT CONTINGENCY 23% .

CONTINGENCY WAS APPLIED TO THE LISTED COST CODES AND THEIR CORRESPONDING
WBS AT THE PERCENTAGES NOTED TO REFLECT UNCERTAINTIES IN: RADIOLOGICAL
CONDITIONS AT THE CENTRAL PUMP AND VALVE PITS AND IN THE TANK AT THE TIME
OF THE WORK; EFFECTIVENESS OF PIT DECONTAMINATION; REQUIREMENTS FOR
HOCK-UP TESTING, SPECIAL TOOLS, TEMPORARY SHIELDING; AVAILABILITY OF
ESSENTIAL SUPPORT PERSONNEL SUCH AS HPT'S, ESSENTIAL EQUIPMENT AND TOOLS;
AVAILABILITY AND RELIABILITY OF EQUIPMENT FROM OTHER PROJECTS; CHANGES IN
TRAINED CREW PERSONNEL; WEATHER; CHANGES IN WORK RULES AND PROCEDURES NOW
IN EFFECT BUT MAY BE DIFFERENT AT THE TIME OF CONSTRUCTION.

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WHC-SD-W211-RD-001, Rev. 0

ICF KAISER HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-211/P3M81B
FILE NO. W211BAF3

** TEST - INTERACTIVE ESTIMATING **
INITIAL TANK RETRIEVAL SYSTEM
CONCEPTUAL - TANK SY 102
DOE_R07 - ONSITE INDIRECT COSTS BY WBS

PAGE 11 OF 12
DATE 02/20/96 15:40:26
BY FCD/DEA/RDP/BAL/JED

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	CONTRACT %	ADMINISTRATION TOTAL	BID PACK PREP.	OTHER INDIRECTS	TOTAL INDIRECTS
=====	=====	=====	=====	=====	=====	=====	=====
5A1101	DRAWINGS	628159	0.00	0	0	0	0
5A1102	CALCS	284307	0.00	0	0	0	0
5A1103	C-SPEC	64444	0.00	0	0	0	0
5A1104	CHECKING	98768	0.00	0	0	0	0
5A1105	I.D.R.	18922	0.00	0	0	0	0
5A1106	COMMENT INCORPORATION	35287	0.00	0	0	0	0
5A1201	DRAWINGS	43446	0.00	0	0	0	0
5A1202	CALCS	2969	0.00	0	0	0	0
5A1203	C-SPEC	21577	0.00	0	0	0	0
5A1204	CHECKING	12480	0.00	0	0	0	0
5A1205	I.D.R.	11150	0.00	0	0	0	0
5A1206	COMMENT INCORPORATION	8400	0.00	0	0	0	0
5A1301	DRAWINGS	2027	0.00	0	0	0	0
5A1303	C-SPEC	869	0.00	0	0	0	0
5A1401	TRANSFER PUMP	11176	0.00	0	0	0	0
5A1403	CONTROL SYSTEM	51700	0.00	0	0	0	0
5A1404	MOBILE BOILER	1810	0.00	0	0	0	0
5A1405	MIXER PUMP	6324	0.00	0	0	0	0
5A1406	PROCUREMENT INPUT/SUPPORT	40670	0.00	0	0	0	0
5A1500	DISC 21-34 SUPPORT ACTIVITIES	265008	0.00	0	0	0	0
5A1600	DISC 35-65 SUPPORT ACTIVITIES	1162680	0.98	11434	0	0	11434
5A2100	ENGINEERING SUPPORT	394126	0.00	0	0	0	0
5A2200	ACCEPTANCE INSPECTION	321838	0.00	0	0	0	0
5A2300	PROJECT SUPPORT	357296	0.00	0	0	0	0
5A31A1	TRANSFER PUMPS - P1 102 SY	614556	0.00	0	0	0	0
5A33A1	RETR'VL CONTROL SYS - P3 102 SY	295278	0.00	0	0	0	0
5A35A1	MIXER PUMPS - P5 102 SY	1117156	0.00	0	0	0	0
5A36A1	FLEXIBLE RECIEVER BAGS	22660	0.00	0	0	0	0
5A36A2	BURIAL CONTAINERS	384408	0.00	0	0	0	0
5A37A1	THERMOCOUPLES	60696	0.00	0	0	0	0
5A37A2	CCTV CAMERA	134880	0.00	0	0	0	0
5A41A1	GREENHOUSE AND SUPPORT - 102 SY	1039228	0.00	0	0	0	0
5A41A2	MOBILIZATION - 102 SY	665486	0.00	0	0	0	0
5A41B1	THERMOCOUPLE REMOVAL - 102 SY	330423	0.00	0	0	0	0
5A41B2	THERMOCOUPLE INSTALL - 102 SY	63638	0.00	0	0	0	0
5A41B3	SLUDGE WT ASSY - 102 SY	63865	0.00	0	0	0	0
5A41B4	SLURRY PUMP REMOVAL - 102 SY	183695	0.00	0	0	0	0
5A41B5	PROCESS PIPING - 102 SY	129494	0.00	0	0	0	0
5A41B6	AIR LIFT CIRCULATOR RMVL - 102 SY	38095	0.00	0	0	0	0
5A41C1	MIXER PMP PLTFM PAD FAB/INSTALL	63623	0.00	0	0	0	0
5A41C2	SPRAY RING FAB/INSTALL - 102 SY	344583	0.00	0	0	0	0

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WESTINGHOUSE HANFORD COMPANY
JOB NO. W-211/P3MB1B
FILE NO. W211BAF3

** TEST - INTERACTIVE ESTIMATING **
INITIAL TANK RETRIEVAL SYSTEM
CONCEPTUAL - TANK SY 102
DOE_R07 - ONSITE INDIRECT COSTS BY WBS

PAGE 12 OF 12
DATE 02/20/96 15:40:26
BY FCD/DEA/RDP/BAL/JED

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	CONTRACT %	ADMINISTRATION TOTAL	BID PACK PREP.	OTHER INDIRECTS	TOTAL INDIRECTS
=====	=====	=====	=====	=====	=====	=====	=====
5A41C3	MIXER PUMP INSTALLATION - 102 SY	215872	0.00	0	0	0	0
5A41C4	HXR PMP WATER SUPPLY ENC - 102 SY	201170	0.00	0	0	0	0
5A41D1	DEMOLITION - 102 SY	74245	0.00	0	0	0	0
5A41D2	COVER BLOCKS - 102 SY	120324	0.00	0	0	0	0
5A41D3	XFER PUMP REMOVAL - 102 SY	374248	0.00	0	0	0	0
5A41D4	JUMPER FABRICATION - 102 SY	159950	0.00	0	0	0	0
5A41D5	JUMPER INSTALLATION - 102 SY	17759	0.00	0	0	0	0
5A41D6	RISER SHIELD PLUG - 102 SY	23288	0.00	0	0	0	0
5A41D7	TRANSFER PUMP INSTALLATION - 102 SY	267658	0.00	0	0	0	0
5A41D8	ELECTRICAL - 102 SY	65729	0.00	0	0	0	0
5A41D9	XFER PMP NITROGEN SYS. - 102 SY	28360	0.00	0	0	0	0
5A41E1	EXCAVATION/BACKFILL - 102 SY	83887	0.00	0	0	0	0
5A41E2	DEMOLITION - 102 SY	318566	0.00	0	0	0	0
5A41E3	JUMPER FABRICATION SY-A - 102 SY	305043	0.00	0	0	0	0
5A41E4	JUMPER INSTALLATION SY-A - 102 SY	63786	0.00	0	0	0	0
5A41E5	JUMPER FABRICATION SY-B - 102 SY	368482	0.00	0	0	0	0
5A41E6	JUMPER INSTALLATION SY-B - 102 SY	64602	0.00	0	0	0	0
5A41E8	DILUENT BACKFLOW PREVENTER - 102 SY	3858	0.00	0	0	0	0
5A41E9	ELECTRICAL - 102 SY	188827	0.00	0	0	0	0
5A41F1	ICE BUILDING ELEC. INST. - 102 SY	46524	0.00	0	0	0	0
5A41F2	ATP'S - 102 SY	128967	0.00	0	0	0	0
5A41G1	BURNOUT - 102 SY	1999211	0.00	0	0	0	0
5A42A1	SITE PREP - 102 SY	3770	0.00	0	0	0	0
5A42A2	STRUCTURE - 102 SY	76846	24.60	18905	0	0	18905
5A42A3	HVAC - 102 SY	12604	24.60	3101	0	0	3101
5A42A4	FIRE PROTECTION - 102 SY	28153	24.60	6926	0	0	6926
5A42A5	ELECTRICAL - 102 SY	321037	24.60	78975	0	0	78975
5A44A1	BURIAL - 102 SY	641896	0.00	0	0	0	0

PROJECT TOTAL

15,601,859

119,341

0

0

119,341

B-12

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APPENDIX C

Project Summary Schedule

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
PROJECT MILESTONES				
15A1KM	SY-102 KEY DECISION 2 - NTP	0	22JAN96	
15A1PM	SY-102 LONG LEAD PROCUREMENT SPECS	0		29MAR96
15A1DM	SY-102 INTERMEDIATE DESIGN PKGS	0		21OCT96
15A1M2	SY-102 KEY DECISION 3A - (C-2)	0		02JAN97
15A1M	SY-102 TITLE II DESIGN COMPLETE	0		31MAR97
15A1M3	SY-102 KEY DECISION 3B - (C-1)	0		28APR97
15A4M	SY-102 CONSTRUCTION COMPLETE	0		31MAR98
16A1M	TANK SY-102 OPERATIONAL	0		28AUG98
1.1 PROJECT MANAGEMENT				
1.1.1 O/C PROJECT MANAGEMENT				
1011101	WHC PROJECT MANAGEMENT	872	27DEC95	27AUG98
1.2.1 CAA PERMITS				
1.2.1 CAA PERMITS				
1012101	TANK SY-102 CAA PACKAGE	3	27DEC95	29DEC95
1012102	TANK SY-102 CAA AGENCY APPROVAL	190	02JAN96	30SEP96
1.2.3 SAFETY ASSESSMENT				
1.2.3 SAFETY ASSESSMENT				
1012301	SA REVISION FOR GENERIC FEATURES	66	27DEC95	29MAR96
1012302	DOE SA APPROVAL	127	01APR96	30SEP96
1.3.8 EA / EIS				
1.3.8 EA / EIS				
1013801	RESOLVE SY-102 CRITICALITY	130	27DEC95	28JUN96
1013802	ISSUE SUPPLEMENTAL SIS-EIS ROD	63	01JUL96	30SEP96
1.5.A TANK SY-102				
1.5.A.1 SY-102 TITLE II DESIGN				
TITLE II MILESTONES				
10000P5	P-5 IFA	0		11MAR96

102A

Project Start: 25DEC95
 Project Finish: 28AUG98
 Date: 25DEC95
 Plot Date: 23FEB96

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W-211 INITIAL TANK RETRIEVAL SYSTEMS
 TANK SY-102 E/C DESCRIPTION OF WORK
 INTEGRATED D/P/C SCHEDULE

Sheet 1 of 9

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C-2

APPROVED

C-4

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Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
41C4100	INSTALL NITROGEN SUPPLY SYSTEM - 5A	5	25SEP97	01OCT97
41C5400	BACKFILL ELECT TRENCHES	5	29SEP97	03OCT97
41C4200	INSTALL NITROGEN SUPPLY SYSTEM - 5B	5	30SEP97	06OCT97
41C5500	ELECTRICAL TERMINATIONS	10	07OCT97	20OCT97
C-1 TRANSFER PUMP				
41D1100	REMOVE CENTRAL PUMP PIT COVER BLOCKS	2	29APR97	30APR97
41D3100	TRANSFER PUMP REMOVAL TRAINING - CTF	20	29APR97	27MAY97
41D1200	DECON CENTRAL PUMP PIT -02A	10	01MAY97	14MAY97
41D1300	EXCAVATE AT CPP FOR NEW CORE DRILLS	5	15MAY97	21MAY97
41D1600	REMOVE JUMPERS IN CENTRAL PUMP PIT -02A	5	22MAY97	29MAY97
41D6100	FAB RISER SHIELD PLUG - 12" EXTENSION	10	28MAY97	10JUN97
41D3200	REMOVE TRANS PUMP & AIR LIFT CIRC	15	28MAY97	17JUN97
41D2100	BUILD NEW COVER BLOCKS FOR CPP	20	28MAY97	24JUN97
41D1400	CORE DRILL 2 NEW HOLES IN CPP	4	30MAY97	04JUN97
41D1500	INSTALL 2 NEW NOZZLES IN CPP	4	05JUN97	10JUN97
41D1550	AS-BUILD NOZZLES	2	11JUN97	12JUN97
41D1700	BACKFILL AT CENTRAL PUMP PIT	2	11JUN97	12JUN97
41D4200	SHOP FAB INSTR JUMPERS (5)	20	11JUN97	10JUL97
41D8100	HAND EXCAVATE FOR I/C CONDUIT	10	13JUN97	26JUN97
41D4100	SHOP FAB MECH JUMPERS (4)	20	13JUN97	14JUL97
41D7120	TRAINING - INSTALL TRANSFER PUMP IN CTF	20	18JUN97	17JUL97
41D8200	INSTALL ELECT TERMINAL BOX/EQUIP	4	27JUN97	02JUL97
41D8400	INSTALL INSTRUMENTS / CCTV	5	11JUL97	17JUL97
41D7130	INSTALL TRANSFER PUMP IN CPP	3	18JUL97	22JUL97
41D5100	INSTALL MECH JUMPERS IN CPP (4)	5	23JUL97	29JUL97
41D8300	RUN CONDUIT/WIRE - TRANSFER PUMP	5	23JUL97	29JUL97
41D5200	INSTALL INSTR JUMPERS IN CPP (5)	5	30JUL97	05AUG97
41D5300	CONNECT INSTR CABLES (7)	2	06AUG97	07AUG97
41D8500	MAKE ELECT CONNECTIONS	5	08AUG97	14AUG97
41D2200	INSTALL NEW COVER BLOCKS	2	15AUG97	18AUG97
C-1 VALVE PITS				
41E1100	HAND EXCAVATE AT VALVE PIT A WALL	15	29APR97	19MAY97
41E1200	HAND EXCAVATE TRENCH AT VALVE PIT A	20	20MAY97	17JUN97
41E2400	FAB NEW COVER BLOCKS - PIT A	20	28MAY97	24JUN97
41E2450	FAB NEW COVER BLOCKS - PIT B	20	28MAY97	24JUN97
41E2100	REMOVE COVER BLOCKS - PIT A	2	18JUN97	19JUN97
41E2150	REMOVE COVER BLOCKS - PIT B	2	18JUN97	19JUN97
41E2300	HIGH PRESSURE WASH PITS	4	20JUN97	25JUN97
41E2500	FINISH/PAINT COVER BLOCKS - PITS A/B	5	25JUN97	01JUL97
41E2200	REMOVE JUMPERS (9)	6	26JUN97	07JUL97
41E2600	CORE DRILL 8" HOLE - PIT A	4	08JUL97	11JUL97
41E9500	HAND EXCAVATE - I/O CAB TO TBs	5	08JUL97	14JUL97
41E2700	INSTALL NEW NOZZLE - PIT A	4	14JUL97	17JUL97
41E9200	INSTALL OUTLET BOX / ELEC EQUIP	5	15JUL97	21JUL97
41E9550	INSTALL I/O CAB AND TBs	5	15JUL97	21JUL97
41E2750	AS-BUILD NOZZLE	2	18JUL97	21JUL97

Project Start: 25DEC95 Project Finish: 28AUG98 Date Date: 25DEC95 Plot Date: 22FEB96

Legend: ▽ Early Bar ▬ Progress Bar ▬ Critical Activity

Scale: 102A

W-211 INITIAL TANK RETRIEVAL SYSTEMS TANK SY-102 E/C DESCRIPTION OF WORK INTEGRATED D/P/C SCHEDULE

Sheet 7 of 9

ICF KAISER HANFORD COMPANY

Date	Revision	Checked	Approved

WHC-SD-W211-RD-001, Rev. 0

98

[illegible]

WHC-SD-W211-RD-001, Rev. 0

Project Start	25DEC95		Early Bar
Project Finish	28AUG96		Progress Bar
Date Date	25DEC95		Critical Activity
Plot Date	22FEB96		

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W-211 INITIAL TANK RETRIEVAL SYSTEMS
TANK SY-102 E/C DESCRIPTION OF WORK
INTEGRATED D/P/C SCHEDULE

Sheet 4 of 4

ICF KAISER HANFORD COMPANY

Date	Revision	Checked	Approved
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[illegible]

APPENDIX D

Tank Data Sheets

TANK 241-SY-102 DATA SHEETS**1.0 DESCRIPTION**

- 1.1.1 The SY Tank Farm is located in the 200-West Area and consists of three underground tanks (Tanks 241-SY-101, -SY-102, and -SY-103). Tank 241-SY-102 is currently an active dilute receiver tank that receives waste from Plutonium Finishing Plant (PFP) and non-complexed saltwell waste.

1.1.2 Physical Data

Tank 241-SY-102 is a double-shell, underground tank for storage of high-level radioactive wastes (see Table 1).

TABLE 1

Total Capacity	1,160,000 gal
Operation Capacity	1,140,000 gal
Material	carbon steel
Size	80-foot outside diameter and 75-foot inside diameter, 46 ft 9-1/2 in. high, encased in a concrete shell, about 6-1/2 ft below grade.
Heat Load	40,000 Btu/hr maximum tank limit. The heat generated by the radioactivity in the tank is estimated to be 7,100 Btu/hr (see ref b).

1.1.3 Riser Configurations (see attachment A and drawing H-2-37773, rev. 1)

Tank 241-SY-102 is equipped with riser pipes that penetrate the concrete dome and the top of the primary or secondary tank. The risers provide access to the annulus and to the primary tank for waste transfer operations and for equipment and monitoring. Risers are located at cover pits (e.g., central pump pits, annulus pump pits, and drain pits) for instrumentation that measures or monitors tank temperature and pressure, liquid and sludge levels, weight

factor, and specific gravity. Risers are also located at observation ports and inspection locations.

Tank 241-SY-102 has a total of 59 risers. The smaller risers, 12 in. and less in diameter, are made of steel pipe and the larger diameter risers are made of rolled mild steel plate (see Table 2 and attachment B for a listing of the riser sizes and locations).

TABLE 2

LOCATION OF RISERS	
Size	Location
4 in. diameter	36
6 in. diameter	4
8 in. diameter	4
12 in. diameter	8
20 in. diameter	2
24 in. diameter	2
42 in. diameter	3

1.1.4 Major Internal Components (see attachment A and reference drawing H-2-85256, rev. 2)

Thermocouple

The temperature profile for Tank 241-SY-102 is recorded by 18 thermocouples at known elevations on one thermocouple tree. The existing tree is located in Riser 4 (reference drawing H-2-34304). A new thermocouple tree will be located in Riser 13A, and will be designed to withstand the jet forces induced by the mixer pump.

Air Lift Circulators

A 16-in. and a 24-in. air lift circulator are located at Riser 12A to minimize the buildup of a solids layer on the bottom of the tank.

The bottom of the air lift circulators are approximately 2.5 ft above the tank bottom (reference drawing H-2-70237).

1.1.5 Major External Components (see attachment A and reference H-2-85256, rev. 2)

Transfer Pump

Riser 3A (12 in. diameter) is located in Central Pump Pit 241-SY-02A (reference drawings H-2-37783 and H-2-37812).

Feed Pump

Riser 24A (12 in. diameter) is located in Feed Pump Pit 241-SY-02E (reference drawings H-2-37773, H-2-37718, and H-2-37812).

Annulus Pump

Riser 21A (12 in. diameter) is located in Annulus Pump Pit 241-SY-02B (reference drawings H-2-37784 and H-2-37794).

Annulus Leak Detection

Riser 19A has a 12-in. diameter (reference drawing H-2-95331).

Vessel Exhaust Port

Riser 7B has a 12 in. diameter and a K1 exhaust system (reference drawing H-2-37745).

Annulus Exhaust Port

Riser 10D has an 8-in. diameter and a K2 exhaust system (reference drawing H-2-37745).

1.1.6 Facility Interfaces

Ventilation/HVAC

Tank 241-SY-102 consists of two ventilation subsystems: K1 and K2. The K1 subsystem is used to ventilate and cool the primary tank and

minimize radioactive vapor releases into the atmosphere by maintaining a negative pressure in the tank. The K2 subsystem is used to ventilate the annulus.

Transfer Lines

V561 and V562 are in valve boxes 241-SY-A and 241-SY-B. Project W-058 is proposed to install new cross-site transfer lines.

Water

The existing 14-in. raw water line supplies water to the 241-SY-A flush pit (see drawing H-2-70835) and the 241-SY-271 instrumentation building. For the existing 4-in. sanitary water, see drawing H-2-46288.

Steam Supply

The existing 6-in., 225-psi steam line was disconnected.

Air Supply Systems

The existing 5-hp, 15-scfm, 75-psig compressor is located in the 241-SY-271 instrumentation building.

1.1.7 Classification

Waste Sampling Schedule

Stored waste is sampled periodically. The most recent samples for chemical, physical, and radionuclide analyses were taken on August 19, 1989 (ref a).

1.2 CHARACTERIZATION

1.2.1 Waste Type

The contents of Tank 241-SY-102 include double-shell slurry feed waste (DSS), neutralized feed waste (receiving supernates from S, SX, T, and U Tank Farms), non-complexant concentrate waste (NCPLX), and complexant concentrate (CC) waste.

Many waste types have been transferred into and out of the tank. Tank 241-SY-102 can be summarized as collecting evaporator feed from the 200-West Area single-shell tanks and wastes from the 222-S Laboratory, T Plant decontamination operations, and PFP processing facility. Wastes from the PFP processing facility may contain significant amounts of Pu and Am which should be found in the sludge. (Refer to ref b, for a graphically illustrated waste transfer history of Tank 241-SY-102 and ref a for the most current characterization and composition data).

The supernate is the region of waste that appears, from in-tank thermocouple data, to be thermally convective. The temperature of the waste is reasonably uniform through this region.

The sludge is the region of waste that appears, from in-tank thermocouple data, to be thermally nonconvective. The temperature of waste in this region (the bottom layer of tank waste) varies as a function of depth.

1.2.2 Waste Composition

TABLE 3

WASTE COMPOSITION		
Property	Supernate	Sludge (DSS)
Volume	246,000 gal	106,000 gal
Depth	90 in.	45 in.
Composition	See ref a and b	see ref a and b
Specific Gravity	1.03	1.56
Viscosity	NA	NA
pH	12.8	NA
Density	1.03 g/ml	1.56 g/ml
Temperature	See ref a appendix D	See ref a appendix D
Solid (Volume %)	15	85
H ₂ O %	95.4	NA

1.2.4 Stored Capacity

Approximately 352,000 gal (135 in.) of total waste includes 246,000 gal (90 in.) of drainable liquid plus 106,000 gal of settled solids at the bottom the tank. Approximately 788,000 gal of tank space is available for use.

1.3 EXISTING EQUIPMENT AND SYSTEMS

1.3.1 Process Monitoring Systems

The tank level is monitored continuously by radar. The tank temperature is monitored continuously and recorded. The tank gas is monitored continuously and recorded.

1.3.2 Ventilation/HVAC Systems

The existing ventilation system for this tank shares a common exhaust system with the other two tanks in the SY Tank Farm. The system is active with control valves and filters for each tank. Malfunctions are alarmed in the control room. A smaller backup system exists for all tanks (reference drawing H-2-37744, Rev. 6, sh 1).

1.4 OPERATING CONDITIONS

1.4.1 Ventilation Systems

Tank 241-SY-102 shares a common exhaust ventilation system with the other two tanks.

1.4.2 Ventilation Control

The common HVAC system for the SY Tank Farm has sensing and control for each tank.

1.4.3 Safety Mitigation

Internally generated hydrogen is removed by the existing exhaust system.

1.4.4 Sampling Techniques

Refer to document WHC-SD-WM-ER-336, Rev. 0, section 3.1 for a description of a sample event and sample handling.

1.5 DECONTAMINATION AND DECOMMISSIONING REQUIREMENTS

Tank decontamination and decommissioning will not take place until all wastes from single-shell tanks have been retrieved. After waste is removed from this tank, it will be used as a receiver to store waste from other tanks.

1.6 REFERENCES

- a) Report, "Supporting Document for the Southeast Quadrant Historical Tank Content Estimate Report for the SY Tank Farm," Document No. WHC-SD-WM-ER-319, Rev. 0.
- b) Engineering Report, "Tank Characterization Report for Double-Shell Tank 241-SY-102," Document No. WHC-SD-WM-ER-336, Rev. 0.
- c) Functional Design Criteria, "Replacement of Cross-Site Transfer System," Document No. WHC-SD-W-058-FDC-001, Rev. 0.
- d) Conceptual Design Report, "Replacement of the Cross-Site Transfer System," Document No. WHC-SD-W058-CDR-001, Rev. 0, May 1991.
- e) Drawing Index, H-2-3700, SY Tank Farm.

241-SY-102

4,396,400 Liters
[1,160,000 Gallons]

TANK RISER LOCATION

Approximate Grade Elevation 204.75m [671.75ft]

Ref: WHC-SD-RE-TI-093, Rev.3

H-2-72213, Rev.2

H-2-37802, Rev.7

H-2-37773, Rev.7

If there was a discrepancy between the documents and drawing, the drawing shall take precedence.

Ref: H-2-37772, Rev.2

TANK CROSS-SECTION

[not to scale]

*- Tank volume based upon inventory estimate on 1/94, "Tank Layer Model (TML)" Rev.1a Agnew, S.F., April 1995

Attachment B

TANK 241-SY-102		
Number	Diameter	Description and Comments
1A	4 in.	Sludge Measurement
1B	4 in.	Sludge Measurement
1C	4 in.	Sludge Measurement
2A	4 in.	Sludge Measurement (Removed sludge level gauge, ECN 112008, 10/22/90)
3A	12 in.	Central Pump Pit Supernatant Pump
4	4 in.	Thermocouple Probe
5A	42 in.	Spare/low
5B	42 in.	Spare
6A	24 in.	Annulus Access
6B	24 in.	Annulus Access
7A	12 in.	APG Instrument
7B	12 in.	Tank Ventilation
8A	4 in.	Air Inlet to Tank Insulation
8B	4 in.	Air Inlet to Tank Insulation
8C	4 in.	Air Inlet to Tank Insulation
8D	4 in.	Air Inlet to Tank Insulation
9A	6 in.	Air Inlet to Annulus
9B	6 in.	Air Inlet to Annulus
9C	6 in.	Air Inlet to Annulus
9D	6 in.	Air Inlet to Annulus
10A	8 in.	Annulus Air Outlet
10B	8 in.	Annulus Air Outlet
10C	8 in.	Annulus Air Outlet
10D	8 in.	Annulus Air Outlet
11A	4 in.	Tank Pressure and Spare
11B	4 in.	Tank Pressure and Spare
12A	42 in.	SN Add and Slurry Distributor
13A	12 in.	Observation Port
14A	4 in.	Condensate Addition or Spare, NF
15A	4 in.	Pump Pit Drain and SN Return
16A	4 in.	Pit Drain

Attachment B

TANK 241-SY-102		
17A	4 in.	Sludge Measurement
17B	4 in.	Sludge Measurement
17C	4 in.	Sludge Measurement
18A	4 in.	Annulus Inspection
18B	4 in.	Annulus Inspection
18C	4 in.	Annulus Inspection
18D	4 in.	Annulus Inspection
18	4 in.	Annulus Inspection
18F	4 in.	Annulus Inspection
18G	4 in.	Annulus Inspection
18H	4 in.	Annulus Inspection
18J	4 in.	Annulus Inspection
18K	4 in.	Annulus Inspection
18L	4 in.	Annulus Inspection
19A	12 in.	Annulus Access
19B	12 in.	Annulus Access
20A	4 in.	TBX 102-4
20B	4 in.	TBX 102-5
20C	4 in.	P/CP TBX 102-6
20D	4 in.	TBX 102-1
20	4 in.	TBX 102-2
20F	4 in.	TBX 102-3
21A	12 in.	Annulus Pump Out
22A	4 in.	Feed Pit Drain and Spare
23A	4 in.	Sludge Measurement
24A	12 in.	Riser for SN Pump
25	20 in.	Heat Treat Vent
25	20 in.	Heat Treat Vent

APPENDIX E

Sketches

ES-211SY2-C1

Area Map & Drawing List

Civil

ES-211SY2-C2
ES-211SY2-C3
ES-211SY2-C4

Civil Site Plan 241-SY Tank Farm
Civil Enlarged Plan and Sections
Civil Plan, Section & Elevations ICE Building

Piping and Vessels

ES-211SY2-M1
ES-211SY2-M2, Sh 1
ES-211SY2-M2, Sh 2
ES-211SY2-M2, Sh 3
ES-211SY2-M2, Sh 4
ES-211SY2-M2, Sh 5
ES-211SY2-M3, Sh 1
ES-211SY2-M3, Sh 2
ES-211SY2-M4
ES-211SY2-M5
ES-211SY2-M6
ES-211SY2-K1

Piping Process Flow Diagram Trans/Diluent/Flush/Recirc
Piping/Instr P & ID Legend
Piping/Instr P & ID Tank 241-SY-102 (Wt)
Piping/Instr P & ID Valve Pit 241-SY-A (Wt)
Piping/Instr P & ID Valve Pit 241-SY-B (Wt)
Piping P & I D Tank 241-SY-102 (Wst)
Piping Tank 241-SY-102 Plan
Piping Tank 241-SY-102 Enlarged Plan, Sect & Det
Jumper Arrangement Central Pump Pit 241-SY-02A
Jumper Arrangement Valve Pit 241-SY-A Plan & Section
Jumper Arrangement Valve Pit 241-SY-B Plan & Section
HVAC Tank SY-102 ICE Bldg Plan and Section

Instrumentation

ES-211SY2-Y1

Instrumentation SY-102 Control System Cable Block Diagram

Electrical

ES-211SY2-N1
ES-211SY2-N2, Sh 1
ES-211SY2-N2, Sh 2
ES-211SY2-N3
ES-211SY2-N4
ES-211SY2-N5
ES-211SY2-N6

Electrical Site Plan 241-SY-102 Tank
Electrical One Line Diagram 241-SY-102 Tank
Electrical One Line Diagram 241-SY-102 Tank
Electrical ICE Bldg Equipment Layout 241-SY-102 Tank
Electrical ICE Bldg Grounding Layout 241-SY-102 Tank
Electrical ICE Bldg Lighting Layout 241-SY-102 Tank
Electrical ICE Bldg Conduit Layout 241-SY-102 Tank

1-2

BY:

PROJECT SITE

HANFORD AREA MAP

NORTH

DRAWING LIST

DRAWING NO.	INDEX NO.	TITLE
ES-71147-C1	0000 0101	BRANCHING LINES & AREA MAP

CIVIL

DRAWING NO.	INDEX NO.	TITLE
02-11107-C1	0001	SALE Plan 241-00 Town of New
02-11107-C1	0002	EXHIBIT Plan of SECTION 5
02-11107-C1	0003	Plan of SECTION 6 of TOWNSHIP 241

PIPING & VESSELS

[illegible]

HEATING, VENTILATION, AND AIR CONDITIONING

DRAWING NO.	INDEX NO.	TITLE
CS-31192-01	0000	PLAN AND ELEVATIONS LAMP ST-MR 100 100 100

INSTRUMENTATION

DRAWING NO.	INDEX NO.	TITLE
25-21582-01	0004	CABLE JUNCTION BOXES, 12-107 CHARTER, BLACKHAWK

ELECTRICAL

DRAWING NO.	INDEX NO.	TITLE
33	7-8	

ISSUED FOR E/C DESCRIPTION OF WORK

W.J. MAGRUDER, P.E.

[illegible]

FOR LEGAL USE ONLY (9-211572-C)

ISSUED FOR E/C DESCRIPTION OF WORK

W. J. MAGRUDER, P.E.

1 NAME WWW.J. MACGRUDER, P.E. ADDRESS 1000 N. W. 10TH ST. CITY MIAMI, FL 33136 STATE FL ZIP 33136	2 FIRM NAME MACGRUDER ADDRESS 1000 N. W. 10TH ST. CITY MIAMI, FL 33136 STATE FL ZIP 33136	3 FIRM TYPE ARCHITECT ADDRESS 1000 N. W. 10TH ST. CITY MIAMI, FL 33136 STATE FL ZIP 33136	4 PROJECT NAME U.S. DEPARTMENT OF ENERGY AT SANDIA ADDRESS 2515 Y ST. CITY ALBUQUERQUE, NM 87131 STATE NM ZIP 87131	5 PROJECT TYPE ENVIRONMENTAL AND ECOLOGICAL ADDRESS 2515 Y ST. CITY ALBUQUERQUE, NM 87131 STATE NM ZIP 87131	6 PROJECT NO. ES-215Y2-C310 ADDRESS 2515 Y ST. CITY ALBUQUERQUE, NM 87131 STATE NM ZIP 87131	7 PROJECT DATE 10-3-93 ADDRESS 2515 Y ST. CITY ALBUQUERQUE, NM 87131 STATE NM ZIP 87131
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ISSUED FOR E/C DESCRIPTION OF WORK

 Ministry of Education, Government of India

DATE: 1-1-78

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[illegible]

2 WITHIN CERTAIN LIMITATIONS AND THAT IN ADEQUATE
MANNER THE UNITED STATES GOVERNMENT WILL BE
AND SHOULD BE KEPT ADVISED OF ANY SUCH
CHANGES BY THE UNITED STATES GOVERNMENT

-

NORTH
↓

NOTES:

1. STREAM INFORMATION IN REGARD TO SPECIFIC GRAVITY AND VISCOSITY IS ON 20 BASED UPON INFORMATION SUPPLIED BY SNC.
2. THIS PAGE IS A SIMPLIFIED DIAGRAM FOR DEPICTING FLOOD PATTERN. SOME COMPONENTS HAVE BEEN OMITTED FOR CLARITY.
3. GULF AREA'S DEPOSITED SANDS IN PET 22A ARE THE SAME AS THOSE DEPOSITED ON SHALLOW N-2 PLATE, SECTION 2.
4. MEMBER'S NUMBER IN PARENTHESIS ARE OLD NUMBERS ASSIGNED PRIOR TO INITIANCE OF MAINTENANCE PROCEDURE 6-17-100.

OPERATING CONDITIONS										
STREAM NO.:	(1)		(2)		(3)		(4)		(5)	
STREAM NAME:	Tank effluent		Inter-cooler effluent		Reformer effluent before reheat		Inter-cooler effluent		Inlet to Reformer effluent	
STREAM PROPERTY:	temp	press	temp	press	temp	press	temp	press	temp	press
OPERATING PRESSURE (psia)	0	10	110	210	110	210	110	210	10	10
OPERATING TEMPERATURE (°F)	60	210	60	210	60	210	120	210	60	210
FLOW RATE (lb-mol/hr)	n/a	n/a	100	140	30	140	100	140	10	140
SPECIFIC HEAT (Btu/lb-mol-°F)	0.6	1.25	1.0	1.72	1.0	1.25	1.0	1.25	0.6	1.0
VISCOSITY (cp)	1.0	30	1.0	30	1.0	30	1.0	30	0.6	1.0
PH	10	14	10	14	10	14	10	14	7	14

COMPONENT NO. :		PUMP
SERVICE:		Waste Transfer
100 IN. of surge		400
PUMPING TEMPERATURE (°F)		200
ESTIMATED H.M.P.		51
COMMENTS:		APR

ISSUED FOR E/C DESCRIPTION OF WORK
M. A. PRZYBYLSKI, P.E.

[illegible]

NOTES:
1. FOR GENERAL NOTES AND LEGEND SEE SHEET 1.
2. THE INSTRUMENT FIELD CABINET IS TO BE INSTALLED IN THE ICE BUILDING.

ISSUED FOR E/C DESCRIPTION OF WORK

TANK 241-SY-102

VALVE POSITION VS OPERATIONAL MODE SEE NOTE B

VALVE NO.	POSITION	MODE
WI-P-3102A	100	100
WI-P-3112A	100	100

DATE: 10/10/01
BY: M. A. PRZYBYLSKI, P.E.
CHECKED BY: [Signature]
APPROVED BY: [Signature]
PROJECT: 241-SY-102
SHEET: 2 OF 7

[illegible]

VALVE POSITION VS OPERATIONAL MODE

VALVE PIT 241-SY-B

ISSUED FOR E/C DESCRIPTION OF WORK

M. A. PRZYBYLSKI, P.E.

NOTES:

2. OCCASIONAL MESS LIES UP FOR THE STAFF OF THE
BUREAU AND ALSO FOR THE BUREAU OF THE BUREAU
IN THE BUREAU OF THE BUREAU.

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

NOTES:
1. ALL INSTRUMENTS SUPPLIED WITH
2. ALL INSTRUMENTS SUPPLIED WITH

ISSUED FOR E/C DESCRIPTION OF WORK
11.1 PRZYBYLSKI, P.E.

NO.	REV.	DATE	BY	CHKD.	DESCRIPTION
1	1	11/11/00	PRZYBYLSKI	PRZYBYLSKI	ISSUED FOR E/C DESCRIPTION OF WORK
2	2	11/11/00	PRZYBYLSKI	PRZYBYLSKI	ISSUED FOR E/C DESCRIPTION OF WORK
3	3	11/11/00	PRZYBYLSKI	PRZYBYLSKI	ISSUED FOR E/C DESCRIPTION OF WORK
4	4	11/11/00	PRZYBYLSKI	PRZYBYLSKI	ISSUED FOR E/C DESCRIPTION OF WORK
5	5	11/11/00	PRZYBYLSKI	PRZYBYLSKI	ISSUED FOR E/C DESCRIPTION OF WORK
6	6	11/11/00	PRZYBYLSKI	PRZYBYLSKI	ISSUED FOR E/C DESCRIPTION OF WORK
7	7	11/11/00	PRZYBYLSKI	PRZYBYLSKI	ISSUED FOR E/C DESCRIPTION OF WORK
8	8	11/11/00	PRZYBYLSKI	PRZYBYLSKI	ISSUED FOR E/C DESCRIPTION OF WORK
9	9	11/11/00	PRZYBYLSKI	PRZYBYLSKI	ISSUED FOR E/C DESCRIPTION OF WORK
10	10	11/11/00	PRZYBYLSKI	PRZYBYLSKI	ISSUED FOR E/C DESCRIPTION OF WORK

PLAN - SHOWN WITH CHAIN BLOCK HOOKS
SCALE 1/4" = 1"

PLAN

ELEVATION

① LOCATING DOWEL ASSY SHOWN AT 1/4\"/>

① SECTION

② SECTION

GENERAL NOTES:

1. THE STUDENT, ENGINEER, OR PLATE SHALL BE AT THE JOB ON THE DATE OF THE PROJECT AND SHALL BE PRESENT FOR THE ENTIRE DURATION OF THE PROJECT.
2. ALL WORK SHALL BE COMPLETED BY THE DATE OF THE PROJECT.
3. THE PROJECT IS TO BE COMPLETED BY THE DATE OF THE PROJECT.
4. THE PROJECT IS TO BE COMPLETED BY THE DATE OF THE PROJECT.
5. THE PROJECT IS TO BE COMPLETED BY THE DATE OF THE PROJECT.
6. THE PROJECT IS TO BE COMPLETED BY THE DATE OF THE PROJECT.
7. THE PROJECT IS TO BE COMPLETED BY THE DATE OF THE PROJECT.

ISSUED FOR E/C DESCRIPTION OF WORK

M. A. PRZYBYLSKI, P.E.

NO.	REV.	DATE	DESCRIPTION
1	0	11/15/73	ISSUED FOR E/C DESCRIPTION OF WORK

NOTES:

1. HVAC UNIT No. 1 AND 2 SHALL BE INSTALLED PER SHALL BE CLASSED AS A LOW VOLTAGE SYSTEM. ALL ELECTRICAL WORK SHALL BE DONE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND ALL APPLICABLE LOCAL, STATE AND FEDERAL REQUIREMENTS.
2. ALL DUCTWORK SHALL BE 2" NO DUCT PRESSURE CLASS

PLAN
SCALE: 3/8" = 1'-0"

SECTION
SCALE: 1/4" = 1'-0"

ISSUED FOR E/C
DESCRIPTION OF WORK

M. A. PRZYBYLSKI

PROJECT NO.		DATE	
W211-RD-001		10-28-2008	
PROJECT NAME		PROJECT LOCATION	
W211-RD-001		1000 W. 10th St. N. Fargo, ND	
PROJECT DESCRIPTION		HVAC SYSTEM	
PROJECT NO.		PROJECT NO.	
W211-RD-001		W211-RD-001	
PROJECT NO.		PROJECT NO.	
W211-RD-001		W211-RD-001

NOTES:
1. FOR LEGEND AND NOTES SEE SHEET 1.

ISSUED FOR E/C DESCRIPTION

ONE LINE DIAGRAM

R. C. AMANTE, PE

E-20	
DATE	10/10/00
BY	R. C. AMANTE
CHECKED BY	J. J. JENNY
DESIGNED BY	J. J. JENNY
ONE LINE DIAGRAM	10/10/00
PROJECT NO.	WHC-SD-W211-AD-001
REVISIONS	1. 10/10/00
1	10/10/00
2	10/10/00
3	10/10/00
4	10/10/00
5	10/10/00
6	10/10/00
7	10/10/00
8	10/10/00
9	10/10/00
10	10/10/00
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95	10/10/00
96	10/10/00
97	10/10/00
98	10/10/00
99	10/10/00
100	10/10/00

LEGEND

- GROUND ROD 3/4" DIA. BY 10 FEET LONG COPPER CLAD STEEL
- GROUNDING CONNECTION AS SHOWN, W/ 1/2" DIA. COPPER RODS TO BE WELDED TO BASE OF ICE BLDG. AT ATTACHED POINTS
- ▼ GROUNDING POINT AS SHOWN, CONNECTIONS TO BE MADE TO BASE OF ICE BLDG. AT ATTACHED POINTS
- GROUNDING WIRE 1/2" DIA. COPPER, STRANDED UNLESS INDICATED OTHERWISE

NOTES:

1. ALL GROUNDING WIRE SHALL BE 1/2" DIA. COPPER, STRANDED UNLESS INDICATED OTHERWISE.
2. ALL GROUNDING RODS SHALL BE 3/4" DIA. BY 10 FEET LONG COPPER CLAD STEEL.
3. ALL GROUNDING CONNECTIONS SHALL BE WELDED TO THE BASE OF THE ICE BUILDING.
4. ALL GROUNDING POINTS SHALL BE MARKED WITH A 1/2" DIA. COPPER ROD.
5. ALL GROUNDING WIRE SHALL BE RUN IN A CONCEALED MANNER.
6. ALL GROUNDING WIRE SHALL BE RUN IN A CONCEALED MANNER.

ISSUED FOR E/C DESCRIPTION OF WORK

R. C. AMANTE, PE

ICE BUILDING GROUNDING LAYOUT
SCALE: 3/8" = 1'-0"

U.S. DEPARTMENT OF ENERGY	PROJECT NO. 101-2-11172-0410
ICE BUILDING GROUNDING LAYOUT	DATE: 11/11/81
BY: R. C. AMANTE	APP. BY: R. C. AMANTE
101-2-11172-0410	101-2-11172-0410

ICE BUILDING EMBEDDED CONDUITS
SCALE: 3/8" = 1'-0"

INSTRUMENT PANELBOARD SCHEDULE	
NO.	DESCRIPTION
1	100 AMP 240V 3PH 4W
2	100 AMP 240V 3PH 4W
3	100 AMP 240V 3PH 4W
4	100 AMP 240V 3PH 4W
5	100 AMP 240V 3PH 4W
6	100 AMP 240V 3PH 4W
7	100 AMP 240V 3PH 4W
8	100 AMP 240V 3PH 4W
9	100 AMP 240V 3PH 4W
10	100 AMP 240V 3PH 4W
11	100 AMP 240V 3PH 4W
12	100 AMP 240V 3PH 4W
13	100 AMP 240V 3PH 4W
14	100 AMP 240V 3PH 4W
15	100 AMP 240V 3PH 4W
16	100 AMP 240V 3PH 4W
17	100 AMP 240V 3PH 4W
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96	100 AMP 240V 3PH 4W
97	100 AMP 240V 3PH 4W
98	100 AMP 240V 3PH 4W
99	100 AMP 240V 3PH 4W
100	100 AMP 240V 3PH 4W

INSTRUMENT PANELBOARD SCHEDULE

MINI POWER CENTER SCHEDULE	
NO.	DESCRIPTION
1	100 AMP 240V 3PH 4W
2	100 AMP 240V 3PH 4W
3	100 AMP 240V 3PH 4W
4	100 AMP 240V 3PH 4W
5	100 AMP 240V 3PH 4W
6	100 AMP 240V 3PH 4W
7	100 AMP 240V 3PH 4W
8	100 AMP 240V 3PH 4W
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98	100 AMP 240V 3PH 4W
99	100 AMP 240V 3PH 4W
100	100 AMP 240V 3PH 4W

MINI POWER CENTER SCHEDULE

NOTES:

1. CONDUIT SCHEDULE AS SHOWN ON E/C DRAWING. ALL CONDUITS TO BE INSTALLED IN ACCORDANCE WITH THE FOLLOWING NOTES:

ISSUED FOR E/C DESCRIPTION OF WORK

R. C. AMANTE, PE

U.S. DEPARTMENT OF ENERGY
NATIONAL BUREAU OF STANDARDS
ICE BUILDING EMBEDDED CONDUITS
PROJECT NO. E-211572-N610
DATE: 11/11/80
BY: R. C. AMANTE