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REMOVAL OF SEPARABLE ORGANIC FROM TANK 241-C-103 SCOPING STUDY

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Abstract: This study is based on previous evaluations / proposals for removing the floating organic layer in C-103. A practical method is described with assumptions, cost and schedule estimates, and risks. Proposed operational steps include bulk organic removal, phase separation, organic washing and offsite disposal, followed by an in-situ polishing process.

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EXECUTIVE SUMMARY

The purpose of this study was to prepare a scoping study and cost estimate on the removal of the separable organic phase from Tank 241-C-103 (C-103). C-103 is a single-shell underground storage tank known to contain about 17,300 liters (4,570 gallons) of floating separable phase organic liquid comprised of tributyl phosphate (TBP) and normal paraffin hydrocarbon (NPH).

The current interim stabilization plan assumes the organic layer in the tank will not be removed separately and stored for future disposition. The Department of Energy (DOE), Office of River Protection (ORP) has directed the River Protection Project (RPP) to plan for the removal of the C-103 organic layer before interim stabilization.

This study is based on previous C-103 evaluations of bulk organic removal technology and partial designs performed in the 1994 to 1996 time frame. It also includes a polishing concept and cost estimate to remove the residue separable organic in C-103.

The main unit operations are briefly described in the following bullets:

- *The organic removal equipment consists of a skimmer and pump assembly that skims the organic from the surface of the tank liquid and pumps it to the phase separation system. The equipment also includes a closed circuit television (CCTV) system to provide observation of the in-tank operation.*
- *The phase separation equipment consists of a coalescer assembly that separates the organic from any aqueous carryover and routes the organic phase to the organic treatment system and the aqueous carryover back to the C-103 tank.*
- *The organic treatment equipment consists of a batch wash tank and connections for wash solution addition from a tanker system. The organic is washed to remove contaminants prior to shipment to the disposal vendor. Once*

decontaminated, the organic phase is routed to the interim storage system. The aqueous is routed to the aqueous return system.

- *The treatment system aqueous return equipment consists of the LR56 cask. The aqueous phase is received in the cask and transported and transferred to a double-shell tank via 204-AR.*
- *Interim storage consists of an International Standard Organization (ISO) tank.*
- *The transport/disposal equipment consists of a vender-supplied tanker and a loadout station with sampling capability.*

While no new separation technology appears applicable since the original 1994-96 work was completed, one disposal site's Waste Acceptance Criteria have significantly changed and will allow the receipt and disposal of the C-103 organic.

The overall cost of the bulk removal of organic from C-103 is estimated \$8.8 million. This includes; \$0.4 million for Engineering, \$1.0 million for Procurement, \$2.2 million for Construction, \$3.5 million for Operating Contractor Expenses, and \$1.7 million for Disposal and Transportation. Section 14, Cost Reduction Initiatives, lists several opportunities that could reduce the overall cost, but increase project risk.

The residual organic polishing strategy developed in this report uses the Light Duty Utility Arm (LDUA) and in-tank absorbents. This polishing step is estimated to cost \$1.0 million.

The main programmatic risk associated this study is the actual concentration of radionuclides in the organic layer and whether the processing and aqueous carryover will increase the projected contamination level above waste acceptance and shipping criteria.

Based on this work and the previous studies, separation and disposal of the bulk C-103 organic layer is a viable alternative and sufficient information is available to prepare a requirement matrix and complete the detail design.

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
µm	micron
AB	authorization basis
ABU	Acceptance for Beneficial Use
ATG	Allied Technical Group of Richland
BNFL	British Nuclear Fuel Limited, Incorporated
CCTV	closed circuit television
cm	centimeters
cp	centipoises
CRA	Criteria Review Approaches
CRS TAP	Chemical Reactions Sub Tank Advisory Panel
DCRT	double-contained receiver tank
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DSSI	Diversified Scientific Services Incorporated
DST	double-shell tank
Ecology	Washington State Department of Ecology
EDTA	ethylenediaminetetraacetic acid
EPA	U.S. Environmental Protection Agency
EReqs	Environmental Permits, Approvals, and Requirements
FSAR	final safety analysis report
ft	feet
g/ml	gram/milliliter
gal/min	gallon per minute
HEPA	high-efficiency particulate air filter
hp	horsepower
in	inch

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ISO	International Standards Organization
JCO	Justification for Continued Operation
l	liters
lb/in ²	pounds per square-inch
LDUA	Light Duty Utility Arm
LSA	low specific activity
ml	milliliters
mm	millimeters
mR/hr	milliREMS per hour
NEPA	National Environmental Policy Act
NOC	Notice of Construction
NPH	normal paraffin hydrocarbon
NTS	Nevada Test Site
ORP	U.S. Department of Energy, Office of River Protection
ORR	Operational Readiness Review
psi	pounds per square inch
PUREX	plutonium uranium extraction
RCRA	Resource Conservation and Recovery Act
RL	U.S. Department of Energy, Richland Operations
ROM	rough order of magnitude
rpm	revolutions per minute
RPP	River Protection Project
RTD	Resistance Temperature Detector
SAR	safety analysis report
SARP	safety analysis report for packaging
SSC	systems, structures and components
SST	single-shell tank
TBD	to be determined
TBP	tributyl phosphate
TSCA	Toxic Substance Control Act
TSCAI	TSCA Incinerator
TSR	technical safety requirement
USQ	unreviewed safety question
V	volt
WFD	Waste-Feed Delivery
WMH	Waste Management Federal Services of Hanford, Inc.
wt%	weight percent

1.0 INTRODUCTION

The purpose of this study was to prepare a scoping study and cost estimate on the removal of organic from Tank 241-C-103 (C-103). C-103 is a single-shell underground storage tank (SST) used to store hazardous and radioactive waste that was generated during defense production operations at the Hanford Site. It is known to contain about 17,300 liters (4,570 gallons) of floating separable phase organic liquid comprised of tributyl phosphate (TBP) and normal paraffin hydrocarbon (NPH). The liquid organic is floating on an aqueous supernatant layer of approximately 503,000 liters (133,000 gallons) and a sludge layer of approximately 230,000 liters (62,000 gallons).

The current interim stabilization plan (Lewis, 1999) assumes the organic layer in the tank will not be removed separately and stored for future disposition. The Department of Energy (DOE), Office of River Protection (ORP) has directed the River Protection Project (RPP) to prepare a scoping study to address removal of the C-103 organic layer before interim stabilization.

This study is based on previous C-103 evaluations of bulk organic removal technology and partial designs performed in the 1994 to 1996 time frame. It covers necessary assumptions, a brief requirements section, proposed architecture, operational concepts, future work required, cost estimates, and a qualitative risk discussion, and cost reduction initiatives. Also included is a polishing concept and cost estimate to remove the residual separable organic in C-103.

2.0 BACKGROUND

Tank C-103 was constructed in 1943-1944 and placed into service in August 1946 to receive B Plant metal waste. It was later used to receive Plutonium-Uranium Extraction (PUREX) plant coating waste and other PUREX plant waste. In addition, other various waste solutions from numerous sources were transferred into/through the tank (Carothers, 1988).

The organic liquid in C-103 is believed to have resulted from the transfer of solvent-rich organic wash waste from Tank 241-C-102 in November 1975 (Dukelow, 1996, Volume 2, section 3.3). The organic liquid currently is a mixture of approximately 67 weight percent (wt%) tributyl phosphate (TBP) and 33 wt% normal paraffin hydrocarbon (NPH), the primary organic compounds that make up the PUREX Plant solvent. Partial evaporation of the organic liquid during periods of forced ventilation between 1975 and 1992 has reduced the volume of the liquid and depleted the more volatile hydrocarbons that were initially present in the NPH. The organic liquid has a density of 0.876 gram/milliliter (g/ml) and a viscosity of 4 cp (centipoises) at 5 degrees Celcius (°C) (Pool and Bean, 1994).

As a result of previous studies by Dukelow (1995, 1996), recommendations were made to the DOE that C-103 be interim stabilized by transferring the organic and aqueous liquids to a double-shell tank (DST) for interim storage. Concerns on interim stabilization without removing the organic have been raised by the Chemical Reactions Sub Tank Advisory Panel (CRS TAP) and the Defense Nuclear Facility Safety Board.

In 1998, the State of Washington Department of Ecology (Ecology) did not approve proposed changes to the Hanford Federal Facility Agreement and Consent Order milestone M-41-22 for completing interim stabilization of the remaining SSTs. Subsequently, the DOE, U.S. Department of Justice, and State of Washington developed a new plan for accelerating the program under a consent decree. One consent decree commitment specifically addresses C-103. This commits DOE to complete the following activities no later than December 20, 2000:

- Determine whether the separable organic layer and pumpable liquids will be pumped from C-103 together or separately, and
- Establish a deadline for initiating pumping of C-103.

The historical work has shown that saltwell pumping the tank does not create a new safety issue. The current baseline is interim stabilizing STET the tank using a saltwell pump.

The DOE letter 99-PD-041 directed the contractor to plan for the removal of the C-103 organic layer before interim stabilization. The DOE letter requested a path forward for removing the bulk separable organic layer and for a polishing step path forward to handle the residue organic in C-103.

The contract between DOE and the Privatization Contractor for Phase 1 immobilization of tank waste contains a requirement that the Project Hanford Management Contractor will not deliver a feed that contains a "...visible, separate organic layer." The criterion is based on suspected deleterious impacts of the organic on the PC's evaporator and ion exchange (pretreatment) system. Neither the Waste Feed Delivery (WFD) nor the Private Contractor's pretreatment system baseline includes an organic removal/destruction process. Furthermore, no such systems are in design and no contingency has been provided, to date, for removal of separable organic. However, feed material from C-103 is currently not part of the minimum order quantity for Phase 1.

Organic solvents have mainly been studied/evaluated from the context of tank safety (i.e., organic fires, organic-nitrate reactions, and flammable gases). Work completed more recently has addressed retrieval, storage, and destruction options for organic in C-103, which has a known floating organic layer several inches deep. Several options were reviewed for handling the separable phase organic in C-103.

Two process alternatives that received the most attention were:

- Separate the organic in C-103 from the aqueous phase for storage in an aboveground tank for eventual disposal/pretreatment at an incinerator site, and
- Saltwell pump the tank liquid contents to a double-shell tank (DST). At the DST, the organic would be subject to decomposition in the highly alkaline solution and evaporation due to the active ventilation system.

This report focuses on the first alternative, removal of the C-103 separable organic.

3.0 REQUIREMENTS

The creation of detailed performance requirements was not within the scope of this study. The requirements below were developed only in sufficient detail to prepare cost estimates of the removal, treatment, interim storage and disposal of the C-103 organic phase. Lower tier assumptions for individual unit operations are listed in Section 8.

- Remove the bulk of organic phase from C-103. The end point for the bulk removal is anticipated to be within 2 millimeters (mm) of the aqueous interface.
- Remove particles ≥ 5 micron (μm) from the feed stream to reduce downstream radiation exposure.
- Reduce aqueous carryover to reduce radiation exposure such that the downstream equipment can be contact maintained.
- Provide an organic treatment process to allow the organic stream to meet shipping and disposal requirements.
- Provide capabilities to return aqueous waste to a DST/double-contained receiver tank (DCRT).
- Provide necessary sampling, interim storage, and load out capabilities.
- Comply with regulations governing environmental interface of radioactive and toxic materials.
- Facilitate decontamination for decommissioning and disposal through system design and construction.

4.0 ASSUMPTIONS

The following assumptions relate to the removal, treatment, interim storage and disposal of the C-103 organic phase:

- Technologies employed in the systems are commercially and industrially proven and adaptable directly for field use.
- Existing facilities and plant structure will be used to the extent possible.
- Previous testing performed primarily to select and validate concepts and verify performance for application in these systems is valid.
- No new safety or environmental requirements are imposed that will affect the scope definition.
- Site support infrastructures are available as required.

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- Current sample analysis/organic contamination level does not change during processing.
- Recovered organic material may require additional treatment to meet shipping and/or disposal site requirements.
- A licensed commercial operator will perform final disposal of the separated organic.
- Passive ventilation mode for the tank and new installations will be acceptable.
- Separated aqueous phase will be returned to existing tank farm systems without treatment or sampling.
- There is no numerical end point criteria for the C-103 polishing step.
- The equipment used for this activity will be flushed and disposed of onsite.

5.0 RESERVED**6.0 PROPOSED ARCHITECTURE**

For the purposes of this scoping study, organic removal consists of the following major process functions summarized in Figure 6.1:

- Organic removal
- Phase separation
- Organic treatment
- Aqueous return
- Interim storage
- Transport/disposal.

The organic removal equipment consists of a skimmer and pump assembly which skims the organic from the surface of the tank liquid and pumps it to a surge tank in the phase separation system. The equipment also includes a closed circuit television (CCTV) system to provide observation of the in-tank operation.

The phase separation equipment consists of a coalescer assembly that separates the organic from any aqueous carryover and routes the organic phase to the organic treatment system and the aqueous carryover back to the C-103 tank.

The organic treatment equipment consists of a batch wash tank and connections for wash solution addition from a tanker system. The organic is washed to remove contaminants prior to shipment to the disposal vendor. Once decontaminated, the organic phase is routed to the interim storage system. The aqueous is routed to the aqueous return system.

The aqueous return treatment process consists of the LR56 cask. The aqueous phase is received in the cask and transported and transferred to a DST via 204-AR.

The interim storage equipment consists of an International Standards Organization (ISO) tank or potentially the final treatment tank/decanter can be used to store clean organic prior to loading into the transport vessel.

The transport/disposal equipment consists of a vender-supplied tanker and a loadout station with tank sampling capability.

The removal of residual organic from C-103 (polishing step) is discussed in Section 11.

Figure 6-1. Tank C-103 Organic Removal, Treatment and Storage System Component Breakdown.

7.0 INTERFACES

The organic removal system interfaces with the following facilities and functions:

- Tank C-103.
- Riser 2 for skimmer pump access, and risers yet to be determined for organic level measurement and CCTV access.
- Power from existing C farm systems.
- Aqueous returns to designated DST via 204-AR.
- Portable decontamination system (chemical tanker).
- Site shipping and transportation personnel and requirements.
- Tank farms chemical make-up and flushing equipment/tanker.

8.0 OPERATIONAL CONCEPT

The primary goal of the organic removal system is to reduce the volume of organic material in C-103 and to remove residual radionuclide contamination from the organic so that it can be sent for off-site disposal. The organic is skimmed and pumped from the tank with a low-capacity, positive displacement pump, and routed through a coalescer device in a shielded enclosure. The coalescer separates the entrained aqueous phase from the organic and routes the aqueous back into the tank. The separated organic is routed to the organic treatment system. The organic treatment system uses a batch alkaline wash process to remove radionuclide contamination to a level that allows the organic to be shipped. The organic is then held in an interim storage container and from there, loaded into the transport vessel through a loadout station and shipped offsite for treatment and disposal.

Each of the proposed architecture systems identified in Section 6.0 is described in detail below.

8.1 ORGANIC REMOVAL SYSTEM

8.1.1 Description

The organic removal system is installed to facilitate removal of a 2-inch (in) separable organic layer from the tank and transfer it to a phase separation system. The organic layer is floating on a layer of aqueous supernate estimated to be 1 to 4 feet (ft) thick. The organic removal system is designed to skim off the organic layer while minimizing mixing within the underlying supernate layer and between the organic and supernate layers.

8.1.2 Operational Concept

The skimmer pump assembly is installed in Riser 2, a nominal 12-in diameter interface. The skimmer preferentially removes the organic layer. The skimmer, by virtue of its buoyancy and

weir design, initially removes only organic, but as the depth of the organic layer decreases, the skimmer begins removing an increasing quantity of aqueous with the organic. The skimmed material is then pumped from the skimmer to a phase separation system external to the tank, where any aqueous carryover is separated from the mixture and returned to the tank (Figure 8.1).

The pump-processing rate is variable with a nominal capacity of 2 to 3 gallons per minute (gal/min) and a maximum design rate of 5 gal/min. Initial pumping rates are the highest and decrease to a fraction of a gallon per minute as the depth of the organic layer decreases to the required residual level of 2 mm. This residual level is based on studies performed by Bruelbach (Bruelbach 1994), Fauske and Associates, Incorporated (FAI 1994), and onsite testing of equipment and simulants. The total operating time for actual, on-line organic removal is expected to be in the range of 5 to 30 days based on continuous 24 hour-per-day operation. The hardware and arrangement are described in Section 8.1.3.

The system is operated by means of a microprocessor control system located at a central control station. Liquid flowrate from the skimmer is controlled manually from the control station. Variable speed pumping capability minimizes the aqueous carryover toward the end of the pumping cycle.

A decontamination collar installed above the riser provides the means to decontaminate the skimmer pump assembly as it is being removed from the tank. The skimmer pump assembly is attached to a shielding enclosure. This provides riser closure, a means to support the skimmer pump assembly in the tank, and an exit interface route for the piping to a phase separation system.

A CCTV system provides the means to monitor in-tank operation at a central control station.

The planned process is to lower the skimmer pump assembly by crane into the riser. Critical lift procedures will be used if necessary. The floating organic will be removed to within 2 mm of the aqueous interface with a *minimum intake of aqueous*. A probe lowered into the tank through a different riser will determine the aqueous interface. Following removal and decontamination, the nominal 35-ft-long skimmer pump assembly support will be cut into appropriate lengths for disposal.

Organic removal tests indicate that efficient removal of the organic can continue until the organic layer reaches a minimum height of less than 1 mm. When the organic layer height reaches its minimum limit, the organic layer breaks apart, forming pools separated by uncovered aqueous. At this point, the flow of organic towards the skimmer becomes very inefficient.

In-line radiation monitoring will be used to detect an increase in aqueous phase carryover. This allows better control of operations and lower system radiation levels. The system will be designed for both daily and extended (>2 day) shutdowns and for continuous operation.

Startup of the organic removal system will follow a standard procedure. Appropriate valves at the shielding enclosure and at the phase separation system will first be positioned and confirmed. The desired pump flowrate will be set and instrumentation operability will be verified. During normal pumping operation the organic layer and some supernate will be skimmed from the tank and pumped to the phase separation system.

Figure 8-1. Organic Removal System Schematic

Shutdown of the system follows a standardized procedure. For short (overnight) shutdowns, the piping will be drained to prevent freezing during cold weather. For longer-term (weekend or longer) shutdowns and shutdowns for equipment maintenance, the piping may be drained and flushed with small volumes of water. The resulting flush water will be discharged to the tank. Appropriate valves in the phase separation system are positioned to prevent backflow to the skimmer pump. Backflushing of the skimmer pump discharge is routed back through the pump with the pump operating in reverse.

During final shutdown and removal, flushing is repeated, piping, hydraulics, and auxiliary systems connected to the system are disconnected and the enclosure and pump support are lifted from the tank while the decontamination collar is used to spray the equipment with

decontamination water. Following successful removal of the skimmer pump assembly, the decontamination collar is removed, and a blind flange placed on the tank riser.

The system is designed to minimize pump cavitation or suction starvation by correct placement of the pump assembly and by flow control. Pump over-pressurization is limited by design and by use of hydraulic controls. The system includes automatic shutdown of the pump on high pressure.

8.1.3 Hardware

The organic removal system consists of three main components: (1) a skimmer pump assembly, (2) a decontamination collar, and (3) a shielding enclosure. The skimmer pump assembly is composed of a skimmer, pump, and hydraulic motor. The skimmer pump assembly is suspended in the riser on a solid support mast. A hydraulic drive unit and associated electric motor are located external to the tank and are hydraulically connected to the skimmer pump assembly. The decontamination collar contains spray nozzles for decontamination. The shielding enclosure shields the top of the riser and provides a solid base to mount the support mast for the pump assembly. A CCTV system provides in-tank observation of the pumping operation.

The skimmer is a modified Douglas Engineering weir skimmer, model 650-SHX Skim-Pak™. It is a stainless steel rectangular float with a central sump. Entry to the sump is from a floating weir hinged to the body of the skimmer. In front of the weir is an elastomer flap. This flap provides the liquid-tight seal to the aqueous solution below the organic. The skimmer requires modification to replace the weir flap with one that is more chemically resistant (Figure 8.2). Additional development is required to select an appropriate material for the weir flap.

The pump is a modified Waukesha™ universal positive displacement pump Model 18. It is a dual-lobe, positive displacement type that minimizes mixing/agitation of fluids with discrete particles. The pump is positioned on a foot bracket base approximately 3 ft above the liquid surface. A flexible connection (Kynar® coil tubing) connects the pump inlet to the skimmer float outlet. The connection between the float and the pump allows a minimum of 1 ft elevation difference in the tank to prevent interference with the float operation. A safety bridle is attached between the pump and float to allow recovery should the flexible connection break. The pump self-primers to 3 ft, uses mechanical seals and has self-drainage capability.

The hydraulic motor is a Ross Operation Torqmotor® MG Series Roller Vane motor. The hydraulic motor is directly coupled to the pump shaft and mounted to the same foot bracket base as the pump. The inlet and outlet to the motor are ported at the rear. The motor is attached to the hydraulic drive unit through connectors external to the shielding enclosure. The hydraulic system was selected to eliminate an in-tank spark source. Authorization basis changes since 1994 may allow an in-tank motor, reducing system costs and complexities.

The hydraulic drive unit is a Paul-Munroe Rucker™ hydraulic drive unit, driven by a 3 horsepower (hp), 230 volt (V), 3-phase electric motor. The drive unit has the capability to reverse the flow with a directional flow control switch and operate at variable speeds through a

Figure 8-2. Mechanical Weir

flow controller. The drive unit and motor are located on a concrete pad external to the shielding enclosure. The hydraulic system is reversible via a directional flow control switch and can operate at variable speeds via a flow controller.

The decontamination collar consists of a 12-in diameter stainless steel pipe section with mounting flanges on both ends. The collar contains three high-pressure decontamination nozzles located equidistant around the collar. The nozzles are connected to a pipe ring located on the exterior of the collar. A self-sealing, no drip, quick disconnect flush connection is installed on the pipe ring to supply inhibited water from a portable decontamination system. A drip guard is installed internally on the lower end of the collar to assist in the decontamination operation. Shielding is installed on the external surface to minimize exposure during organic transfer. The collar assembly is connected to the C-103 High-Efficiency Particulate Air filter (HEPA) to assure passive ventilation of the tank headspace.

The shielding enclosure section consists of a 12-in diameter stainless steel pipe section with a mounting flange on the lower end and a cover plate on the upper end. A four-inch extension is installed on the side of the enclosure to facilitate connection of the pump outlet piping to the phase separator. All penetrations in the enclosure will be air- and liquid-tight to prevent the accidental release of contamination. A 6-in diameter pump support mast will be attached to the underside of the enclosure cover plate and extended into the tank approximately 30 ft. The

bracket on the lower end of the mast will rigidly support the pump and motor in a vertical shaft orientation without rotation. A leak detection system is installed in the 4-in extension to detect leakage from the pipe connection. Shielding is installed on the external surface to minimize exposure during organic transfer.

External piping connected from the shielding enclosure extension to the phase separator surge tank is of the same design as the SY-101 piping.

Instrumentation to monitor the organic removal system operation consists of a microprocessor control system. Process control parameters include hydraulic drive speed, motor controls and status information (motor running amps, motor temperature, motor running status), organic flow rate, feed tank liquid level, phase separator and treatment surge tank liquid levels, and interim storage tank liquid level.

Parameters also include leak detection and radiation monitoring information.

The CCTV system consists of a camera and lights installed in riser TBD and a monitoring/recording station located at the system control center. The system has normal pan, tilt and zoom controls typical to these types of systems.

8.1.4 Assumptions

The following assumptions relate to the removal of the C-103 organic phase:

- Technologies employed in the systems are commercially and industrially proven and directly adaptable for field use.
- Previous testing performed primarily to select and validate concepts and verify performance for application in these systems is valid.
- The previous weir flap material testing indicated a three month design life.

8.1.5 Interfaces

The organic removal system interfaces with the phase separator and the decontamination tanker.

Process control interface via microprocessor control system includes variable speed drive control, organic flow rate, feed tank liquid level, phase separator and treatment surge tank liquid levels, and interim storage tank liquid level. System shut-off will occur if a leak is detected or radiation limits are exceeded.

Process piping includes one section of double containment piping that connects the pump discharge line from the shielding enclosure to the phase separator surge tank. The secondary containment drains back through a weep hole into the shielding enclosure.

Electrical interface includes a 3-phase electrical distribution system.

8.1.6 Reserved

8.1.7 Work Scope

The following activities are required to assure an effective organic removal system life cycle:

- Completion of studies on the operation of the Douglas Engineering Skim-Pak® Model 8500-AS skimmer pump and alternate weir flap material.
- Design and construction to include skimmer flap material selection.
- Riser preparation (remove existing equipment, etc).
- Skimmer, level and CCTV subsystem installation.
- Test procedure development.
- Readiness documentation development.
- Operating procedure development.
- Process testing and readiness performance.
- Organic removed to the phase separator surge tank.
- Skimmer, level and CCTV subsystem removal.
- Equipment decontamination and disposal.

8.2 PHASE SEPARATOR

8.2.1 Description

Separation of the organic aqueous product stream will be performed by the phase separator system, specifically a coalescer installed inside of the separator enclosure. Separation will be performed prior to transfer of the organic to the organic treatment system. Provisions will be made in the design to pump the organic back through the phase separator system if further separation is required before the organic is transferred to the organic treatment system. The separated aqueous stream will be transferred back to C-103.

A coalescer was selected for the aqueous-organic separation because of its demonstrated capability to separate two phases with a small difference in the surface tension into two homogenous streams. A comparable gravity settler decanter was considered unacceptable due to the larger size, which would require a larger enclosure with more shielding. Another device investigated for separation of the organic was the liquid-liquid centrifuge. The main disadvantage of the centrifuge is that it is a complex machine and complex machines typically can have maintenance problems. Any breakdown at tank farms would present obvious

difficulties. Aqueous removed by the skimmer pump will be separated from the organic to the extent that the entrained aqueous in the organic is reduced to a fraction of 1% by volume.

8.2.2 Operational Concept

The skimmer pump transfers the C-103 organic through the coalescer to the organic treatment system. As the mixture of aqueous to organic increases with the decrease in the organic level in C-103, the interface between the two phases will tend to vary. An interface control valve in the aqueous return maintains the interface at a constant level within the coalescer.

The coalescer is constructed of 6-in schedule 40 pipe fabricated in the shape of a tee. The coalescer is installed with the long leg in the horizontal position and the two short legs in a vertical orientation. The feed is introduced into the horizontal leg of the coalescer, which contains a hollow, cylindrical spun glass coalescer element. The emulsion of C-103 aqueous and organic waste flows radially from the hollow core of the coalescer element to the exterior. The density of the spun glass in the coalescing element is varied radially from the interior to the exterior of the element. Initially, the fluid passes through a low-density spun glass zone that strips away any colloidal dirt film that surrounds the droplets. The second zone is high-density spun glass where the droplets are brought into close contact and begin to coalesce. A second zone of low-density spun glass increases droplet size and a screen covering the coalescing element is the site for droplet release. The coalescing element is manufactured without adhesives or binders that could be degraded by chemicals or radiation. The spun glass is resistant to both.

The enlarged droplets formed in the coalescing element separate by gravity into two distinct phases. The fluid velocity through the coalescer is sufficiently low to allow fine droplets of aqueous or organic to migrate to the respective phases before exiting the unit. The aqueous accumulates in the down-leg of the "tee" and the organic rises and exits the coalescer through the upper section of the "tee." Performance testing of the coalescer was performed with chemically equivalent simulants, which included additives to further simulate the disengaging times determined by observing actual tank waste organic/aqueous samples. This testing has shown the organic outlet stream will contain no more than 0.2% aqueous phase.

Temperature affects coalescer performance. The lowest temperature the coalescer has been operated at, using simulants, is 20°C. Efficient operations have been achieved at temperatures less than 25°C. Better results have been achieved at slightly elevated temperatures (40°C). In C-103 the tank temperature is about 46°C.

The aqueous drains into the drain tank and is pumped by a positive displacement pump to C-103 through a double-encased transfer line. The drain tank is sized to accommodate twice the volumetric capacity of the aboveground system, excluding the organic treatment system.

The drain tank also serves as a flush tank. This tank is vented to the separation enclosure. The open vent prevents the tank from becoming pressurized and forcing process solution out of the separation enclosure through the flush connection. Flush solution added to this tank can be circulated through the filters and coalescer and returned to the drain tank. After the operation is complete, all separation enclosure piping can be flushed via the drain tank.

A sump leg and valve allow the drain tank pump to return any accumulated aqueous or flush liquids in the enclosure back to C-103 via a subsurface addition leg to minimize in-tank mixing.

The phase separator system will be designed so that the line from the separations enclosure to the organic treatment system drains back to the separations enclosure; and the line connecting the separations enclosure to C-103 drains back to C-103. Alternatively, if this is not possible, vacuum breakers shall be installed at the high point in the lines. The vacuum breakers shall be vented back to the enclosure or directly/indirectly to C-103 headspace.

Flowmeters on the coalescer feed and aqueous drain lines are of primary importance to the skimmer operation. The skimmer pump flow rate is reduced as the quantity of organic in C-103 is reduced or the quantity of aqueous is increased. This will be measured using radiation detectors mounted on the transfer line. Reducing the pumping rate reduces the quantity of entrained aqueous removed in the skimming operation. The pumping rate is initially highest when the skimmer is removing pure organic. The coalescer feed flowmeter indicates to the operator that the desired skimmer flow rate is being maintained and the microprocessor controller calculates, totals, and displays the organic processed. The pumping rate is reduced when the skimmer pump begins removing aqueous. The fractional flow of aqueous at the lower pumping rates varies from 10% to 90% of the total flow, hence the aqueous flowmeter has a lower flow rate range than the feed flowmeter. Performance testing of the combined system will determine the optimum operating parameters. The flow rate from both flowmeters and the total organic and aqueous recovered is displayed in the control trailer.

Gauges located on the upstream and downstream side of the prefilters and the coalescer read pressures. The pressure gauges are the only locally mounted instruments in the enclosure. A high differential pressure between upstream and downstream gauges indicates a plug. The flowmeter on the feed to the coalescer will actuate an interlock on low flow shutting down the skimmer pump.

8.2.3 Hardware

Hardware Requirements:

The phase separator system enclosure shall be vented through a HEPA filter located at the enclosure. The enclosure vent line shall connect to the C-103 vent upstream of the filters.

The phase separator system shall be capable of removing all particles $\geq 5\mu\text{m}$ from the feed stream to the coalescer.

The phase separator system shall be designed to contain leaks in the piping containment and the separation enclosure.

The coalescer and all related equipment shall be designed for the life of the project. Flushing the coalescer and selected piping to maintain required performance and acceptable exposure levels is included in the system. Flushes will be transferred back to C-103.

All equipment associated with the phase separator system, including transfer lines, shall be above-ground.

The phase separator system shall be capable of automatic shutdown for any of the following contingencies:

- High radiation in the separated organic.
- High-high level indication in the drain tank.
- Liquid indication in the enclosure sump/line encasement collection point.
- High liquid level in temporary holding tank.

The coalescer shall separate any emulsions created by the retrieval process into two streams, organic and aqueous. Minimum purity of organic discharged to the treatment system: less than 2% aqueous carryover.

- Material of coalescer element: corrosion and radiation resistant (e.g., glass fibers).
- Material of coalescer vessel: preferably 316 or 316L austenitic stainless steel.
- Coalescer Flow capacity: 5 gal/min maximum.
- Coalescer operating pressure: 2 to 5 pounds per square-inch (lb/in²) (gauge) differential.
- Coalescer operating temperature: 25°C to 60°C.
- System shall be flushable.

The separations enclosure shall be shielded to limit personnel exposure to no greater than 30 mR/hr or less.

Hardware Description:

The separations enclosure will consist of a two-compartment shielded box approximately 3 ft by 6 ft by 6 ft high. The arrangement is similar to a common design used in plutonium operations. The cabinet design has an operating side and a maintenance side. Locating the maintenance side in a room separate from the operating side affects contamination control. The partition between the maintenance side and operating side of the cabinet serves as a radiation shield from expected high exposure items.

The partition wall in the separation enclosure serves a similar purpose, shielding the operator from the radiation emissions from the drain tank, coalescer, and filter. The operating side houses the pump, valves, and instrumentation, which are accessible for maintenance through removable panels. The extension rods for the valve handles pass through the operating side panel. The backside of the separation enclosure is sealed; the only access is through the lid. The radiation monitors are located on the operating side, one on the inlet and the other on the outlet of the coalescer. Other instrumentation in the operating compartment include the interface detector, liquid-level detectors, flowmeters, and the temperature element. An encased line will extend from the separations enclosure to the organic treatment system.

The separations enclosure houses the aqueous-organic separation system that consists of the following:

- Pre-filters
- Coalescer
- Aqueous drain tank
- Aqueous return transfer pump.

The pre-filters remove particulate from the separation system inlet. The coalescer separates the organic and aqueous phases. The aqueous drain tank serves many functions including temporary storage of separated aqueous, aboveground system drain, separation enclosure sump, and flush tank. The aqueous return drain tank pump transfers the contents of the drain tank back to C-103.

The first component of this system is the pre-filters. The pre-filters prevent the particulates from plugging the coalescer. Three coalescer prefilters are provided, but only one pre-filter is on-line at a time. The sintered metal cartridges are rated for 5 μ m particles and the filter housing is drainable back through one of the other two filters.

The phase separator system will be equipped with radiation detection devices to ensure that highly radioactive solution is not pumped to the organic treatment system.

Instrumentation and controls will provide for automatic shutdown of the process for high radiation, leaks, and other important process central parameters.

The phase separator system will be designed to contain leaks in the piping containment and the separation enclosure.

A self-contained, stand-alone microprocessor handles the analog inputs and outputs, discrete inputs, and discrete outputs. The microprocessor controller is contained in a cabinet with the analog and discrete termination panels and signal conversion modules.

The separation enclosure instrumentation is primarily for monitoring and controlling the coalescer. The only control loop is associated with the coalescer. A level monitor instrument will be used to position the aqueous drain valve.

Radiation monitors fixed to the coalescer inlet pipe and the outlet pipe indicate the performance of the coalescer. The ionization chambers, which are shielded from background radiation, detect the level of radioactivity of the feed and the separated organic. The continuous online monitoring of the radioactivity in these streams provides the operator with immediate indication of the inability of the coalescer to effect a clean phase separation. A high level of detected radiation in the organic will actuate an interlock shutting down the skimmer pump.

There are two options for aqueous removal from the coalescer to C-103. As a back up, pumping is possible from the drain tank as follows: the aqueous draining from the coalescer accumulates in the drain tank until the liquid level reaches the high-level detector, which causes the switch to

close, starting the drain tank pump. Transfer of aqueous waste continues until the pumping has lowered the liquid level to the low-level detector, which switches the pump off. The drain tank is also equipped with a high-high liquid level detector that is a backup to the high liquid level detector. If liquid in the drain tank should exceed the level that would normally cause the pump to start because the high level detector-switch system failed, then the high-high liquid level actuates an interlock that shuts down the skimmer pump.

A liquid detection probe is used to detect leakage into the separation enclosure sump. When contacted with any liquid solution, this probe actuates an interlock that shuts down the skimmer pump.

The coalescer performance is best at temperatures greater than 25°C. A temperature device is mounted in the organic product line. The temperature of the C-103 waste and the heat from the drain tank pump is expected to maintain the operating temperature of the coalescer above 25°C. However, if winter operation is planned, unacceptably low system temperatures could occur. Manually adjusted electrical resistance heating of the coalescer is provided to increase the coalescer temperature to the optimum level.

The separation enclosure is made up of a heavy shielded section and a light shielded section. The components exposed to the highly radioactive aqueous solution (i.e., coalescer, filters, and the drain tank) are mounted in the heavily shielded section. The drain tank is fabricated with 1.5-in thick plate for additional radiation protection. The lightly shielded section, containing the valving, radiation monitors, and instrumentation, is separated from the heavily shielded area by an additional shielding plate. Front removable access panels allow for equipment replacement and maintenance in the lightly shielded section only. Final thickness of the shielded plates will be determined during definitive design.

The separation enclosure will normally be sealed. All internal valves have extension rods connected through enclosure walls to external valve handles. Enclosure penetrations and non-welded seams will be fitted either with a gasket, or packing glands. There will also be a vent line with a HEPA filter in it that goes back to the existing HEPA filter system at C-103 Riser 2.

Fluid entering the separation enclosure C-103 from Riser 2 flows through 1/2 in, schedule 40, double encased stainless steel pipe and is filtered through one of a bank of three (5µm) filters.

Local pressure indicators will be located at the inlet and outlet of the filters and the outlet of the coalescer. These indicators will help monitor the performance of the filters and the coalescer.

There will be a radiation detector and a flow measurement device at the inlet of the coalescer and another radiation detector, as well as temperature measurement device, at the outlet of the coalescer. The radiation detectors will be used to determine the adequacy of the organic separation. Radionuclides are more prevalent in the aqueous solution than they are in the organic solution. The inlet and outlet radiation readings can be compared to determine how the separation process is working. Based on the outlet radiation reading, the operator can decide to continue the transfer to the tank trailer or terminate it. High-level radiation readings will shut down the system. The temperature and flow measurement systems will be used to ensure the inlet flow and temperature is maintained for proper coalescer operation.

Level instrumentation will monitor the level in the coalescer itself. Motor operated valves will be provided at the outlet and the drain lines of the coalescer for level control inside the coalescer.

8.2.4 Assumptions

The design of the phase separation system is based on the May, 1994 preliminary design (WHC-SD-WM-PLN-092).

- Laboratory testing of coalescer performance is valid.

8.2.5 Interfaces

The phase separation system is connected by encased lines to C-103 and to the organic treatment system. There are two encased lines from C-103: the discharge line from the skimmer pump to the enclosure and the aqueous return to the salt well riser, and one encased line connecting the coalescer to the trailer mounted container. A filtered vent line at the separation enclosure is connected to the existing charcoal filter system on the tank.

8.2.6 Reserved

8.2.7 Work Scope

The following activities are required to assure an effective phase separation system life cycle:

- Completion of studies on the optimum temperature and flow rate for coalescer operation.
- Completion of studies to determine the effect of foam formation and dispersion.
- Completion of studies to assure the test simulant adequately represents the organic to be processed.
- Perform filter system investigation on particle volumes, flushing requirement and plugging potential.
- Test procedure development.
- Readiness documentation development.
- Operating procedure development.
- Process testing and readiness performance.
- System operation.
- Equipment decontamination and disposal.

8.3 ORGANIC TREATMENT

8.3.1 Description

The objective of organic treatment is to decontaminate the retrieved C-103 organic in order to meet DOT shipping requirements and the WAC requirements of the disposal facility. If the phase separation system can remove enough radionuclide contamination, it is likely that organic

treatment will not be required. As the organic is removed from the tank progressively from the top of the organic layer to the bottom of the organic layer, the most likely scenario is that the top layers of organic will be clean enough for shipping and not require washing. As the lower layers of organic are retrieved from the tank, though, more aqueous is expected to be entrained in the organic and thus require washing to meet shipping requirements.

In radioactive processes, organic solvents have typically been purified by two methods – distillation, or by “washing” with an immiscible chemical solution. The solvents used at the PUREX and B Plants were mixtures of several organic compounds. These organic compounds are relatively nonvolatile and chemically stable at moderate temperatures. Therefore, chemical washing has proven to be a simple and effective treatment method for these materials.

Solvent decontamination by adsorption of contaminants on porous media is a more recent development. Laboratory studies have shown that certain macroreticular ion exchange resins are very effective in removing residual radioactivity from PUREX solvent. Assuming this method would work successfully with the C-103 organic, an ion exchange system could be installed near the separation apparatus. The organic would be pumped through the system and into the interim storage tank or trailer transport tank. However, this method requires laboratory development with C-103 organic simulant, as well as scale-up data in order to pursue further design.

Alkaline wash is the first choice for treatment of the organic in C-103 because its effectiveness for a TBP-NPH mixture is well established. The success of this method has been demonstrated by its incorporation in the PUREX process. In addition, the PUREX organic inventory (sent for disposal after plant shutdown) treated by solvent washing met Low Specific Activity (LSA) requirements.

Based on initial laboratory testing with actual C-103 waste samples, it has been determined that 0.1 M sodium ethylenediaminetetraacetic acid (EDTA) at pH 11 will reduce the organic radionuclide concentrations by approximately 95% after two washes (Lumetta, 1996). This should qualify the organic as LSA material.

The chemical washing process involves adding a chemical (alkaline or caustic) as an agent to effectively “wash” the radioactive constituents out of the organic. In this case, the EDTA will be used as a complexing agent to attach onto the radionuclides in the entrained aqueous, thereby removing them from the organic phase. The highly radioactive constituents, then, would remain in the wash solution and be disposed of through the aqueous return system, while the “cleaned” organic would be interim stored for offsite shipment and subsequent disposal.

8.3.2 Operational Concept

The items required for an effective organic treatment system include a phase disengager or decanter, a vessel for achieving intimate contact between the aqueous and organic phases, and up to two auxiliary vessels – one for temporary storage of the makeup wash solution and one for receiving the residual high-level waste solution from the decanter. The vessels should be equipped with samplers, agitation, heating/cooling capability, and specific gravity and temperature measurement instruments. In addition, pumps and jumpers will be required to transfer the solutions between tanks. Finally, a clean transport truck is required for interim

storage of the cleaned organic pending final disposition. This is the preferred option to preclude recontaminating the organic.

Contacting Vessel:

The organic wash vessel must be capable of achieving intimate contact between the organic and aqueous phases. Any tank that is equipped with a high-efficiency, slow speed [~300 revolutions per minute (rpm)] agitator will probably be capable of providing the necessary phase mixing. Since time is not of great importance (within reasonable limits), less efficient contacting can be compensated by longer contact time.

The size of the contacting vessel is not critical, within reasonable limits. Any vessel in the size range of 1,500 to 5,000 gal, equipped with an efficient agitator should be adequate. A vessel smaller than (1,500 gal) would require an excessive number of small batches with the probability of higher "losses" of organic to aqueous waste. With larger vessels it would be more difficult to obtain intimate phase contact, particularly with agitators of limited size. An International Standards Organization (ISO) tank in the size range of 2,500 gal will be used.

At the B Plant, the required degree of cleanup of the organic solvent was accomplished with a recirculation pump and a standard propeller-type agitator in a standard (4,000 gal) vessel. This type of contacting vessel performed satisfactorily under the process conditions at B Plant and should be satisfactory for cleaning the organic from C-103.

Decanter:

An aqueous-organic decanter vessel will be required to obtain a good, clean separation of the phases after the treatment step. Preliminary studies with simulated aqueous waste and organic solutions indicate a relatively long disengaging time, therefore a horizontal box-type decanter with a large interfacial area, will be required. The approximate dimensions of the unit are 5 ft long by 30-in wide by 18-in deep.

Auxiliary Equipment:

The installation of jumpers or other auxiliary equipment will be required in order to receive and treat the organic and separate the phases. Most, if not all, of the equipment changes can be accomplished by contact maintenance.

Operating Sequence:

The process flow diagram for organic treatment is shown in Figure 8.3.

First, the EDTA wash solution (approximately 1,000 gal) is added to the wash tank. The aqueous recirculation pump is started and the aqueous wash solution is circulated in the wash tank. The organic (and entrained aqueous) solution is pumped from the coalescer (phase separation system) to the wash tank.

Figure 8-3. Organic Washing Process Flow Diagram

When a batch of organic (approximately 1,000 gal) is in the wash tank, the organic re-circulation pump is started and the organic is circulated along with the aqueous wash solution for at least two hours (as determined through laboratory development).

The organic and wash solution is then allowed to settle in the wash tank for a period of time, as determined through laboratory development. Once phase disengagement has occurred, the wash solution is pumped out from the bottom of the tank via a bottom suction pump into an LR56/H cask truck, sampled (if required), and sent to the 204-AR Unloading Facility. Another option of sending the wash solution to C-103 is discussed later.

The organic and any remaining wash solution in the wash vessel is then pumped to the decanter vessel where phase disengagement is allowed to continue until completion. Any additional wash solution is also pumped into an LR56/H cask truck for transfer to 204-AR. The organic is then sampled and analyses requested for gamma scan, ^{90}Sr , ^{241}Am , and total Pu. Upon receipt of the sampling results, the organic is then either stored (temporarily) in the decanter or pumped to an ISO tanker for interim storage or into a transportation vessel for immediate shipment to the disposal facility. By sampling in the decanter vessel and determining the "cleanliness" of the organic, it can be assured that the ISO tanker will remain uncontaminated for shipment to the disposal facility.

8.3.3 Hardware

An unshielded portable tank will be required for use as the wash vessel. A standard ISO tank is approximately 605 centimeters (cm) (238 in) long and has a maximum capacity of 24,000 liters (L) (6,300 gal). Pipe, valve, pump, decanter, and pipe connection panel supports will be added, as well as the standard propeller-type agitator. The ISO tank will be built to specification and skid-mounted next to the phase separation system at the C Farm.

Organic/aqueous from the coalescer will flow through piping to the ISO wash tank through an organic pump. A bottom suction pump on the wash tank will remove the disengaged wash solution from the tank to the LR56/H cask truck. The organic and remaining wash solution will flow through piping to the decanter. The dilute 0.1M EDTA solution will flow from the existing fixed dilute solution tanker truck through a pump to a nozzle on the wash tank. Vent gas and overflow liquid will flow through a third hose from/to a wash tank nozzle to the LR56/H cask truck. Electrical instrument power will be connected to a control panel for distribution to (1) the Resistance Temperature Detector (RTD) sensor in a wash tank nozzle, (2) the associated transmitter and indicator, and (3) the three differential pressure transducers, signal conditioners, and indicators associated with specific instruments.

The organic pump can recirculate organic liquid through the wash tank nozzle or the decanter. Foam fire suppression piping and a distribution nozzle will be installed above the wash tank location in the containment tent. This will serve for fire protection from combustion of the organic.

The decanter and pump capacity of 25 gal/min was selected to allow unloading the approximately 2,500 gal load into the wash tank in two hours. The 1 hp pump will produce a 26 psi pressure rise and will self prime from 12 ft. This is assumed sufficient for the coalescer and the distribution manifold connected to the wash tank nozzle.

The decanter is of standard size of approximately 2,500 gal, fitted with a sight glass and sampling equipment. Upon receipt of favorable sampling results, "clean" organic will flow

through piping from the decanter through a pump to an ISO tanker for interim storage or shipment to offsite disposal. The decanter will also have a bottom suction pump to remove any remaining wash solution to the LR56/H cask truck. Used wash solution will flow through piping from the decanter through a pump to the LR56/H cask truck.

The wash vessel and decanter will likely be sited at the same place as the phase separation equipment. The concrete pad will require a stainless steel liner with raised sides to provide secondary spill containment.

8.3.4 Assumptions

- Performance of the coalescer. Effective coalescer performance does not rule out the need for additional organic decontamination.
- Radiation survey of the organic stream after the phase separation process will help to determine the amount of aqueous carryover in the organic stream.
- The treated organic shall qualify for shipment as an LSA material as defined by current regulations or as acceptable by the disposal receiving facility, whichever is limiting.
- The dose rate of the organic after the washing process will be such that interim storage and transportation to the disposal facility can take place in an unshielded tank.

8.3.5 Interfaces

The organic treatment process will receive organic with entrained aqueous from the phase separation process. The organic treatment process will provide "cleaned" organic for interim storage (as necessary) prior to offsite treatment and disposal as well as aqueous (removed from the organic) and "used" wash solution routed to the 204-AR Unloading Facility. In addition, the organic treatment process will require support from Site Utilities (power, decontamination solution, water, fresh air, etc), and laboratory support for the makeup of the EDTA wash solution.

8.3.6 Reserved

8.3.7 Work Scope

The following activities are required to assure an effective chemical washing process:

- Completion of laboratory development for the optimization of the chemical washing process. At this time, a ratio of 1:1 has been used effectively to show that chemical washing of the organic can be effected. Optimization of the process will involve varying the ratio of wash solution to simulated organic, varying the temperature, and varying the contact and disengaging time.
- Preparation of conceptual design of the chemical wash.
- Test procedure development.

- Readiness documentation development.
- Operating procedure development
- Process testing and readiness assessment.
- Organic treatment through washing of the organic with EDTA.
- Pump cleaned and sampled organic to the receiving tank.
- Move the receiving tank to permitted interim storage.
- Equipment decontamination and disposal.

8.4 AQUEOUS RETURN

8.4.1 Description

The aqueous return system for the organic treatment solution is the LR-56 cask system. After organic treatment and after the treatment solution has settled, it will be “vacuum loaded” into the LR-56. Once the LR-56 is full, the treatment solution will be transported to the 204-AR facility where it will be “vacuum unloaded”. From the 204-AR facility, the organic treatment solution will be pumped to a double shell tank in east area.

Another wash solution aqueous return concept is to drain/pump the treatment wash water directly to C-103 using the same under the surface drop leg as the coalescer. This option reduces operational complexity and cost but creates two potential issues, one is that “newly generated waste” is going to a SST and the other is will this water addition affect skimmer operation. The baseline in this report is to use the LR-56 and transfer the wash solution to a DST via 204-AR.

8.4.2 Operational Concept

The LR-56 is a self contained transport system and as such has all of the pumping, piping, controls and interlocks necessary to transport the organic treatment solution from the organic treatment system to the 204-AR facility. One drawback of the LR-56 is that it has a capacity of approximately 1000 gallons, therefore, transport of the organic treatment solution to the 204-AR facility may require several cycles.

It is anticipated that the pumping of the organic treatment solution will be performed using the “vacuum loading” and “vacuum unloading” modes of the LR-56. Using these modes will place all piping under a negative pressure, therefore, there will be no possibility of leakage.

The 204-AR facility operates and maintains the LR-56. Currently, operator training is ongoing and startup activities are proceeding to be able to operate the LR-56 in the very near future.

8.4.3 Hardware

The LR-56 is a complex shielded tanker with a liquid capacity of 4,000 L (1,057 gal) and incorporates 35 mm (1.4 in.) of lead shielding. The packaging was designed and manufactured in France and is certified in that country to transport Type B quantities of liquid. The RPP has procured a LR56, which is available for use. At Hanford, the shipment of C-103 waste using LR56 within site boundaries is authorized by an onsite Safety Analysis Report for Packaging (SARP) (WHC-SD-TP-SARP-009). The LR56 is new and has not been radioactively contaminated, however, it is planned to be put in to service in the very near future.

8.4.4 Assumptions

The organic treatment solution will be compatible with the 204-AR facility and double shell tank wastes.

8.4.5 Interfaces

The aqueous return system (LR-56) must interface with the organic treatment system and the 204-AR facility. Scheduling of the LR-56 will need to be coordinated with other user projects.

8.4.6 Reserved

8.4.7 Work Scope

- Readiness documentation development.
- Operating procedure development.
- Transfer and offload wash water at 204-AR.
- Flush LR56 system for future use.

8.5 INTERIM ORGANIC STORAGE

8.5.1 Description

Interim storage may be required upon completion of organic treatment, prior to offsite shipment to the disposal facility, due to scheduling conflicts or other unanticipated delays in offsite shipping. If at all possible, immediate shipping of the clean organic will be the preferred in C-103 organic removal process.

8.5.2 Operational Concept

The purpose of interim storage is simply to store the organic in a tank until the organic can be shipped offsite to a disposal facility. Pumping of the organic into the tank is covered Section 8.3, Organic Treatment, and offloading of the tank and/or its contents for vendor shipment is covered in Section 8.6, Disposal/Destruction Site.

8.5.3 Hardware

An unshielded portable tank will be required for use as the interim storage vessel. A standard ISO tank fits within a 605 cm (long) by 259 cm (wide) by 244 cm (high) (238- by 102- by 96-in) frame. The maximum capacity of such a tank is 24,000 L (6,300 gal).

The interim storage will be sited most likely at the C Farm on a concrete pad. A regulatory compliant storage pad design has been developed and storage location is dependent on access and dose rate (McClure, 1999).

8.5.4 Assumptions

The dose rate of organic will be such that interim storage can take place in an unshielded tank.

8.5.5 Interfaces

The interim storage process will receive "cleaned" organic that has been verified through sampling from the organic treatment process (or the phase separation process if organic treatment is deemed unnecessary). The interim storage process will provide an ISO tank containing the organic ready for shipment offsite in the same tank or for unloading into a vendor's tank.

8.5.6 Reserved

8.5.7 Work Scope

The following activities are required to assure effective interim storage:

- Tank construction and siting.
- Readiness documentation development.
- Operating, surveillance, and emergency response procedure development.
- Acceptance and storage of the cleaned and sampled organic.
- Transfer to stripping vehicle.
- Tank clean-up for reuse.

8.6 DISPOSAL /DESTRUCTION SITE (INCLUDES TRANSPORT CAPABILITY)

8.6.1 Description

Transporting C-103 organic phase liquid to a site for disposal by incineration is an effective disposal method (Dukelow, 1996). The type of shipping container is dependent upon the volume to be transported, the radionuclide concentration DOT regulations, and the WAC of the receiving disposal facility.

This is based on the concentration of radionuclides in the organic phase and the Waste Acceptance Criteria (WAC) of the receiving incineration facility. Diversified Scientific Services, Inc. (DSSI) of Kingston, Tennessee (currently), and Allied Technical Group of Richland (ATG), Washington (scheduled to accept waste by September, 2000), and TSCA Incinerator (TSCAI) of Oak Ridge, Tennessee each operate an incinerator that can accommodate the contaminated separable organic phase of C-103. No disposal costs for ATG are available at this time.

Offsite land disposal at the Nevada Test Site (NTS) is an additional option that recently became available. Fluid Tech, Inc. of Las Vegas, Nevada, will perform stabilization of the liquid organic waste shipped in overpacked 55-gal drums, provided the radionuclide concentration meets the WAC for NTS. While preliminary evaluation has indicated this is a viable disposal option, the remainder of this section uses incineration as the baseline.

8.6.2 Operational Concept

Before the waste can be accepted, the radionuclide concentration must be within the prescribed limits of the facility WAC. The analysis (Lumetta, 1996) indicates that activity of radionuclide species are within the allowable limits prescribed in the DSSI in the untreated organic phase liquid. However the ^{90}Sr concentration exceeds the ATG WAC by a factor of 7 (see Appendix A, Tables A-1 and A-2). If subsequent analyses of the C-103 organic phase liquid are in accordance with the 1996 results, then EDTA treatment to reduce radionuclide concentrations is not required to meet the DSSI WAC. However, it is expected that the total volume of organic phase liquid removed by the skimming process will contain approximately 0.2% aqueous phase with a high concentration of radionuclides. As a result, it is likely that the radionuclide concentration of the organic phase liquid will increase. If the increase exceeds the WAC of the receiving facility, then treatment and phase separation will be necessary.

If DSSI incinerates the waste, they will be responsible for disposal of the ash. In addition, DSSI is exploring disposal options other than incineration for this C-103 waste stream in an effort to reduce disposal cost.

Tables A-1 identifies each radionuclide species, the concentration and total amounts of radionuclides in untreated organic phase, and the maximum allowable by DSSI. The untreated C-103 organic phase liquid could fail to meet the requirements of the DSSI WAC for ^{90}Sr , as that radionuclide is less than an order of magnitude less than the WAC limit.

Transportation Requirements

It appears that the untreated C-103 organic phase will qualify as LSA-II waste in accordance with 49 CFR 173.433 (Appendix A). Although the untreated concentrations of radionuclides are within the allowable shipping limits for LSA-II radioactive waste, the skimming process could elevate the radionuclide levels. Sampling after skimming and phase separation will be necessary to determine if further treatment is needed to reduce the levels to within the LSA-II limits.

There are two shipping container options. A 7,700 gal ISO tank and the DSSI disposal facility can provide a 4,800 gal liquid tanker that is permitted to transport LSA-II wastes.

Transportation Cost

The transportation cost of the C-103 waste by bulk liquid tanker or containerized waste on a flatbed truck, is normally based on round-trip mileage. The average rate of \$1.50 per mile for the approximately 4,800-mile round trip to DSSI is approximately \$7,200. The advantage of the International Standards Organization (ISO)/flatbed system over the bulk liquid tanker is that the waste could be transported in one load with the ISO system as opposed to two loads with the tanker. Using multiple shipping vessels could result in more waste generated through decontamination at the transfer pad.

Analysis Cost

The analysis of the organic phase liquid will be sent to Waste Management Technical Services (WMTS) for evaluation and final determination of the offsite shipping classification. WMTS will make arrangements for offsite shipping including arranging for suitable shipping container, container inspection, mode of transportation, and completion of all shipping documentation. The cost for this service is estimated at \$1,000.

Disposal Cost

Cost for disposal of the C-103 organic phase liquid by DSSI is estimated to be approximately \$1.6 million for the estimated 5,000 gal of organic phase liquid. The cost driver is the high concentration of TBP.

8.6.3 Hardware

The hardware under consideration for transportation consists of a vendor-supplied bulk liquid tanker and an ISO tank flat-bed truck. DSSI has a 4,800 gallon bulk liquid tanker permitted to transport LSA-II liquids over the highway. If, as a result of the skimming process, the activity of the organic phase increase to above the LSA-II limit, the tanker may not be used to transport the C-103 organic phase liquid.

A flatbed truck can be used to transport an ISO tank containing the C-103 organic phase when the organic phase meets shipping and WAC requirements. The advantage of the ISO tank over the tanker is that no additional tank needs to be obtained to treat the skimmed organic phase liquid from C-103. The tank is skid-mounted ISO tank and can be placed on a flatbed truck to transport the waste to the disposal facility. If however, no treatment is necessary, less expensive options may be more attractive. DSSI will provide the bulk liquid tanker at no cost for waste shipped to their facility. An ISO tank already on the Hanford Site might be used at no cost, otherwise one would have to be purchased.

8.6.4 Assumptions

The main assumption is that after phase separation and treatment, the C-103 separable organic phase liquid will meet the WAC requirements of the receiving disposal facility and DOT shipping requirements as LSA-II. Thus, the organic phase may be transported in one or two shipments.

Since the DSSI bulk liquid tanker is dedicated only to transporting LSA-II material, the tanker will carry residual radioactive contamination after rinsing at the disposal site. It is assumed that the residual activity will not increase the total activity of the containerized separated/treated C-103 organic phase liquid of the containerized treated/separated C-103 organic phase liquid to levels above the LSA-II limits. If the activity of the tanker is too high, then the organic phase liquid may need to be treated/further treated to reduce activity levels low enough so that the combination of tanker residual and organic phase liquid do not exceed the LSA-II limits.

8.6.5 Interfaces

Transportation will interface with Interim Storage, the Waste Transfer Pad, onsite Solid and Radioactive Waste Disposal Facility, onsite Facilities, and offsite Disposal facility.

Interim Storage

After the phase separation and wash phase, the organic phase liquid will be placed in an interim storage vessel. The liquid needs to be sampled and analyzed for radioactive contamination to comply with DOT shipping (Tables A-3 and A-4) and disposal facility requirements (Table A-1). In addition, a pumping system to transfer the separated organic phase liquid to the tank/tanker for transportation needs to be compatible with the transportation vessel.

Load In/Load Out Station

If a bulk liquid tanker is used to transport the C-103 organic phase liquid, a transfer pad will need to be constructed to transfer the washed C-103 organic phase liquid from the holding tank to the tanker. The pad needs to be constructed to accommodate decontamination of the transportation vessel if needed. If an ISO tank is used to contain the organic phase liquid during interim storage, then facilities must be provided to move the tank from its interim storage location to a transfer pad, and to place the tank onto a flatbed truck for transportation to the disposal facility.

Solid and Radioactive Waste Disposal

Decontamination of the vessel after transfer needs to be performed and provisions made to analyze and dispose of the decontamination solution. Thus, the transfer pad needs to be constructed to contain potential decontamination fluids.

Site Facilities

Electrical power as well as and water for decontamination of the transportation vessel and waste transfer equipment decontamination need to be provided.

Offsite Disposal facility.

The waste will be shipped in bulk liquid form to a disposal facility, DSSI in Kingston, Tennessee.

8.6.6 Reserved

8.6.7 Work Scope

- Receive separable organic phase liquid with no aqueous phase at the load-out station.
- The organic liquid is pumped into one ISO tank, or in a bulk liquid tanker provided by the incineration vendor. Two loads in the tanker will be necessary to transport all the suspected volume of organic phase liquid.
- Shipping container/transporting vehicle are decontaminated as necessary.
- Load-out station is removed and all materials disposed in accordance with Site requirements.
- If an ISO tank is used to transport the waste, then the ISO tank will be returned to the Site, decontaminated as necessary and stored.

9.0 REGULATORY, PERMIT AND AUTHORIZATION BASIS CHANGES

9.1 Introduction

The methods and processes for the removal, treatment, storage, and disposal of separable organic from C-103 involve processes that have been investigated and documented in several previous studies. Any time new or modified processes are to be employed in RPP facilities an assessment of the potential regulatory impacts on the RPP Authorization Basis (AB) needs to be performed. Based upon the results of such an assessment the following regulatory, permit and/or Authorization Basis changes may be required:

- Hanford facility Dangerous Waste Part A Permit modification,
- Air permit review and Notice of Construction issuance,
- National Environmental Policy Act (NEPA) impacts and updates for organic treatment other than phase separation,
- RPP Final Safety Analysis Report (FSAR) Amendment or Justification for Continued Operation (JCO) preparation,
- Safety Analysis Report for Packaging (SARP) for transportation of organic to disposal location/facility.

9.2 Assessment Methodology

The assessment of AB impacts on the C-103 separable organic treatment/disposal is initiated through the Unreviewed Safety Question (USQ) process (CHGI, 1999). The USQ process exists to allow contractors to make physical and procedural changes and conduct tests and experiments without prior DOE approval as long as the changes do not explicitly or implicitly affect the AB

of the facility or result in a change to Technical Safety Requirements (TSRs). If the equipment and processes involved in the removal, treatment, storage, and disposal of the separable organic layer from C-103 are deemed to be a modification of existing systems, and are bounded by the accident analysis in the RPP FSAR, then utilization of the USQ process is appropriate. This process begins with a USQ Screening to determine whether a USQ Evaluation is required. For the removal/treatment/disposal of C-103 separable organic there are enough unanswered regulatory and AB questions to require the performance of a detailed USQ Evaluation. To determine if this project is within (or covered by) the current RPP FSAR it will probably be necessary to perform some analyses and calculations to demonstrate compliance. If there is a positive USQ determination a RPP FSAR Amendment (or JCO) will need to be prepared to modify the AB. These issues are discussed in Section 9.3 below.

The regulatory and permit impacts must also be assessed and recommendations provided for the disposition of the issues regarding Ecology Air Permits and NOC issuance, NEPA impacts, modifications to the Dangerous Waste Part A Permit, and other state and federal permits. These issues are discussed in Section 9.4 below.

The shipment of separable organic offsite for storage/disposal may be impacted by the type of shipping container selected, chemical composition of the material, activity concentration in the organics, shipping volume, and total activity shipped. The onsite shipment of the aqueous return also has shipping requirements which must be met. Both types of shipments require an analysis of the potential impacts of accidents and abnormal events, and an assessment of the ability to meet DOE and DOT shipping requirements. These analyses are typically contained within a Safety Analysis Report for Packaging (SARP). A discussion on the status of the shipping options is contained in Section 9.5 below.

9.3 Authorization Basis Modifications

Based upon a review of the C-103 separable organic removal/disposal processes being recommended, the following assumptions and initial conclusions/recommendations have been developed.

1. Performance of a USQ Screening will result in a positive finding (i.e., a USQ Evaluation will be required).
2. There is a likelihood that a USQ determination will be negative. The equipment being proposed could be classified as waste transfer equipment and processes in relation to the FSAR and TSR documents. In addition, the expected radionuclide concentrations and inventories are orders of magnitude below the aqueous tank wastes which are normally involved in waste transfers. Consequently, any potential accident scenarios associated with this process should be adequately bounded by the following FSAR Evaluation Basis Accidents:
 - Section 3.4.2.4 - Organic Solvent Fire,
 - Section 3.4.2.5 - In-Tank Fuel Fire/Deflagration,

- Section 3.4.2.7 - Surface Leak Resulting in Pool, and
- Section 3.4.2.9 - Spray Leak in Structure or from Waste Transfer Lines.

However, there are issues on the toxic consequences and whether there is more solvent burnt in a glovebox organic solvent fire than the in tank fire.

3. It is estimated that a USQ Evaluation and the accompanying analysis could take up to two months and cost around \$20K to \$30K.
4. Although it may be possible to close the AB modification issue with a negative USQ Evaluation, it is considered prudent to budget for the preparation of a RPP FSAR Amendment package. A SAR Amendment package typically requires detailed facility/process descriptions; hazards and accident analyses; determination of safety Systems, Structures, and Components (SSCs); and identification of potential TSR requirements. Preparation of a SAR Amendment package could cost between \$200K and \$300K, and require three months or more. The total time from initiation of the amendment process through the approval cycle is typically 6 months.
5. For planning purposes this scoping study will assume that a SAR Amendment package will be required at a cost of \$200K and a duration of 6 months from start through DOE approval.

9.4 Permits, NOCs, and NEPA Impacts

The Environmental Permits, Approvals, and Requirements (EReqs) Checklist is a general purpose tool for identifying environmental standards and determining their applicability to Hanford Site work. The EReqs Checklist is updated as necessary to account for new or changed federal and state regulations, significant permit and approval conditions, and other relevant environmental mandates. Assessments of permitting needs for RPP projects are performed by a representative from RPP Environmental Services. K. S. Tollefson prepared an EReqs Checklist (Table C-1) and a RCRA and Operational Monitoring estimate (Table C-2) for the C-103 separable organic removal/disposal scoping study. These tables are contained in Appendix C of this document.

9.5 Transportation SARP

Results of initial analyses on untreated C-103 organic phase liquid indicates that this material should qualify as LSA-II waste in accordance with DOT regulations contained in 49 CFR 173.433. With the assumption that the organic liquid meets LSA-II, the determination of a recommended transportation vessel depends on the disposal location and the total cost associated with the transportation options. At this time there appear to be four shipping tanks/vessels which are under consideration: 1) LR56/H cask; 2) a standard ISO tank; 3) an extended ISO tank; and 4) a bulk liquid tanker owned by DSSI. Of these four vessels both the standard ISO tank and the DSSI bulk liquid tanker have current SARPs which should need no modifications to transport the C-103 organic offsite.

1. The Hanford Site LR56/H cask was manufactured and certified in France to that country's transportation standards. If this cask is selected for offsite use of LSA-II material, it will probably require an evaluation by Waste Management personnel to determine compliance with DOE and DOT requirements and the preparation of the necessary transportation documentation. This is estimated to cost less than \$5K.
2. The standard ISO tank which is currently on the Hanford Site may require an evaluation by Waste Management personnel to determine compliance with DOE and DOT requirements and the preparation of the necessary transportation documentation. This is estimated to cost \$5K.
3. To be used for transport of C-103 organic, an extended ISO tank would have to be designed, procured, and may require development of a transportation SARP. The combined cost for all these services has been estimated at \$250K. The additional shipping volume obtained with this tank does not justify the additional costs associated with this tank.
4. The DSSI bulk liquid tanker is owned by DSSI and will be loaned to the C-103 organic removal project at no cost if the waste is shipped to DSSI for disposal. All necessary certifications and paperwork will be provided.

Based upon the lack of any significant added costs associated with compliance to DOT and DOE transportation requirements, it is recommended that the LR56/H, the standard ISO tank, or the DSSI bulk liquid tanker be utilized for the transport of the C-103 organic to the storage/disposal site.

It has been assumed that the aqueous which has been separated by washing the organic with EDTA solution can not be returned to C-103, but rather must be sent to a double shell tank (DST). This transfer to a DST can be accomplished by the use of the LR56/H cask. This cask is designed for the transport of Type B quantities of radioactive materials, and has a current SARP which covers such shipment within the Hanford site. The transportation documentation necessary to authorize such shipments is expected to cost about \$5K.

10.0 STARTUP, TESTING AND READINESS STRATEGY

The Startup strategy would follow the RPP Acceptance for Beneficial Use (ABU) process for the turnover of equipment necessary for the removal, treatment, and transfer to a mobile tank of the organic layer from Tank 241-C-103. This assumes these steps would be conducted by plant forces.

The startup strategy for the transportation and disposal of the organic layer to the off-site vendor would be developed and conducted under the off-site vendor's requirements [e.g., Safety Analysis Report for Packaging (SARP) and WAC]. A Startup Plan will be prepared and approved by RPP.

The testing strategy would follow the RPP processes for acceptance testing (e.g., Factory/Construction testing) and operating testing (e.g., Performance testing). Performance Testing will be accomplished in two phases: 1) a cold Operational Demonstration on a bench scale to test the

skimmer pump and separations equipment and 2) a final test in the field with all in place equipment, including the mobile tank. A Test Plan and procedures will be developed and approved by RPP. Within the Test Plan, an Operational Demonstration Plan will be prepared with all relevant performance and acceptance criteria. The conduct of the Operational Demonstration, and the completed Operational Demonstration Final Report will become the performance review of the ORR.

The readiness strategy will be an Operational Readiness Review (ORR) with compliance to DOE Order 425.1 and respective ORP and RPP procedures. The conduct of an ORR assumes Authorization Basis (i.e., accident analysis) changes will be required for the removal and treatment of the C-103 organic layer. It is also assumed that there will be vendor readiness requirements for the input of the organic layer into the mobile unit, which would be included in the ORR. It is further assumed that the transportation and disposal safety/readiness requirements will be covered under the SARP. Therefore, any costs for the vendor's readiness for the transportation and disposal of the organic are in their cost estimates. A Plant Readiness Plan, an ORR Plan of Action, and an ORR Implementation Plan with Criteria Review Approaches (CRA) will be prepared and approved by RPP and ORP. The completed ABU and Operational Demonstration Final Report will be an integral part of the ORR. Completed CRA documents with attached affidavits, the Final ORR Report, and Declaration of Readiness letter will be transmitted to ORP for their review and judgement. This strategy assumes ORP and contractor will conduct their Independent Overview during the plant ORR.

11.0 ORGANIC POLISHING STRATEGY

Organic polishing involves the remaining organic left in C-103 after bulk removal by the skimmer. The skimmer will leave behind about an 1.5-mm layer of organic on top of the aqueous waste. The 1.5-mm layer corresponds to approximately 200 to 600 L (50 to 150 gal) of organic. This thin layer is assumed to be discontinuous over the top of the waste, with "puddling" in some areas, and just a sheen in other areas. Removal of this remaining organic may be required to meet commitments for interim stabilization of C-103 and the no-visible-organic-phase specifications of the Privatization contract.

Four alternatives are provided here as options for organic polishing. They are: 1) no action, 2) in-situ treatment, 3) global system, and 4) in-line treatment system. Each option is briefly discussed in the following paragraphs and either accepted or rejected based on preliminary evaluations.

The "no action" alternative leaves the sheen layer of organic in the tank after skimming. The remaining organic, then, would be saltwell pumped along with the supernatant. Since the saltwell pumping will take place at the bottom of the tank, the organic would be among the last of the liquid to be pumped from the tank. A study completed by CHG Process Engineering indicates that this would not create a unique situation. There is no additional cost for this alternative, as nothing will be done as far as organic polishing in this organic removal system.

The in-situ treatment alternative involves treatment of the organic sheen within the confines of the tank. The most reasonable alternative would be to add an absorbent to the tank to clean up the organic. This alternative was removed from consideration for cleaning up the bulk organic

due to the larger volume of the bulk organic. In addition, once an absorbent was placed in the tank, there were questions as to how to remove the solid material. The concept presented here does use an absorbent to bind the organic, but the absorbent is contained within a mesh container that will allow its removal from the tank and disposal as hazardous waste. This option was considered most feasible and will be further evaluated for this scoping study.

The global system alternative involves a treatment system at the pretreatment facility where all the tank system waste will pass through prior to vitrification. The global system is based on the increasing evidence that there are about 87,000 L (23,000 gal) of process organic still present in the Hanford Site waste tank system (Dukelow, 1996). Therefore, it is likely that an organic pretreatment system will be required at the front end of the vitrification facility. The global system would not be a part of the organic removal system for C-103, and therefore will not be considered further in this study. Such a system will likely be required if a zero separable organic specification continues for Extend Phase I or Phase II vitrification operations.

The in-line treatment system involves treating the remaining organic as it is pumped with the supernatant from the waste tank through an absorbent bed located in a shielded enclosure outside the tank. The supernatant is expected to contain solids along with other contaminants that may be captured in the absorbent bed, thus preventing the absorbent from capturing and removing the organic from the waste stream. This option may be feasible if the filtering system can be designed to capture only the organic and not any other contaminants. Another result of this in-line treatment system would allow the supernatant to settle at a DCRT and then pump out the bottom portion of the waste. However, disengaging time could be long and with the amount of organic remaining, the organic/aqueous interface could be difficult to determine. Using a self-contained absorbent at this point in time may work (based on the concept presented for the in-situ treatment option); however, no DCRT is available with the deactivation of CR vault. This option will not be discussed in this study.

11.1 Description

In-situ treatment of the remaining organic in C-103 seems to be the most feasible option when considering the relatively small amount of organic. The in-situ treatment will minimize contamination of the tank solids and waste transfer lines by the organic, and mixing of the aqueous and organic phases (with saltwell pumping) will reduce the amount of organic entrained in the aqueous.

The use of an absorbent for the removal of hydrocarbons from aqueous phases has been widely used in the oil industry for oil spill recovery operations. Many companies are using a variety of media as absorbents, from cellulose to activated carbon to polymers. The concept presented here is a hydrocarbon recovery system based on innovative polymer technologies by AbTech Industries of Scottsdale, Arizona. This technology consists of a proprietary blend of polymers called the OARS Smart Sponge™ that is chemically selective to hydrocarbons. It readily encapsulates the organic and bonds it within the structure. The process transforms the liquid waste into a manageable solid, repels water and remains completely buoyant for easy retrieval even when fully saturated.

11.2 Operational Concept

The Light Duty Utility Arm (LDUA) would be used to move the absorbent into and out of the tank, as well as move the absorbent around in the tank to contact the organic. The absorbent is contained within a flexible mesh container that can fit well within the 12-in riser on the tank. The container is lowered into the tank and moved around the surface of the tank using the LDUA. The LDUA would potentially have to be positioned in several risers to remove most of the organic. Once saturated, the container would be removed from the tank through the 12-in riser and the mesh container holding the organic-saturated polymer would be disposed of through the Hanford Site Solid Waste program.

11.3 Hardware

Light Duty Utility Arm (LDUA):

The LDUA is a mobile robotic system that can deploy other tools inside underground waste tanks. These tools are instrumental in retrieval, surveillance, confined sluicing, inspection, and waste analysis. The system contains 1) a flexible and adaptive robotic arm that can be positioned in tanks through the small tank openings (called risers), 2) a telescoping deployment housing, 3) a deployment vehicle, 4) an operations trailer, and 5) various tools called end effectors. The end effectors can be deployed at multiple elevations and positions within the tank. The end effectors for the LDUA include sensors to measure physical properties of tank waste. The LDUA has a radial reach of at least 13.5 ft from the tank riser centerline. The deployment mast extends to at least 62.5 ft to access the full depth of the tank.

OARS Smart Sponge™ Propellets for Surface Skimming:

OARS Propellets are non-leaching absorbent units, cylindrical in shape and approximately 2.5-in in length. The Propellets have a rough exterior and a very high internal surface area. OARS Propellets are packaged in flexible mesh containers and are designed to remove floating hydrocarbons, including sheen, from aqueous surfaces. Packaged OARS Propellets float on the surface and work equally well in calm or agitated environments.

Disposal:

Disposal of the organic-saturated OARS Propellets would be handled through the Solid Waste program. The OARS Propellets by themselves are recyclable, and therefore would become a waste based upon the waste classification of the hydrocarbon that it encapsulates.

11.4 Assumptions

One important assumption is that the absorbent material used for the in-situ treatment will indeed encapsulate and remove the organic from C-103. AbTech Industries is confident that the NPH will be absorbed by the polymer without any problem. The TBP, however, was questionable due to its larger size. AbTech did do a preliminary laboratory evaluation with TBP and its polymer and found the ratio of polymer to TBP required to absorb the TBP. Further evaluation with C-103 simulant is required, though, to determine if anything else in the solution will affect the absorption capability of the polymer absorbent. (AbTech 2000).

11.5 Interfaces

The in-situ tank treatment will interface with tank farm operations in the mobilization of the LDUA to lower the absorbent container into C-103, move the absorbent container around the tank, and then raise the absorbent container out of the tank for disposal. Interfaces with Site Utilities will be needed for water, power, radiation monitoring, etc. An interface with Hanford Site Solid Waste will be required to dispose of the organic-saturated OARS Propellets according to its hazard classification.

11.6 Reserved

11.7 Work Scope

The following activities are required to assure an effective organic polishing system life cycle.

- Further evaluation of absorbents to polish tank organic. How the absorbent will work with actual or simulant C-103 organic. Will the absorbent capture all the organic and what else (radionuclides and other contaminants) will it also capture?
- Laboratory development of polymer absorbent with C-103 simulant.
- Test procedure development.
- Readiness documentation development.
- Operating procedure development.
- Process testing and readiness performance.
- Deploy LDUA and remote organic.
- Equipment decontamination.
- Material disposal.

12.0 RISK MANAGEMENT

There are several technical risk associated with this scoping study.

Risk 1: Existing facility and plant structure will be able to support the utility and equipment needs for C-103 processing.

Risk 2: Current C-103 sample analysis/contamination levels do not change during processing.

Risk 3: Recovered organic material may require additional treatment beyond washing to meet shipping an/or disposal site requirements.

Risk 4: Passive ventilation mode for the tank and new installations will be acceptable during processing operations and system flushing and decontamination.

Risk 5: Separated aqueous phase and the organic wash solution will be returned to existing tank farm systems without treatment or sampling.

Risk 6: There is no numerical endpoint criteria for the C-103 polishing step.

Risk 7: Previous testing performed primarily to select and validate concepts and verify performance for application of these systems is valid. An alternate weir flap material is available. Washing ratio of 1:1 is acceptable.

Risk 8: The treated organic shall qualify for shipment as a LSA material as defined by current regulations or as acceptable by the disposal receiving facility, whichever is limiting.

Risk 9: The dose rate of the organic after the initial separation process will be such that, treatment, interim storage and transportation to the disposal facility can take place in unshielded vessels.

Risk number 2 is the main technical risk to the ability to produce a product that can be cleaned, handled and shipped off-site for disposal. Potential handling actions include further sampling of the C-103 organic, aqueous, performing radionuclide analysis and contacting laboratory studies. Also a contingent treatment system such as an IX column could be designed and built.

Risk numbers 4 and 5 are the main regulatory risk to completing this task. Having to install active ventilation will increase the cost but is not expected to change the overall schedule. The inability to dispose of the aqueous return streams into C-103 or the wash water to a DST will add treatment equipment and increase overall complexity of the system.

13.0 COST ESTIMATE

13.1 DESCRIPTION

The purpose of the cost estimate is to show Rough Order of Magnitude (ROM) Study costs for removal of the separable organic phase liquid from C-103. A ROM takeoff of material quantities is utilized in the preparation of this cost estimate. Historical Hanford data and construction experience is utilized in developing the method of performance and productivity units. Construction labor, materials, and equipment units are estimated based upon both industry standard commercial estimating manuals and Hanford experience.

13.2 ASSUMPTIONS

The cost estimate is based on seven general assumptions as follows:

- Work is to be performed by on-site Construction Forces.
- Mockups for equipment installation are a factored allowance.

- Contingency and site allocations are included in the installation costs.
- The exact location of the new equipment is not firm.
- Instrumentation and Controls is a factored allowance.
- Burnout allowances are not included.
- The cost estimate does not include the purchase cost of an LR-56/H Cask System. It is assumed that one is available for use.

13.3 COST BASIS

Direct costs are adjusted by the estimator, as appropriate, to reflect influences by work site or other identified project and special conditions. This includes (but not limited to) allowances for Special Work Procedures, sales tax, construction consumables, construction equipment usage, general conditions, etc.

Construction and procurement costs include allowances for a skimmer pump, a prefabricated pump pit, CCTV equipment, phase separation equipment and enclosure, wash tanks, and instrumentation and controls. Of these the phase separation equipment and assembly, the pump and pump pit, and instrumentation and controls are the largest cost items. Vendors were contacted for rough quotes on pump parts, lead sheets, ISO and wash tanks, coalescer, and process enclosure. Material costs for piping and fittings are priced from commercially available cost estimating manuals.

The operating contractor's biggest expense lies with the transportation and disposal costs and the operational readiness review costs. The remaining costs in the estimate for the Operating Contractor are based upon factors developed from W-314, Phases I & II and the AZ-101 mixer pump estimate. There are O/C for engineering support, construction support, testing and turnover, operability testing, and operation preparation.

Further information for the above items can be found in the Estimate Details in Appendix B. These include percentages used in labor and material markups, contingency analysis, escalation basis, remarks, etc.

13.4 PROJECT COST

The overall cost of the bulk removal of organic from C-103 is estimated \$8.8 million. This includes; \$0.4 million for Engineering, \$1.0 million for Procurement, \$2.2 million for Construction, \$3.5 million for Operating Contractor Expenses, and \$1.7 million for Disposal and Transportation. Figure 13.1 is a Summary Cost Rollup. The cost details are shown in Appendix B. The polishing step which uses the Light Duty Utility Arm (LDUA) and an absorbent is estimated to cost \$1.0 million.

Figure 13.1. Summary Cost Rollup (page 1 of 2)

Figure 13.1. Summary Cost Rollup (page 2 of 2)

14.0 COST REDUCTION INITIATIVES

The costs reported in Section 13 and Appendix B are based on past experience and normal estimating techniques. The risks associated in the baseline are shown in Section 12, Risk Management. It is possible to take a higher risk profile and reduce the initial cost projections. The veracity of these options should be verified by performing small engineering evaluations before accepting them as the baseline.

The following initiatives could reduce the projected cost by several million dollars:

- Returning the wash solution to SST C-103 eliminates the costs and operational complexities associated with the LR-56 transfer to a DST via 204-AR and could save \$200-300K. The increased risks are that this concept puts “newly generated” waste into a SST and the water addition can potentially impact skimmer operation.
- Changing the startup strategy from an ORR to a readiness assessment (RA) could save about \$1M. This strategy is acceptable if the Authorization Bases do not require a DOE approved change.
- Eliminating the need to remove the residual organic in C-103 (polishing step) could save \$1.M. This is a relatively low risk change, while C-103 would look like other SST following stabilization it could affects its (C-103) removal from the watchlist.
- Changing the disposal option from incineration to solidification and burial in Nevada could potentially save \$1.0M. There are still unanswered waste acceptance criteria questions with this method.
- Close coupling of the vendor truck and the organic treatment could eliminate the need for an interim storage tank and could save \$150K to \$200K.

The cost estimate for the bulk separation of the organic has \$1.9M of contingency built into it. Following detailed design and initial procurement, the contingency should be reevaluated.

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APPENDIX A
WASTE ACCEPTANCE CRITERIA

APPENDIX A

WASTE ACCEPTANCE CRITERIA

Table A-1. Radioactive Content of Tank 241-C-103 – Treated (Lumetta, 1996)

Radionuclides	Analyses (1996) μ Ci/ml	Total Radiation μ Ci	DSSI WAC (μ Ci)**	Weight Total gm*	DSSI WAC (gm)**
90Sr	3.51E-01	6.39E+06	1.00E+07		
154Eu	2.11E-04	3.84E+03			
3H	5.80E-04	1.06E+04	5.00E+09		
60Co	4.44E-04	8.08E+03			
137Cs	1.09E-02	1.98E+05	1.00E+07		
14C	2.60E-04	4.73E+03	1.00E+08		
241Am	4.96E-04	9.03E+03	1.00E+05		
239Pu	6.50E-05	1.18E+03		1.93E-02	
*238Pu+241Am	1.70E-04	3.09E+03		1.78E-04	2.00E+02
**238Pu+241Am	1.70E-04	3.09E+03	1.00E+05		

1.64E+04

Specific Gravity of Organics = 0.873
 Total Volume separable organic = 1.82E+07 ml (=18,200 L)
 Specific Activity 239Pu = 6.13E-02 Ci/gm
 Specific Activity 238Pu = 1.74E+01 Ci/gm

- * Assumes all the activity from 238Pu + 241Am is from 238Pu to create a worst-case scenario in calculating amount of 238Pu since the WAC is different for each species. The total (1.78E-04) is less than the WAC limit of 2E+2.
- ** Assumes all the activity from 238Pu + 241Am is from 241Am to create a worst-case scenario in calculating amount of 241Am since the WAC is different for each species. The total, combined with the individual 241Am (1.21E+04) is less than the WAC limit of 1E+5.

Table A-2. ATG Waste Acceptance Criteria-Activity Limits, Draft July 5, 1999, Rev. 0

Radionuclide Species	μ Ci/ml	Ci	ATG WAC
90Sr	3.51E-01	6.39E+00	1 Ci
14C	2.11E-04	3.84E-03	2 Ci
3H	5.80E-04	1.06E-02	10 Ci
60Co	4.44E-04	8.08E-03	2.0 Ci
137Cs	1.09E-02	1.98E-01	
154Eu	2.60E-04	4.73E-03	
241Am	4.96E-04	9.03E-03	
239Pu	6.50E-05	1.18E-03	
238Pu+241Am	1.70E-04	3.09E-03	

Table A-3. Untreated Tank 241-C-103 Separable Organic Phase Liquid Offsite Shipping Limits for Bulk Liquid (LSA-II) (from 49 CFR 173.427)

Radionuclide	Organic Phase Activity (μ Ci/ml)	Organic Phase Activity	*Shipping Limits (100 A2 Ci)
		(Ci)	
90Sr	3.51E-01	6.39E+00	2.70E+02
154Eu	2.11E-04	3.84E-03	1.35E+03
3H	5.80E-04	1.06E-02	1.08E+05
60Co	4.44E-04	8.08E-03	1.08E+03
137Cs	1.09E-02	1.98E-01	1.35E+03
14C	2.60E-04	4.73E-03	5.41E+03
*241Am	4.96E-04	9.03E-03	5.41E-01
239Pu	6.50E-05	1.18E-03	5.41E-01
*238Pu	1.70E-05	3.09E-03	5.41E-01

Specific Gravity of Organics = 0.873

*Packaging Requirements: IP-2 (49 CFR 173.427, Table 9)

Table 8-4. LSA-II Shipping Classification for Tank 241 C-103 - Untreated Separable Organics

Radionuclide	Organic Phase Activity	Organic Phase Activity	Organic Phase Activity	LSA-II Limit (Ci/gm) (1.0E-5 A2/gm)
	μ Ci/ml	μ Ci/gm	Ci/gm	
90Sr	3.51E-01	4.02E-01	4.02E-07	2.70E-05
154Eu	2.11E-04	2.42E-04	2.42E-10	1.35E-04
3H	5.80E-04	6.64E-04	6.64E-10	1.08E-02
60Co	4.44E-04	5.09E-04	5.09E-10	1.08E-04
137Cs	1.09E-02	1.25E-02	1.25E-08	1.35E-04
14C	2.60E-04	2.98E-04	2.98E-10	5.41E-04
241Am	4.96E-04	5.68E-04	5.68E-10	5.41E-08
239Pu	6.50E-05	7.45E-05	7.45E-11	5.41E-08
238Pu+241Am	1.70E-04	1.95E-04	1.95E-10	5.41E-08

APPENDIX B
COST

03/10/00
Removal Of Separable Organic in Tank 241-C-103
Job No. S20101
Wastren, Inc.

ESTIMATE BASIS

1. Estimate Purpose
The purpose of this estimate is to show Rough Order of Magnitude (ROM) costs for Removal of Separable Organic From Tank 241-C-103.
2. Estimate Technical Basis
 - A. This estimate is prepared for Wastren, as requested by the Project Contract.
 - B. The technical scope of work description is in the following reference documents:
 1. Draft engineering document dated 2/1/00.
 2. Drawings from a previous study WHC-SD-WM-PLN-092.
 3. Informational meeting with the Wastren project manager.
 4. The estimate is consistent with the cost work breakdown structure.
 - C. This cost estimate utilizes the Industry Standard Construction Specification Institute (CSI) System. The CSI format is used to accumulate all costs on the project. The CSI format is separated into the following categories:
 - 01 - General
 - 02 - Excavation and Civil
 - 03 - Concrete
 - 04 - Masonry
 - 05 - Metals
 - 06 - Wood and Plastics
 - 07 - Thermal and Moisture Protection
 - 08 - Doors and Windows
 - 09 - Finishes
 - 10 - Specialties
 - 11 - Equipment
 - 15 - Mechanical
 - 16 - Electrical and Instrumentation/Controls
 - D. The following constraints and/or special conditions exist:
3. Estimate Methodology
 - A. Direct Costs: A rough order of magnitude takeoff of material quantities is utilized in the preparation of this estimate.

ESTIMATE BASIS

- (1) Historical Hanford data and construction experience is utilized in developing the method of performance and productivity units.
- (2) Construction labor, material, and equipment units are estimated based upon Industry Standard Commercial Estimating Manuals and Databases.

B. General Direct Cost Adjustments:

- (1) The direct cost can be adjusted by the estimator, as appropriate; to reflect influences by work site or other identified project or special conditions.
- (2) A Special Work Procedure (SWP) adjustment is applied to the estimate to account for Hanford work requirements. The SWP adjusts direct labor upward to account for daily pre-job safety meetings; gaining access authorization to work areas from Operations; dressing and undressing personal protective equipment (PPE); clearing or releasing work areas of contaminated materials; and moving materials, tools, and equipment in and out. The SWP adjustments are applied as follows:
 - a. Labor hours are adjusted upward 78% for work inside the tank farms.
 - b. Labor hours are adjusted upward 100% for work with PPE and respirator
- (3) Premium Pay:

Overtime requirements and shift differential pay for craft labor are union-negotiated under the Hanford Site Stabilization Agreement (HSSA). The cost estimate does not include overtime allowances. The estimate basis is based on working one shift five days a week.
- (4) Sales tax is applied to all materials and procured equipment purchases at 8%.
- (5) Construction consumable items, such as small tools, weld rod, tape, caulking, plastics, gloves, paper, are estimated at 3.2% of direct construction labor dollars. This is an allowance based on the estimator's experience and the requirements of these items to be used during construction.
- (6) Equipment usage of government-owned equipment, controlled by Dyncorp, is included in the estimate at 8% of direct construction labor dollars.
- (7) General Conditions: This is an allowance of 25% of direct construction labor hours and is based on projects previously estimate at the Hanford Site. It includes the following:
 - a. All project personnel are required to attend four hours of safety meetings each month. The estimate includes the cost for conducting and attending these meetings. The meeting dates are coordinated with the Fluor Project Hanford (FPH) mandatory safety meetings to minimize impacts to construction.
 - b. Detailed daily construction work planning is conducted outside normal shift hours.

03/10/00
Removal Of Separable Organic in Tank 241-C-103
Job No. S20101
Wastren, Inc.

ESTIMATE BASIS

- c. Haul men and materials
- d. Clean-up pad support
- e. Clean-up support
- f. Non-project materials
- g. Training
- h. General condition materials

- (8) Construction support staffing is a percentage of direct construction labor hours at 23%. These items include Project Management, Construction Department Management, Construction Superintendents/Supervision, Project Controls, Construction Engineering, Contract Management, Safety/Industrial Hygiene Support, Construction Document Control, and other miscellaneous Construction Support Personnel.
- (9) Construction foreman costs is included at 9% of direct construction labor hours.
- (10) Escalation is based upon the latest factors provided by the Department Of Energy in the Multi Year Work Plan (MYWP) Guidance.

D. Rates:

- (1) Construction craft labor rates are those listed in Appendix A of the Hanford Site Stabilization Agreement (HSSA). The HSSA rates include base wage, fringe benefits, and other compensation as negotiated between Fluor Daniel Hanford, Inc. (FDH) and the National Building and Construction Trades Department AFL-CIO. COGEMA Engineering incorporates costs for workmen compensation, FICA, State and Federal Unemployment Insurance, and fee to develop a fully burdened rate by craft.
- (2) Engineering rates are based on engineering allowances.
- (3) FPH rates are based upon engineering allowances.

E. Site Allocations Adjustments:

FDH G&A/ESS and Government Furnished Services (GFS) rates are applied to Enterprise Contractor costs that provide engineering, construction, and procurement services. Work is performed by FPH contractors, and provided by COGEMA Engineering with labor and material rates, which included site allocations.

Site allocation adjustments for labor, materials, and procured equipment for Enterprise Contractors are developed and provided by FDH for cost estimating use as follows:

- (1) FDH GFS = 3% (FY 00) 5% (FY 01 through FY 06)
- (2) FDH G&A/ESS = 19.1% (FY 00) 19.9% (FY 01 through FY 06)
- (3) Compounded rate for GFS & G&A/ESS for FY 2000 = 22.7% & FY 01 through FY 06 = 25.9%.

The compounded rate is applied to engineering labor, construction labor and material, and procurement.

03/10/00
Removal Of Separable Organic in Tank 241-C-103
Job No. S20101
Wastren, Inc.

ESTIMATE BASIS

4. Contingency Analysis:

- A. A 35% contingency is applied to design engineering because it is entirely factored on labor hours.
- B. Procurement has a 30% contingency applied because the design level is still in the preliminary stage.
- C. Construction contingency is applied at 30% because of the uncertainties that arise inside the tank farm during construction and because of a ROM takeoff of construction materials and labor. The exact location of equipment and services is not defined.
- D. A 25% contingency is applied to Operating Contractor Expenses as the factors are developed from the W-314, phase II cost estimate and AZ-101 estimates and they are not yet completely constructed.

An overall project contingency of 30% is included in the cost estimate.

5. ASSUMPTIONS:

- A. Work is to be performed by the on-site Construction Forces.
- B. Mockups for equipment installation is a factored allowance.
- C. Contingency and site allocations is included in the installation costs.
- D. The exact location of the new equipment is not firm.
- E. Instrumentation & Controls is a factored allowance.
- F. Burnout allowances are not included.
- G. The cost estimate does not include the cost of a LR-56 Cask System. It is assumed (per engineer) that one is available for transfers.
- H. The Decant tank is quoted as standard tank fabrication and is not Section III, N stamped.
- I. Tanker truck costs for transporting the ISO tank is not included in the cost estimate as others provide it.

241-C-103 Organic Removal
 PROJECT COST SUMMARY

Cost Code	Description	Escalated Total Cost	Contingency %	Contingency Total	Total Dollars
000	Engineering	\$323,000	35%	\$113,000	\$436,000
050	Construction Management	\$356,000	30%	\$107,000	\$463,000
060	Project Management	\$148,000	25%	\$37,000	\$185,000
550	Other Structures	\$524,000	30%	\$157,000	\$681,000
700	Special Equipment/Process Systems	\$1,269,000	30%	\$381,000	\$1,650,000
7060	Electrical	\$62,000	31%	\$19,000	\$81,000
7065	Instrumentation/Controls	\$258,000	30%	\$77,000	\$335,000
<hr/>					
	Total Estimated Cost (TEC)	\$2,940,000	30%	\$891,000	\$3,831,000
900	Other Project Costs	\$4,000,000	25%	\$1,000,000	\$5,000,000
	Other Project Cost (OPC)	\$4,000,000	25%	\$1,000,000	\$5,000,000
<hr/>					
	TOTAL PROJECT COST (TPC)	\$6,940,000	27%	\$1,891,000	\$8,831,000

Type of Estimate	ROM - Study Estimate	Lead Estimator
Architect/Engineer		Project Lead Estimator
Operating Contractor		Remarks:
Director of Projects		See Cost Estimate Basis.

B. L. Treadway

ROM - Study Estimate
WORK BREAKDOWN STRUCTURE SUMMARY

WBS Description	Estimate Subtotal	Escalation %	Escalation Total	Subtotal	Contingency %	Contingency Total	Total Dollars
241-C-103 Organic Removal	\$6,719,280	3.28%	\$220,662	\$6,939,943	27%	\$1,890,717	\$8,830,660
-- 1 Engineering	\$318,667	1%	\$3,983	\$322,651	35%	\$112,928	\$435,578
-- 11 Engineering	\$234,337	1%	\$2,929	\$237,267	35%	\$83,043	\$320,310
-- 112 Title II Design (DD)	\$234,337	1%	\$2,929	\$237,267	35%	\$83,043	\$320,310
-- 112000 Definitive Design	\$234,337	1%	\$2,929	\$237,267	35%	\$83,043	\$320,310
-- 12 Engineering During Construction	\$84,330	1%	\$1,054	\$85,384	35%	\$29,884	\$115,268
-- 120 Title III Eri During Construction	\$84,330	1%	\$1,054	\$85,384	35%	\$29,884	\$115,268
-- 120000 Eri During Construction	\$84,330	1%	\$1,054	\$85,384	35%	\$29,884	\$115,268
-- 2 Procurement	\$739,818	3%	\$22,269	\$762,086	30%	\$228,626	\$990,712
-- 21 Procurement	\$739,818	3%	\$22,269	\$762,086	30%	\$228,626	\$990,712
-- 210000 Pump	\$114,200	3%	\$3,437	\$117,637	30%	\$35,291	\$152,929
-- 210000A Waukesha Pump	\$11,349	3%	\$342	\$11,691	30%	\$3,507	\$15,198
-- 210000B Ross Hydraulic Motor	\$1,419	3%	\$43	\$1,461	30%	\$438	\$1,900
-- 210000C Paul Monroe Rucker Hydraulic Drive	\$5,675	3%	\$171	\$5,845	30%	\$1,754	\$7,599
-- 210000D Modified Skimmer	\$5,675	3%	\$171	\$5,845	30%	\$1,754	\$7,599
-- 210000E Pump Fabrication	\$28,245	3%	\$790	\$27,035	30%	\$8,110	\$35,145
-- 210000F Pump Spray Ring and Riser Extension	\$63,839	3%	\$1,922	\$65,760	30%	\$19,728	\$85,488
-- 210001 (PPP) Prefab Pump Pit & Riser Plug	\$141,863	3%	\$4,270	\$146,133	30%	\$43,840	\$189,974
-- 210002 CCTV	\$113,491	3%	\$3,416	\$116,907	30%	\$35,072	\$151,979
-- 210002A CCTV	\$85,118	3%	\$2,562	\$87,680	30%	\$26,304	\$113,984
-- 210002b CCTV Riser	\$28,373	3%	\$854	\$29,227	30%	\$8,768	\$37,995
-- 210003 Impact Limiters	\$56,745	3%	\$1,708	\$58,453	30%	\$17,536	\$75,989
-- 210004 Phase Separation Equipment & Enclosure	\$180,167	3%	\$5,423	\$185,590	30%	\$55,677	\$241,266
-- 210004A Assembly	\$83,699	3%	\$2,519	\$86,219	30%	\$25,866	\$112,084
-- 210004B Enclosure	\$85,118	3%	\$2,562	\$87,680	30%	\$26,304	\$113,984
-- 210004C Coalescer	\$11,349	3%	\$342	\$11,691	30%	\$3,507	\$15,198

WASTREN, Inc

By: TLW,BPL - COGEMA

03/10/2000

ROM - Study Estimate
WORK BREAKDOWN STRUCTURE SUMMARY

WBS Description	Estimate Subtotal	Escalation		Subtotal	Contingency		Total Dollars
		%	Total		%	Total	
— 210005 ISO Tank	\$87,955	3%	\$2,647	\$90,603	30%	\$27,181	\$117,784
— 210008 Decant Tank	\$45,396	3%	\$1,368	\$46,763	30%	\$14,029	\$60,792
— 3 Construction	\$1,657,358	3%	\$49,886	\$1,707,245	30%	\$512,173	\$2,219,418
— 31 On-site Construction Forces	\$1,657,358	3%	\$49,886	\$1,707,245	30%	\$512,173	\$2,219,418
— 311 On-site Construction Forces	\$1,286,892	3%	\$38,133	\$1,325,025	30%	\$391,508	\$1,696,533
— 3111 Transfer/Skimmer Pump Installation	\$254,704	3%	\$7,667	\$262,371	30%	\$78,711	\$341,082
— 3112 CCTV Installation	\$237,765	3%	\$7,157	\$244,921	30%	\$73,478	\$318,398
— 3113 Process Enclosure	\$159,808	3%	\$4,810	\$164,617	30%	\$49,385	\$214,002
— 31131 Process Building	\$107,618	3%	\$3,239	\$110,855	30%	\$33,256	\$144,111
— 31132 Phase Separation Installation	\$28,173	3%	\$848	\$29,021	30%	\$8,708	\$37,727
— 31133 ISO & Decant Tank Assembly	\$24,018	3%	\$723	\$24,741	30%	\$7,422	\$32,164
— 3114 Instrumentation/Control Mobile Trailer	\$333,450	3%	\$10,037	\$343,487	30%	\$103,046	\$446,533
— 31141 Move Trailer On-site	\$87,699	3%	\$2,038	\$89,737	30%	\$20,921	\$90,657
— 31142 Power & Control Feeders (Contr. Rm. Bldg. to	\$9,513	3%	\$286	\$9,800	30%	\$2,940	\$12,740
— 31143 Power & Control Feeders (Contr. Trailer to	\$7,238	3%	\$218	\$7,456	30%	\$2,237	\$9,692
— 31144 Instrumentation & Controls	\$249,000	3%	\$7,485	\$256,485	30%	\$76,948	\$333,443
— 3115 Above Ground Connection Piping	\$76,548	3%	\$2,304	\$78,852	30%	\$23,656	\$102,508
— 3116 Aqueous Return Piping	\$187,522	3%	\$5,042	\$192,564	30%	\$51,768	\$224,334
— 3118 Transport	\$37,097	3%	\$1,117	\$38,214	30%	\$11,464	\$49,678
— 31181 Transport Road Modifications	\$8,657	3%	\$261	\$8,918	30%	\$2,675	\$11,593
— 31182 Load-In / Load-out Station	\$28,440	3%	\$858	\$29,298	30%	\$8,769	\$38,065
— 314 On-site Construction Forces Construction Management	\$345,734	3%	\$10,407	\$356,140	30%	\$106,842	\$462,983
— 3141 Construction Management	\$345,734	3%	\$10,407	\$356,140	30%	\$106,842	\$462,983
— 313 Construction Equipment	\$44,732	3%	\$1,348	\$46,078	30%	\$13,824	\$59,902
— 313000 Construction Equipment	\$44,732	3%	\$1,348	\$46,078	30%	\$13,824	\$59,902
— 4 Operating Contractor Expense	\$4,003,437	4%	\$144,524	\$4,147,962	25%	\$1,036,990	\$5,184,952

WASTREN, Inc

By: TLW,BPL - COGEMA

03/10/2000

Success Estimating and Cost Management System

Tank 241-C-103 Organic Removal Scoping Study
C-103
S20101 Rev. 0
C-103 Organic Removal

ROM - Study Estimate
WORK BREAKDOWN STRUCTURE SUMMARY

WBS Description	Estimate Subtotal	Escalation		Subtotal	Contingency		Total Dollars
		%	Total		%	Total	
--- 41 O/C Engineering Support	\$119,910	4%	\$4,329	\$124,239	25%	\$31,060	\$155,298
--- 411 O/C Engineering Support	\$119,910	4%	\$4,329	\$124,239	25%	\$31,060	\$155,298
--- 411000 O/C Engineering Support & E/I During	\$119,910	4%	\$4,329	\$124,239	25%	\$31,060	\$155,298
--- 43 O/C Construction Support	\$132,090	4%	\$4,768	\$136,858	25%	\$34,215	\$171,073
--- 430000 O/C Construction Support	\$132,090	4%	\$4,768	\$136,858	25%	\$34,215	\$171,073
--- 44 O/C Project Management	\$142,920	4%	\$5,159	\$148,079	25%	\$37,020	\$185,099
--- 440000 O/C Project Management	\$142,920	4%	\$5,159	\$148,079	25%	\$37,020	\$185,099
--- 45 O/C Testing & Turnover	\$480,440	4%	\$17,344	\$497,784	25%	\$124,446	\$622,230
--- 4510 Safety Assessment	\$13,440	4%	\$485	\$13,925	25%	\$3,481	\$17,406
--- 4530 Permitting and Approvals	\$157,000	4%	\$5,668	\$162,668	25%	\$40,667	\$203,335
--- 4540 ABU Process	\$100,000	4%	\$3,610	\$103,610	25%	\$25,903	\$129,513
--- 4550 Authorization Basis	\$200,000	4%	\$7,220	\$207,220	25%	\$51,805	\$259,025
--- 4560 SARP For Transportation	\$10,000	4%	\$361	\$10,361	25%	\$2,590	\$12,951
--- 46 Mockup/Operability Testing	\$131,705	4%	\$4,755	\$136,460	25%	\$34,115	\$170,575
--- 4610 Mockup Testing	\$52,885	4%	\$1,909	\$54,795	25%	\$13,699	\$68,493
--- 4620 Operability Testing	\$78,820	4%	\$2,845	\$81,665	25%	\$20,416	\$102,082
--- 47 Operations	\$2,996,372	4%	\$108,169	\$3,104,541	25%	\$776,135	\$3,880,676
--- 4720 Operation Preparation	\$47,390	4%	\$1,711	\$49,101	25%	\$12,275	\$61,376
--- 4730 Transportation & Disposal	\$1,283,850	4%	\$46,347	\$1,330,197	25%	\$332,549	\$1,662,746
--- 4740 Operationing Expense During Pumping	\$165,132	4%	\$5,961	\$171,093	25%	\$42,773	\$213,867
--- 4750 ORR	\$1,500,000	4%	\$54,150	\$1,554,150	25%	\$388,538	\$1,942,688

WASTREN, Inc
By: TLW/BPL - COGEMA
03/10/2000

Acct #	Description	Quantity	Unit	Manhours	Baseline	SWP-Adj	Labor	Const	Equip	Material	S/C	Procured	General	OH&P	Estimate
Craft ID												Equip	Cond	&SiteAlloc	Subtotal

WBS 210000A Waukesha Pump

Cost Code: 700	Special Equipment/Process Systems														
110000000	UNIVERSAL POSITIVE DISPLACEMENT PUMP	1	EA												
Note: Phone Quote - Modified Waukesha - Model 18															
Subtotal 11 Equipment		0					\$0				\$0				\$11,349
Total Hours:		0					\$0					\$8,640			\$2,709
Total Cost Code: 700		0					\$0				\$0				\$11,349
TOTAL WBS 210000A		0					\$0				\$0				\$11,349
Total Hours:		0					\$0				\$0				\$2,709

WBS 210000B Ross Hydraulic Motor

Cost Code: 700	Special Equipment/Process Systems														
110000004	TORQMOTOF SERIES ROLLER VANE MOTOR	1	EA												
Note: Ph. Quote Berendsen Fluid Power - Spokane															
Subtotal 11 Equipment		0					\$0				\$0				\$1,419
Total Hours:		0					\$0					\$1,080			\$339
Total Cost Code: 700		0					\$0				\$0				\$1,419
TOTAL WBS 210000B		0					\$0				\$0				\$1,419
Total Hours:		0					\$0				\$0				\$339

Tank 241-C-103 Organic Removal Scoping Study

C-103

S20101 Rev. 0

C-103 Organic Removal

Success Estimating and Cost Management System

2 Procurement

21 Procurement

210000 Pump

ROM - Study Estimate

241-C-103 Organic Removal

ESTIMATE DETAIL BY WBS / COST CODE

Acct #	Description	Quantity	Unit	Manhours	Baseline	SWP-Adj	Labor	Equip	Material	SIC	Procured Equip	General Cond	OH&P & Site Alloc	Estimate Subtotal
Craft ID														

WBS 210000C Paul Monroe Rucker Hydraulic Drive

Cost Code: 700 Special Equipment/Process Systems

110000000 PAUL MONROE RUCKER HYDRAULIC DRIVE 1 EA

Note: Paul Monroe bought Rucker several years back but still makes the Hydraulic Drive as described in the 8.1.3 scope.

Phone Quote

Subtotal 11 Equipment	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$5,675
Total Hours:	0						\$0	\$0	\$0		\$4,320		\$1,355	
Total Cost Code: 700	0	0	0	0	0	0	\$0	\$0	\$0	\$0	\$4,320	\$0	\$1,355	\$5,675
TOTAL WBS 210000C	0	0	0	0	0	0	\$0	\$0	\$0	\$0	\$4,320	\$0	\$1,355	\$5,675
Total Hours:	0						\$0	\$0	\$0		\$4,320		\$1,355	

WBS 210000D Modified Skimmer

Cost Code: 700 Special Equipment/Process Systems

110000000 WEIR SKIMMER MODEL 650-SHX 1 EA

Note: Phone Quote

Subtotal 11 Equipment	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$5,675
Total Hours:	0						\$0	\$0	\$0		\$4,320		\$1,355	
Total Cost Code: 700	0	0	0	0	0	0	\$0	\$0	\$0	\$0	\$4,320	\$0	\$1,355	\$5,675
TOTAL WBS 210000D	0	0	0	0	0	0	\$0	\$0	\$0	\$0	\$4,320	\$0	\$1,355	\$5,675
Total Hours:	0						\$0	\$0	\$0		\$4,320		\$1,355	

WASTREN, Inc

By: TLW/BPL - COGEMA

03/10/2000

Sales Tax included

Tank 241-C-103 Organic Removal Scoping Study
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C-103 Organic Removal

Success Estimating and Cost Management System

2 Procurement
21 Procurement
210000 Pump

ROM - Study Estimate
241-C-103 Organic Removal

ESTIMATE DETAIL BY WBS / COST CODE

Acct # Craft ID	Description	Quantity	Unit	Manhours Baseline	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P & Site Alloc	Estimate Subtotal
Cost Code: 700	Special Equipment/Process Systems												
110000000	FABRICATION - Note: Components cost \$18.5K allow 100% for fabrication.	0	1 LOT	0		0	0	0	0	19980	0	6285	26245
Subtotal 11 Equipment		0		0		\$0	\$0	\$0	\$0	\$19,980	\$0	\$6,265	\$26,245
Total Cost Code: 700		0		0		\$0	\$0	\$0	\$0	\$19,980	\$0	\$6,265	\$26,245
TOTAL WBS 210000E		0		0		\$0	\$0	\$0	\$0	\$19,980	\$0	\$6,265	\$26,245
WBS 210000F Pump Spray Ring and Riser Extension													
Cost Code: 700	Special Equipment/Process Systems												
110000000	Pump spray ring and riser extension Note: Based upon W-320 procurement costs. Smaller component so used 50%	0	1 EA	0		0	0	0	0	48600	0	15239	63839
Subtotal 11 Equipment		0		0		\$0	\$0	\$0	\$0	\$48,600	\$0	\$15,239	\$63,839
Total Cost Code: 700		0		0		\$0	\$0	\$0	\$0	\$48,600	\$0	\$15,239	\$63,839
TOTAL WBS 210000F		0		0		\$0	\$0	\$0	\$0	\$48,600	\$0	\$15,239	\$63,839

WASTREN, Inc

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03/10/2000

Sales Tax Included

Tank 241-C-103 Organic Removal Scoping Study

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C-103 Organic Removal

Success Estimating and Cost Management System

241-C-103 Organic Removal

2 Procurement

21 Procurement

ROM - Study Estimate

241-C-103 Organic Removal

ESTIMATE DETAIL BY WBS / COST CODE

Acct #	Description	Quantity	Unit	Baseline	Manhours	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P & Site Alloc	Estimate Subtotal
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WBS 210001 (PPP) Prefab Pump Pit & Riser Plug

Cost Code: 700 Special Equipment/Process Systems

110000000 PREFAB PUMP PIT ALL S.S.

Note: Used SY-101 PPP actuals for an 8' x 9 1/2' 1/2" thk. sidewalls and 1" thk. bottom with s.s. shielding plug welded on.

Subtotal 11 Equipment

Total Hours:

Total Cost Code: 700

Total Hours:

TOTAL WBS 210001

Total Hours:

WBS 210002A CCTV

Cost Code: 700 Special Equipment/Process Systems

110000000 CCTV COSTS

Note: Based upon W-320 procurement costs for CCTV.

Subtotal 11 Equipment

Total Hours:

Total Cost Code: 700

Total Hours:

TOTAL WBS 210002A

Total Hours:

WASTREN, Inc

By: TLW,BPL - COGEMA

03/10/2000

Sales Tax Included

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Success Estimating and Cost Management System

Tank 241-C-103 Organic Removal Scoping Study

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C-103 Organic Removal

2 Procurement

21 Procurement

210002 CCTV

ROM - Study Estimate
241-C-103 Organic Removal
ESTIMATE DETAIL BY WBS / COST CODE

Acct #	Description	Quantity	Unit	Baseline	Manhours	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P & Site Alloc	Estimate Subtotal
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WBS 210002b CCTV Riser

Cost Code: 700 Special Equipment/Process Systems

110000000 RISER FABRICATION COSTS

Note: 1 LOT
Based upon W-320 procurement costs for CCTV riser.

Subtotal 11 Equipment

0	0	0	0	0	0	0	0	0	0	0	0	0	0	28373
---	---	---	---	---	---	---	---	---	---	---	---	---	---	-------

Total Hours:

0	0	0	0	0	0	0	0	0	0	0	0	0	0	28,373
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Total Cost Code: 700

0	0	0	0	0	0	0	0	0	0	0	0	0	0	28,373
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

TOTAL WBS 210002b

0	0	0	0	0	0	0	0	0	0	0	0	0	0	28,373
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Total Hours:

0	0	0	0	0	0	0	0	0	0	0	0	0	0	28,373
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

WBS 210003 Impact Limiters

Cost Code: 700 Special Equipment/Process Systems

110000000 Impact Limiters

Note: 2 EA
Based upon W-320 procurement costs.

Subtotal 11 Equipment

0	0	0	0	0	0	0	0	0	0	0	0	0	0	56745
---	---	---	---	---	---	---	---	---	---	---	---	---	---	-------

Total Hours:

0	0	0	0	0	0	0	0	0	0	0	0	0	0	56,745
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Total Cost Code: 700

0	0	0	0	0	0	0	0	0	0	0	0	0	0	56,745
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

TOTAL WBS 210003

0	0	0	0	0	0	0	0	0	0	0	0	0	0	56,745
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

Total Hours:

0	0	0	0	0	0	0	0	0	0	0	0	0	0	56,745
---	---	---	---	---	---	---	---	---	---	---	---	---	---	--------

WASTREN, Inc

By: TLW/BPL - COGEMA

03/10/2000

Sales Tax Included

Success Estimating and Cost Management System

Tank 241-C-103 Organic Removal Scoping Study
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C-103 Organic Removal

2 Procurement
21 Procurement
210004 Phase Separation Equipment & Enclosure

ROM - Study Estimate
241-C-103 Organic Removal
ESTIMATE DETAIL BY WBS / COST CODE

Acct # Craft ID	Description	Quantity	Unit	Manhours Baseline	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P &SiteAlloc	Estimate Subtotal
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WBS 210004A Assembly

Cost Code: 700 Special Equipment/Process Systems

11000000	ASSEMBLE EQUIPMENT INSIDE ENCLOSURE	1	EA	0		0	0	0	0	63720	0	19979	\$3699
Note: See H-2-823489 Sheets 1 thru 4 for internal piping and fittings details. 165ea. 1" 304l el's, T's, flanges and all Butt Welded. These are for 3 prefilers, 1 coalescer, and 1 tank inside the enclosure. For these fab m's I have allowed 4.2m's/ea BW (165ea x 3=495 m's). I doubled this number to install other items like the equipment, 1 control valve, 16ea Ball valves, 2ea flow meters, 2ea gamma detectors, level switches and xm'ters, etc.. 693m's x 2=890m's @ \$60 per m'h= \$59K													

Subtotal 11 Equipment

		0		\$0		\$0		\$0		\$0		\$0	\$83,699
Total Hours:													

Total Cost Code: 700

		0		\$0		\$0		\$0		\$0		\$0	\$83,699
Total Hours:													

TOTAL WBS 210004A

		0		\$0		\$0		\$0		\$0		\$0	\$83,699
Total Hours:													

WBS 210004B Enclosure

Cost Code: 700 Special Equipment/Process Systems

11000000	PHASE SEPARATOR ENCLOSURE	1	EA	0		0	0	0	0	64800	0	20318	85118
Note: See H-2-823470 - Price based upon phone quote.													

Subtotal 11 Equipment

		0		\$0		\$0		\$0		\$0		\$0	\$85,118
Total Hours:													

Total Cost Code: 700

		0		\$0		\$0		\$0		\$0		\$0	\$85,118
Total Hours:													

WASTREN, Inc

By: TLW,BPL - COGEMA
03/10/2000
Sales Tax included

Tank 241-C-103 Organic Removal Scoping Study

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C-103 Organic Removal

Success Estimating and Cost Management System

2 Procurement

21 Procurement

210004 Phase Separation Equipment & Enclosure

ROM - Study Estimate

241-C-103 Organic Removal

ESTIMATE DETAIL BY WBS / COST CODE

Acct # Craft ID	Description	Quantity	Unit	Manhours Baseline	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P &SiteAlloc	Estimate Subtotal
--------------------	-------------	----------	------	----------------------	---------	-------	----------------	----------	-----	-------------------	-----------------	--------------------	----------------------

TOTAL WBS 210004B

0	0	0	0	0	0	0	0	0	0	\$64,800	\$0	\$20,318	\$85,118
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Total Hours:

WBS 210004C Coalescer

Special Equipment/Process Systems

Cost Code: 700

110000000

COALESCER

Note:

Ph. quote on pre-filters and coalescer. All stainless steel pre-filter with sintered metal filters for liquids. Allow \$11K/ea

x 3ea. Coalescer is for 3gpm system = \$5K. Total = \$8K

0	0	0	0	0	0	0	0	0	0	0	0	0	\$11,349
---	---	---	---	---	---	---	---	---	---	---	---	---	----------

Subtotal 11 Equipment

Total Hours:

Total Cost Code: 700

Total Hours:

TOTAL WBS 210004C

Total Hours:

WBS 210005 ISO Tank

Special Equipment/Process Systems

Cost Code: 700

110000000

ISO TANK - 7700 GALLONS AND

AGITATOR

Note:

Phone quote for standard 316L tanks. Includes \$10K for a Lightning type agitator. \$50K+10K=\$62K This quote

came from a DOT approved vendor. It is to set on a flatbed trailer provided by others.

0	0	0	0	0	0	0	0	0	0	0	0	0	\$87,955
---	---	---	---	---	---	---	---	---	---	---	---	---	----------

Subtotal 11 Equipment

Total Hours:

Total Cost Code: 700

Total Hours:

WASTREN, Inc

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03/10/2000

Sales Tax Included

Success Estimating and Cost Management System

Tank 241-C-103 Organic Removal Scoping Study

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C-103 Organic Removal

3 Construction

31 On-site Construction Forces

311 On-site Construction Forces

ROM - Study Estimate

241-C-103 Organic Removal

ESTIMATE DETAIL BY WBS / COST CODE

Acct #	Description	Quantity	Unit	Manhours	Baseline	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P & Site Alloc	Estimate Subtotal
11000008	PUMP REMOVAL	1	Lot	742	579		55673	0	23328	0	0	19041	21289	119331
CPW	Note: For pump removal used the same costs as for installation.													
Subtotal 11 Equipment		1628		1270			\$119,693	\$0	\$48,816	\$0	\$0	\$40,845		\$254,704
Total Hours:		2898									\$0		\$45,349	
Total Cost Code: 700W		1,628		1,270			\$119,693	\$0	\$48,816	\$0	\$0	\$40,845		\$254,704
CELECW		2,898											\$45,349	
TOTAL WBS 3111		1,628		1,270			\$119,693	\$0	\$48,816	\$0	\$0	\$40,845		\$254,704
		2,898									\$0		\$45,349	

WBS 3112 CCTV Installation

Special Equipment/Process Systems

Cost Code: 700W														
11000002	CCTV INSTALLATION	775	1 Lot		605		55387	0	23328	0	0	18951	21217	118882
CELECW	Note: Based upon AZ-101 Installation costs. Material is for storage/burial box.													
11000002	CCTV REMOVAL	775	1 Lot		605		55387	0	23328	0	0	18951	21217	118882
CELECW	Note: For CCTV removal used the same costs as for installation.													
Subtotal 11 Equipment		1550		1209			\$110,773	\$0	\$46,656	\$0	\$0	\$37,902		\$237,765
Total Hours:		2759									\$0		\$42,433	
Total Cost Code: 700W		1,550		1,209			\$110,773	\$0	\$46,656	\$0	\$0	\$37,902		\$237,765
CELECW		2,759									\$0		\$42,433	
TOTAL WBS 3112		1,550		1,209			\$110,773	\$0	\$46,656	\$0	\$0	\$37,902		\$237,765
		2,759									\$0		\$42,433	

WASTREN, Inc

By: TLW/BPL - COGENA

Sales Tax Included

03/10/2000

Success Estimating and Cost Management System

Tank 241-C-103 Organic Removal Scoping Study

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C-103 Organic Removal

31 On-site Construction Forces
311 On-site Construction Forces
3113 Process EnclosureROM - Study Estimate
241-C-103 Organic Removal
ESTIMATE DETAIL BY WBS / COST CODE

Acct #	Description	Quantity	Unit	Manhours	Baseline	SWP-Adj	Labor	Equip	Material	S/C	Procured	General	OH&P	Estimate
Cost ID												Cond	&Site/Alloc	Subtotal

WBS 31131 Process Building

Cost Code: 550W Other Structures

020000002 EXCAVATION FOR PROCESS BUILDING

Note: Per engineer allow 15'w x 16'L x 12" thick =

020000006 HAUL OFF EXCESS

Note: Allow 15'w x 16'L x 12" thick =

020000002	EXCAVATION FOR PROCESS BUILDING	9	CY	38	28		2002	0	0	0	0	827	502	3132
020000006	HAUL OFF EXCESS	9	CY	5			152	0	0	0	0	48	38	237
CTEAM	Note: Allow 15'w x 16'L x 12" thick =													
Subtotal 02 Site Work				41	28			\$0		\$0		\$875		\$3,369
030000002	POUR CONCRETE - slab	10	CY	40	31		2318	0	1890	0	0	855	1175	6238
CCMAW	Note: Labor and Material includes allowances for formwork, resteel, c.c. work.													
030000006	POUR CONCRETE - walls	12	CY	72	56		4173	0	2268	0	0	1463	1759	9682
CCMAW	Note: Allow 4 walls @ 5' high x 15' x 4ea x 12" thick = 12CY. Labor and Material includes allowances for formwork, resteel, c.c. work.													
Subtotal 03 Concrete				112	87			\$0		\$0		\$2,318		\$15,901

Subtotal 03 Concrete

050000002 FAB 304L S.S. LINER 15'W X 6'L X 5'H X

12GA THK

Note: Allow 8'w x 15'L x 12GA = 4.43#/sf

Note: Allow 15'w x 16'L x 10 EVES =

050000006 FAB BUTLER TYPE BLDG.

Note: Allow 15'w x 16'L x 10 EVES =

050000002	FAB 304L S.S. LINER 15'W X 6'L X 5'H X	1550	LBS	48	38		3153	0	2511	0	0	1159	1579	8402
CSHTW	Note: Allow 8'w x 15'L x 12GA = 4.43#/sf													
050000006	FAB BUTLER TYPE BLDG.	240	SF	60	47		3465	0	5184	0	0	1439	2495	12883
CCARPW	Note: Allow 15'w x 16'L x 10 EVES =													
Subtotal 05 Metals				108	85			\$0		\$0		\$2,599		\$20,886
150000002	HEPA ALLOWANCE	1	LOT	30	23		1953	0	14040	0	0	1568	4892	22454
CSHTW														
Subtotal 15 Mechanical				30	23			\$0		\$0		\$1,568		\$22,454

Total Cost Code: 550W

Total Hours: 291

Total Hours: 514

				223			\$17,216	\$0	\$25,893	\$0	\$0	\$7,160	\$12,440	\$62,709

WASTREN, Inc

By: TLW/BPL - COGEMA

03/10/2000 Sales Tax included

ROM - Study Estimate
 241-C-103 Organic Removal
 ESTIMATE DETAIL BY WBS / COST CODE

Acct # Craft ID	Description	Quantity	Unit	Manhours Baseline	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P Site Alloc	Estimate Subtotal
Cost Code: 7060W	Electrical												
16000002	ELECTRICAL ALLOWANCE	240	SF	360	281	25728	0	3370	0	0	8285	7514	44907
CELECW													
Subtotal 16 Electrical				360	281	\$25,728	\$0	\$3,370	\$0	\$0	\$8,285	\$7,514	\$44,907
	Total Hours:			641						\$0			
Total Cost Code: 7060W				360	281	\$25,728	\$0	\$3,370	\$0	\$0	\$8,285	\$7,514	\$44,907
	Total Hours:			641									
TOTAL WBS 31131				651	504	\$42,944	\$0	\$29,263	\$0	\$0	\$15,455	\$19,954	\$107,616
	Total Hours:			1,155						\$0			
WBS 31132 Phase Separation Installation													
Cost Code: 550W	Other Structures												
15000002	HOOKUP PHASE SEPARATOR SKID	1	LOT	240	187	18008	0	0	0	0	5645	4520	28173
CPFW	Note: 1. skid is assembled at the vendor shop. After receiving onsite then allow 2 lab, 2 PF, 1 elec. 1 sheetmetal worker 40m/h's/ea = 240MH's												
Subtotal 15 Mechanical				240	187	\$18,008	\$0	\$0	\$0	\$0	\$5,645	\$4,520	\$28,173
	Total Hours:			427						\$0			
Total Cost Code: 550W				240	187	\$18,008	\$0	\$0	\$0	\$0	\$5,645	\$4,520	\$28,173
	Total Hours:			427									
TOTAL WBS 31132				240	187	\$18,008	\$0	\$0	\$0	\$0	\$5,645	\$4,520	\$28,173
	Total Hours:			427						\$0			

Tank 241-C-103 Organic Removal Scoping Study

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Success Estimating and Cost Management System

31 On-site Construction Forces

311 On-site Construction Forces

3113 Process Enclosure

ROM - Study Estimate
241-C-103 Organic Removal

ESTIMATE DETAIL BY WBS / COST CODE

Acct # Craft ID	Description	Quantity	Unit	Baseline	Manhours	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P &SiteAlloc	Estimate Subtotal
WBS 31133 ISO & Decant Tank Assembly														
Cost Code: 550	Other Structures													
110000001	PLACE SKID INTO PROCESS BUILDING	1	LOT	32	32		2698	0	0	0	0	846	677	4221
CPFM	Note : 2 PFS 16MH/YEA													
Subtotal 11 Equipment				32	32			\$0		\$0		\$846		\$4,221
Total Hours:				64			\$2,698		\$0		\$0		\$677	
Total Cost Code: 550														
Total Hours:				32	32			\$0	\$0	\$0	\$0	\$846	\$677	\$4,221
Cost Code: 550W	Other Structures													
110000004	PROCESS PIPING FOR BOTH TANKS	1	LOT	114	114	114	9802	0	3456	0	0	3245	3494	19798
CPFM	Note : ALLOWANCE FOR PROCESS PIPING @ 10% OF DIRECT TANK COSTS (SEE PROCUREMENT). SPLIT 60/40.													
Subtotal 11 Equipment				114	114			\$0		\$0		\$3,245		\$19,798
Total Hours:				228			\$9,602		\$3,456		\$0		\$3,494	
Total Cost Code: 550W														
Total Hours:				114	114			\$0		\$0	\$0	\$3,245	\$3,494	\$19,798
Total Hours:				228			\$9,602		\$3,456		\$0		\$3,494	
TOTAL WBS 31133				146	146			\$0		\$0		\$4,091		\$24,018
Total Hours:				292			\$12,300		\$3,456		\$0		\$4,171	

WBS 31133 ISO & Decant Tank Assembly

Cost Code: 550 Other Structures

11000001 PLACE SKID INTO PROCESS BUILDING

CPFM Note: 2 PPS 16MH/EA

Subtotal 11 Equipment

Total Hours:

Total Cost Code: 550

Total Hours:

Cost Code: 550W Other Structures

11000004 PROCESS PIPING FOR BOTH TANKS

CPFM Note: ALLOWANCE FOR PROCESS PIPING @ 10% OF DIRECT TANK COSTS (SEE PROCUREMENT). SPLIT 60/40.

Subtotal 11 Equipment

Total Hours:

Total Cost Code: 550W

Total Hours:

TOTAL WBS 31133

Total Hours:

WBS 31134 Process Interim Storage (Sampling)

Note: This is also on a skid and located inside the Process Building

Cost Code: 550 Other Structures

11000002

CPFM

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Sales Tax Included

ROM - Study Estimate
241-C-103 Organic Removal
ESTIMATE DETAIL BY WBS / COST CODE

Acct #	Description	Quantity	Unit	Manhours	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P & Site Alloc	Estimate Subtotal
Cost ID				Baseline									

Subtotal 11 Equipment		0		0		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Hours:		0		0		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Cost Code: 550		0		0		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Hours:		0		0		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
TOTAL WBS 31134		0		0		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Hours:		0		0		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

WBS 31141 Move Trailer On-site

Cost Code: 550	Other Structures												
020000004	MOVE TRAILER	1	Lot	107		83	6179	0	0	0	1937	1551	9687
CCARPW	Note: Based upon previous COGEMA study D89008.												
020000006	PLACE TRAILER	1	Lot	156		122	9009	0	11652	0	3617	5915	30183
CCARPW													
020000006	TELEPHONE LINES	1	Lot	105		82	7504	0	11652	0	3146	5537	27839
CELECW													

Subtotal 02 Site Work		368		287		\$0	\$0	\$0	\$0	\$0	\$8,700	\$67,699	\$67,699
Total Hours:		655		655		\$22,692	\$23,304	\$0	\$0	\$0	\$13,003	\$13,003	\$13,003
Total Cost Code: 550		368		287		\$0	\$0	\$0	\$0	\$0	\$8,700	\$67,699	\$67,699
Total Hours:		655		655		\$22,692	\$23,304	\$0	\$0	\$0	\$13,003	\$13,003	\$13,003
TOTAL WBS 31141		368		287		\$0	\$0	\$0	\$0	\$0	\$8,700	\$67,699	\$67,699
Total Hours:		655		655		\$22,692	\$23,304	\$0	\$0	\$0	\$13,003	\$13,003	\$13,003

ESTIMATE DETAIL BY WBS / COST CODE

Act #	Cost Code	Description	Quantity	Unit	Manhours	Baseline	SWP-Adj	Labor	Const	Equip	Material	S/C	Procured	General	OH&P	Estimate
Craft ID																Subtotal

WBS 31142 Power & Control Feeders (Contr. Rm. Bldg. to Contr. Trailer)

Cost Code:	7060W	Electrical															
160000000	3#4 AWG W#8 GND MC CABLE	1800 LF	25					1012	0	0	972	0	0	383	559	2928	
CELEC	Note: 3 #4 + 1#8 x 450' = 1800LF are routed above ground from the Control Rm. to the Control Trailer.																
160000001	DIST. PNL. 3PH 4W NEMA 12, 120/208V	1 EA	4					141	0	0	1793	0	0	166	597	2697	
CELEC	Note: New Distribution Panel and Transformer located inside Control Room Bldg.																
160000002	15KVA TRANSFORMER	1 EA	7					281	0	0	1071	0	0	161	406	1920	
CELEC																	
160000003	TERMINATIONS	26 EA	3					125	0	0	22	0	0	41	38	226	
CELEC																	
160000005	400 AMP CB	1 EA	4					141	0	0	1104	0	0	119	381	1745	
CELEC																	

Total Cost Code: 7060W

Total Hours:

TOTAL WBS 31142

Total Hours:

WBS 31143 Power & Control Feeders (Contr. Trailer to Encl's & Tank)

Cost Code: 7060	Electrical																
160000001	DIST. PNL. 3PH 4W NEMA 12, 120/208V	1	EA	4													
CELEC	Note : New Distribution Panel and Transformer located inside Control Room Bldg.																
Subtotal 16 Electrical				4				\$0	\$0	\$0	1793	0	0	0	166	597	2697

WASTREN, Inc

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Success Estimating and Cost Management System

Tank 241-C-103 Organic Removal Scoping Study

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31 On-site Construction Forces

311 On-site Construction Forces

3114 Instrumentation/Control Mobile Trailer

ROM - Study Estimate

241-C-103 Organic Removal

ESTIMATE DETAIL BY WBS / COST CODE

Acct # Craft ID	Description	Quantity	Unit	Baseline	Manhours	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P & Site Alloc	Estimate Subtotal
	Total Hours:			4			\$141		\$1,793		\$0		\$597	
	Total Cost Code: 7060			4		0	\$141	\$0	\$1,793	\$0	\$0	\$166	\$597	\$2,697
	Total Hours:			4										
Cost Code: 7060W	Electrical			8			225	0	216	0	0	85	124	650
160000000	344 AWG W/8 GND MC CABLE	400	LF											
CELEC	Note: 3 #4 + 1#8 x 450lf = 1800LF													
160000002	15KVA TRANSFORMER	1	EA	7			281	0	1071	0	0	161	406	1920
CELEC														
160000003	TERMINATIONS	26	EA	3			125	0	22	0	0	41	38	226
CELEC														
	Total Hours:			16			\$631	\$0	\$1,309	\$0	\$0	\$287	\$569	\$2,796
	Total Cost Code: 7060W			16		0	\$631	\$0	\$1,309	\$0	\$0	\$287	\$569	\$2,796
	Total Hours:			16										
Cost Code: 7065W	Instrumentation/Controls			4			141	0	1104	0	0	119	381	1745
160000005	400 AMP CB	1	EA											
CELEC														
	Total Hours:			4			\$141	\$0	\$1,104	\$0	\$0	\$119	\$381	\$1,745
	Total Cost Code: 7065W			4		0	\$141	\$0	\$1,104	\$0	\$0	\$119	\$381	\$1,745
	Total Hours:			4										
	TOTAL WBS 31143			23		0	\$912	\$0	\$4,206	\$0	\$0	\$572	\$1,548	\$7,238
	Total Hours:			23										

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Acct #	Cost Code	Description	Quantity	Unit	Manhours	Baseline	SWP-Adj	Labor	Equip	Material	S/C	Procured Equip	General Cond	OH&P & Site Alloc	Estimate Subtotal
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WBS 31144 Instrumentation & Controls

Cost Code: 7065 INSTRUMENTATION & CONTROLS CELEC Note: Allowance of 30% of Procurement Costs and split 60/40 labor and material.	1	LOT	2420	97163	0	70200	0	35239	46399	249000
	2420									
	2420									
	2420									
Total Hours:										
Total Hours:										
Total Hours:										
TOTAL WBS 31144										

WBS 3115 Above Gr. Connection Piping

Cost Code: 550W PIPE SUPPORTS CPFW Note: It is assumed that all of the pipe is above grade and with no elbows (straight run only). Per the engineer the pipe needs to be supported every 5' by a concrete and steel support. It will set on grade and excavation is not required. Allow a 2' x 2' x 1' thick c.c. base with a steel riser made of square tube and plate. 3MH's to fab @ \$50/hr. plus \$50 of material. PIT ENTRY IS COVERED WITH THE PUMP INSTALLATION	15	EA	30	23	2251	0	3240	0	928	1581	7998
	30										
	30										
	30										
Subtotal 03 Concrete											
150000002 PIPE IN PIPE 1/2" 304L/2" A-53 C.S. - HANDLING Note: This is for handling of the 1/2" 304L S.S. pipe. Material pricing from Richardson. It is assumed that all of the pipe is above grade and with no elbows (straight run only).	75	LF	5	4	338	0	182	0	117	136	752
	75										
	75										
	75										
150000006 PIPE IN PIPE 1/2" 304L/2" A-53 C.S. - HANDLING Note: This is for handling of the 2" A-53 C.S. pipe. Material pricing from Richardson.	75	LF	7	5	506	0	182	0	170	178	1016
	75										
	75										
	75										
150000010 WNF FITTINGS - HANDLING Note: Material pricing from Richardson.	4	EA	2	1	141	0	112	0	52	71	376
	4										
	4										
	4										

Tank 241-C-103 Organic Removal Scoping Study

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C-103 Organic Removal

Success Estimating and Cost Management System

3 Construction

31 On-site Construction Forces

311 On-site Construction Forces

ROM - Study Estimate
241-C-103 Organic Removal
ESTIMATE DETAIL BY WBS / COST CODE

Acct #	Description	Quantity	Unit	Baseline	Manhours	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P & Site Alloc	Estimate Subtotal
150000014	1/2" BW 304L	4	EA	17	13		1261	0	0	0	0	0	316	1972
CPFW	Note: Allow 1ea BW per 20LF of pipe.													
150000018	2" BW A-53 C.S.	8	EA	34	26		2521	0	0	0	0	0	633	3944
CPFW	Note: Allow 1ea BW per WMF and 1ea per 20LF of pipe.													
150000022	2" BW A-53 C.S. CLAM SHELL	1	EA	10	8		750	0	0	0	0	0	188	1174
CPFW	Note: Allow 10MH for tea BW clam shell to finish off pipe in pipe.													
150000028	BOLT-UPS	2	EA	4	3		300	0	108	0	0	0	101	619
CPFW	Note: It is assumed that all of the pipe is above grade and with no elbows (straight run only). Allow 10MH for tea BW clam shell to finish off pipe in pipe.													
150000030	NDT TESTING - X-RAY	4	EA	12	9		900	0	0	0	0	0	228	1409
CPFW	Note: Allow 10MH for tea BW clam shell to finish off pipe in pipe.													
150000034	DOUBLE WRAP PIPE IN 1/2" THK. X 1" WX	50	EA	150	117		11255	0	3402	0	0	0	3760	22398
CPFW	3L SHEETS													
150000038	CONTROL VALVE - JUMPER	1	EA	0	0		0	0	3584	0	0	0	1117	4924
CPFW	Note: Its installation is with the fab cost of the jumper. Material cost is from Richardson, 150#, RF flanged, 1" 316 S.S.													
150000042	MECHANICAL FLEX JUMPER WITH CONNECTORS	1	EA	0	0		0	0	3240	0	0	0	1016	4477
CPFW	Note: It is assumed that the jumper inside the pit is going to be a flex jumper with a control valve.													
150000046	GREENHOUSE FAB OUTSIDE OF FARM	1	LOT	135	105		7798	0	8840	0	0	0	3032	24134
CCARPW	Note: Based upon W-314 Phase II cost estimate.													
150000048	GREENHOUSE PLACE IN FARM	1	LOT	16	12		924	0	0	0	0	0	290	1446
CCARPW	Note: Based upon W-314 Phase II cost estimate.													
Subtotal 15 Mechanical				391	305		\$26,692	\$0	\$19,390	\$0	\$0	\$9,688	\$12,780	\$68,550
Total Hours:				695							\$0	\$0		
Total Cost Code: 550W				421	328		\$28,943	\$0	\$22,630	\$0	\$0	\$10,614	\$14,360	\$76,548
Total Hours:				749							\$0	\$0		
TOTAL WBS 3115				421	328		\$28,943	\$0	\$22,630	\$0	\$0	\$10,614	\$14,360	\$76,548
Total Hours:				749							\$0	\$0		

WBS 3116 Aqueous Return Piping

Cost Code: 550W Other Structures

030000042

PIPE SUPPORTS

CPFW

Note:

It is assumed that all of the pipe is above grade and with no elbows (straight run only). Per the engineer the pipe needs to be supported every 5' by a concrete and steel support. It will set on grade and excavation is not required.

Allow a 2' x 2' x 1' thick c.c. base with a steel riser made of square tube and plate. 3MH's to fab @ \$50/hr. plus \$50 of material.

WASTREN, Inc

By: TLW/BPL - COGEMA

03/10/2000

Sales Tax included

Tank 241-C-103 Organic Removal Scoping Study

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C-103 Organic Removal

Success Estimating and Cost Management System

3 Construction

31 On-site Construction Forces

311 On-site Construction Forces

ROM - Study Estimate
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ESTIMATE DETAIL BY WBS / COST CODE

Acc# Craft ID	Description	Quantity	Unit	Baseline	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P &SiteAlloc	Estimate Subtotal
Subtotal 03 Concrete		30	23					\$0		\$0	\$926		\$7,998
150000002 CPFW	PIPE IN PIPE 1/2" 304L/2" A-53 C.S. - HANDLING Note: This is for handling of the 1/2" 304L S.S. pipe. Material pricing from Richardson. It is assumed that all of the pipe is above grade and with no elbows (straight run only).	75	LF	5	4	338	0	182	0	0	117	136	752
150000006 CPFW	PIPE IN PIPE 1/2" 304L/2" A-53 C.S. - HANDLING Note: This is for handling of the 2" A-53 C.S. pipe. Material pricing from Richardson. It is assumed that all of the pipe is above grade and with no elbows (straight run only). Insulation is not included.	75	LF	7	5	508	0	182	0	0	170	178	1016
150000010 CPFW	WNF FITTINGS - HANDLING Note: Material pricing from Richardson. It is assumed that all of the pipe is above grade and with no elbows (straight run only).	4	EA	2	1	141	0	112	0	0	52	71	376
150000014 CPFW	1/2" BW 304L Note: It is assumed that all of the pipe is above grade and with no elbows (straight run only). Allow 1ea BW per 20LF of pipe.	4	EA	17	13	1261	0	0	0	0	395	316	1972
150000018 CPFW	2" BW A-53 C.S. Note: It is assumed that all of the pipe is above grade and with no elbows (straight run only). Allow 1ea BW per WNF and 1ea per 20LF of pipe.	8	EA	34	26	2521	0	0	0	0	790	633	3944
150000022 CPFW	2" BW A-53 C.S. CLAM SHELL Note: It is assumed that all of the pipe is above grade and with no elbows (straight run only). Allow 10MH for 1ea BW clam shell to finish off pipe in pipe.	1	EA	10	8	750	0	0	0	0	235	188	1174
150000026 CPFW	BOLT-UPS Note: It is assumed that all of the pipe is above grade and with no elbows (straight run only). Allow 10MH for 1ea BW clam shell to finish off pipe in pipe.	2	EA	4	3	300	0	108	0	0	101	109	619
150000030 CPFW	NDT TESTING - X-RAY Note: It is assumed that all of the pipe is above grade and with no elbows (straight run only). Allow 10MH for 1ea BW clam shell to finish off pipe in pipe.	4	EA	12	8	900	0	0	0	0	282	226	1409
150000034 CPFW	DOUBLE WRAP PIPE IN 1/2" THK. X 1" WX 3L SHEETS Note: It is assumed that all of the pipe is above grade and with no elbows (straight run only). PHONE QUOTE - The company said that the sheets are not easy to bend.	50	EA	150	117	11255	0	3402	0	0	3760	3892	22308
150000038 CPFW	CONTROL VALVE FOR JUMPER Note: It is assumed that the jumper inside the pit is going to be a flex jumper with a control valve. Its installation is with the fab cost of the jumper. Material cost is from Richardson, 150#, RF flanged, 1" 316 S.S.	1	EA	0	0	0	0	3584	0	0	243	1117	4924
150000042 CPFW	MECHANICAL FLEX JUMPER WITH CONNECTORS Note: It is assumed that the jumper inside the pit is going to be a flex jumper with a control valve.	1	EA	0	0	0	0	3240	0	0	221	1016	4477
150000046 CCARPW	GREENHOUSE FAB OUTSIDE OF FARM Note: Based upon W-314 Phase II cost estimate.	1	LOT	135	105	7796	0	8640	0	0	3032	4686	24134
150000048 CCARPW	GREENHOUSE PLACE IN FARM Note: Based upon W-314 Phase II cost estimate.	1	LOT	16	12	924	0	0	0	0	290	232	1446

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ROM - Study Estimate
241-C-103 Organic Removal
ESTIMATE DETAIL BY WBS / COST CODE

3 Construction
31 On-site Construction Forces
311 On-site Construction Forces

Acct # Craft ID	Description	Quantity	Unit	Manhours Baseline	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P &SiteAlloc	Estimate Subtotal
15000036 CPFW	AQUEOUS PIT ENTRY Note: Used the same manhour costs as CCTV Installation	1	LOT	775	605	58150	0	0	0	0	18228	14596	90974
Subtotal 15 Mechanical													
		1166		909		\$84,842	\$0	\$19,390	\$0	\$0	\$27,917	\$27,375	\$159,524
Total Hours:													
		2075											
Total Cost Code: 550W													
		1,196		933		\$87,093	\$0	\$22,630	\$0	\$0	\$28,843	\$28,956	\$167,522
		2,128											
TOTAL WBS 3116													
		1,196		933		\$87,093	\$0	\$22,630	\$0	\$0	\$28,843	\$28,956	\$167,522
		2,128											

WBS 31181 Transport Road Modifications

Cost Code: 550W Other Structures													
02000002 CLABW	RELOCATE EXISTING GATE Note: 2 Men 12 m/h/ea. to move 20' gate 30' to SE. Allow 2 new 8' gate posts and 2 inline chainlink fence posts.	24	LOT	19		1334	0	130	0	0	427	376	2287
02000006 COEW	GRADE ACCESS ROUTE Note: Allow 16'W x 55'L per H-2-823455 plus 40% for curves=1232 SF plus 4'W x 55'L for slope = 220 SF Total = 1450SF Allow 4men 8m/h/ea	32	SF	25		1945	0	0	0	0	610	488	3044
02000008 COEW	COMPACT ACCESS ROUTE Note: Allow 2' gravel = 9 cy @ \$15/cy say \$200	32	SF	25		1945	0	219	0	0	825	557	3347
Subtotal 02 Site Work													
		88		68		\$5,225	\$0	\$349	\$0	\$0	\$1,662	\$1,421	\$8,657
Total Hours:													
		156											
Total Cost Code: 550W													
		88		68		\$5,225	\$0	\$349	\$0	\$0	\$1,662	\$1,421	\$8,657
		156											
TOTAL WBS 31181													
		88		68		\$5,225	\$0	\$349	\$0	\$0	\$1,662	\$1,421	\$8,657
		156											

ROM - Study Estimate
241-C-103 Organic Removal
ESTIMATE DETAIL BY WBS / COST CODE

Acc#	Cost ID	Description	Quantity	Unit	Baseline	Manhours	SWP-Adj	Labor	Const Equip	Material	SJC	Procured Equip	General Cond	OH&P & Site Alloc	Estimate Subtotal
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WBS 31182 Load-in / Load-out Station

Cost Code: 550W	Other Structures														
020000008	GRADE TANK TRAILER RETENTION PAD	2440	SF	54	42	3274	0	0	0	0	0	0	1028	822	5122
COEW	Note: Allow 18"W x 111"L per H-2-823455 = 1776 SF plus 6"W x 111"L for slope = 667 SF Total = 2440SF Allow 4men 12m/hr														
020000008	COMPACT TANK TRAILER RETENTION PAD	2440	SF	54	42	3274	0	369	0	0	0	0	1051	937	5632
COEW	LINER FOR TANK TRAILER RETENTION PAD	2000	SF	60	47	3659	0	4320	0	0	0	0	1441	2273	11694
COEW	Note: Includes a 100mil non woven geotextile layer, 30mil geotextile cushion layer and a 60mil geomembrane liner. 16"W = 2"W for slope = 18"W x 111"L = 2000SF PH-QUOTE - THERE WILL BE A MINIMUM CHARGE SINCE ONLY 2000SF.														
020000016	SPIRGARD FOR TANK TRAILER RETENTION PAD MEMBRANE	98	EA	25	19	1494	0	2846	0	0	0	0	649	1205	5993
COEW	Note: No information. They are 4.5'L x 2"W and support the geomembrane. Allow \$25/ea														

Subtotal 02 Site Work

Total Hours:	192	150	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$28,440
Total Cost Code: 550W	192	150	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$28,440
TOTAL WBS 31182	192	150	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$28,440

WBS 313000 Construction - Equipment

Cost Code: 550	Other Structures														
010000008	DynCorp Equipment	1	LS	0	0	44732	0	0	0	0	0	0	0	0	44732
Subtotal 01 General Conditions															
Total Hours:	0	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$44,732
Total Cost Code: 550	0	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$44,732

WASTREN, Inc

By: TLW,BPL - COGEMA
03/10/2000

Sales Tax included

Tank 241-C-103 Organic Removal Scoping Study
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Success Estimating and Cost Management System

3 Construction
31 On-site Construction Forces
313 Construction Equipment

ROM - Study Estimate
241-C-103 Organic Removal
ESTIMATE DETAIL BY WBS / COST CODE

Accrual	Description	Quantity	Unit	Baseline	Manhours	SWP-Adj	Labor	Equip	Material	S/C	Procured Equip	General Cond	OH&P & Site Alloc	Estimate Subtotal
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TOTAL WBS 313000		0	0	0	\$0	\$44,732	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$44,732
Total Hours:		0	0	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

WBS 3141 Construction Management

Cost Code: 050	Construction Management	1	LS	0	276366	0	0	0	0	0	0	0	66368	345734
92000002	Construction Management													
Note:	Based upon 23% of direct construction manhours.													

Subtotal 92 Construction Management		0	0	0	\$0	\$276,366	\$0	\$0	\$0	\$0	\$0	\$0	\$69,368	\$345,734
Total Hours:		0	0	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

Total Cost Code: 050		0	0	0	\$0	\$276,366	\$0	\$0	\$0	\$0	\$0	\$0	\$69,368	\$345,734
Total Hours:		0	0	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
TOTAL WBS 3141		0	0	0	\$0	\$276,366	\$0	\$0	\$0	\$0	\$0	\$0	\$69,368	\$345,734
Total Hours:		0	0	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

WBS 411000 O/C Engineering Support & E/I During Construction

Cost Code: 900	Other Project Costs	1	LOT	1713	119910	0	0	0	0	0	0	0	0	119910
00000002	O/C Engineering Support & E/I DURING													
AVEREENG	CONST.													
Note:	16% average and is based upon W-314 Phase I&II and AZ-101 estimates.													

Subtotal 00		1713	1713	1713	\$0	\$119,910	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$119,910
Total Hours:		1713	1713	1713	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

Total Cost Code: 900		1,713	1,713	1,713	\$0	\$119,910	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$119,910
Total Hours:		1,713	1,713	1,713	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

WASTREN, Inc

By: TLW/BPL - COGEMA
03/10/2000

Sales Tax Included

Tank 241-C-103 Organic Removal Scoping Study

C-103

S20101 Rev. 0

C-103 Organic Removal

Success Estimating and Cost Management System

4 Operating Contractor Expense

41 O/C Engineering Support

411 O/C Engineering Support

ROM - Study Estimate
241-C-103 Organic Removal
ESTIMATE DETAIL BY WBS / COST CODE

Acct #	Quantity	Unit	Baseline	Manhours	SWP-Adj	Labor	Equip	Material	S/C	Procured Equip	General Cond	OH&P & Site Alloc	Estimate Subtotal
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TOTAL WBS 411000 1,713 0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$119,910

Total Hours: 1,713 \$119,910

WBS 430000 O/C Construction Support

Cost Code: 900 Other Project Costs

000000002 Other Project Costs 1 LOT 1887 132090 0 0 0 0 0 0 0 0 132090

AVERENG Note: 17.6% average and is based upon W-314 Phase I&II and AZ-101 estimates.

Subtotal 00 1887 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$132,090

Total Hours:

Total Cost Code: 900 1,887 0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$132,090

Total Hours: 1,887 \$132,090

TOTAL WBS 430000 1,887 0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$132,090

Total Hours: 1,887 \$132,090

WBS 440000 O/C Project Management

Cost Code: 060 Project Management

000000002 Other Project Costs 1 LOT 1588 142920 0 0 0 0 0 0 0 0 142920

PM Note: 14.8% average and is based upon W-314 Phase I&II and AZ-101 estimates.

Subtotal 00 1588 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$142,920

Total Hours:

Total Cost Code: 060 1,588 0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$142,920

Total Hours: 1,588 \$142,920

WASTREN, Inc

By: TLW,BPL - COGEMA

03/10/2000

Sales Tax included

B-32

ROM - Study Estimate
241-C-103 Organic Removal
ESTIMATE DETAIL BY WBS / COST CODE

Acct #	Description	Quantity	Unit	Baseline	Manhours	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P & Site Alloc	Estimate Subtotal
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TOTAL WBS 440000				1,588	0		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$142,920
				1,588			\$142,920		\$0					\$0
	Total Hours:													

WBS 4510 Safety Assessment

Cost Code: 900	Other Project Costs													
00000002			1	LOT			13440	0	0	0	0	0	0	13440
AYERENG	Note: 1.8% average and is based upon W-314 Phase I&II cost estimates.													

Subtotal 00				192			\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$13,440
-------------	--	--	--	-----	--	--	-----	-----	-----	-----	-----	-----	-----	----------

Total Hours: \$13,440

Total Cost Code: 900				192	0		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$13,440
				192			\$13,440		\$0					\$0

Total Hours:

TOTAL WBS 4510				192	0		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$13,440
				192			\$13,440		\$0					\$0
	Total Hours:													

WBS 4530 Permitting and Approvals

Cost Code: 900	Other Project Costs													
00000002	Permitting / AB		1	LOT			157000	0	0	0	0	0	0	157000
AYERENG	Note: Provided by engineering.													

Subtotal 00				2243			\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$157,000
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Total Hours: \$157,000

Total Cost Code: 900				2,243	0		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$157,000
				2,243			\$157,000		\$0					\$0

Total Hours:

WASTREN, Inc

Tank 241-C-103 Organic Removal Scoping Study

C-103

S20101 Rev. 0

C-103 Organic Removal

Success Estimating and Cost Management System

241-C-103 Organic Removal
4 Operating Contractor Expense
45 O/C Testing & Turnover

ROM - Study Estimate
241-C-103 Organic Removal
ESTIMATE DETAIL BY WBS / COST CODE

Acct #	Description	Quantity	Unit	Manhours Baseline	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P & Site Alloc	Estimate Subtotal
Craft ID													

TOTAL WBS 4530

2,243	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$157,000
2,243				\$157,000									
<u>Total Hours:</u>													

WBS 4540 ABU Process

Cost Code: 900 Other Project Costs

000000002	Place Holder	1	LOT	1429		100000	0	0	0	0	0	0	100000
AVERENG	Note: For turnover documentation.												

Subtotal 00

1429	\$0	\$100,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$100,000
1429													
<u>Total Hours:</u>													

Total Cost Code: 900

1,429	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$100,000
1,429				\$100,000									
<u>Total Hours:</u>													

TOTAL WBS 4540

1,429	0	\$0	\$0	\$0	\$0	\$100,000	\$0	\$0	\$0	\$0	\$0	\$0	\$100,000
1,429													
<u>Total Hours:</u>													

WBS 4550 Authorization Basis

Cost Code: 900 Other Project Costs

000000002	Authority Basis	1	LOT	2857		200000	0	0	0	0	0	0	200000
AVERENG	Note: Provided by engineering.												

Subtotal 00

2857	\$0	\$200,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$200,000
2857													
<u>Total Hours:</u>													

Total Cost Code: 900

2,857	0	\$0	\$0	\$0	\$0	\$200,000	\$0	\$0	\$0	\$0	\$0	\$0	\$200,000
2,857													
<u>Total Hours:</u>													

WASTREN, Inc

By: TLW,BPL - COGEMA

03/10/2000

Sales Tax included

P. 2/10

ROM - Study Estimate
241-C-103 Organic Removal
ESTIMATE DETAIL BY WBS / COST CODE

Acct #	Description	Quantity	Unit	Manhours	SWP-Adj	Labor	Equip	Material	S/C	Procured	General	OH&P	Estimate
Craft ID				Baseline						Equip	Cond	&SiteAlloc	Subtotal

TOTAL WBS 4550
 2,857 0 \$0 \$0 \$0 \$0
Total Hours: 2,857 \$200,000 \$0 \$0 \$0 \$200,000

WBS 4560 SARP For Transportation

Cost Code: 900 Other Project Costs
 00000002 Paper work for transportation
 AVERENG Note : Provided by engineering.

Subtotal 00 143 143 \$0 \$10,000 \$0 \$0 \$0 \$10,000

Total Hours: 143 143 \$0 \$10,000 \$0 \$0 \$0 \$10,000

Total Cost Code: 900 143 143 \$0 \$10,000 \$0 \$0 \$0 \$10,000

TOTAL WBS 4560
 143 0 \$0 \$10,000 \$0 \$0 \$0 \$10,000
Total Hours: 143 \$10,000 \$0 \$0 \$0 \$10,000

WBS 4610 Mockup Testing

Cost Code: 900 Other Project Costs
 920000002 Mockup Testing
 AVERENG 1 LOT 535 37450 0 12960 0 0 0 2475 52885

Subtotal 92 Construction Management 535 535 \$0 \$37,450 \$12,960 \$0 \$0 \$2,475 \$52,885

Total Hours: 535 535 \$37,450 \$12,960 \$0 \$0 \$2,475 \$52,885

Total Cost Code: 900 535 535 \$0 \$37,450 \$12,960 \$0 \$0 \$2,475 \$52,885

ROM - Study Estimate
241-C-103 Organic Removal
ESTIMATE DETAIL BY WBS / COST CODE

Acc#	Description	Quantity	Unit	Manhours Baseline	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P &SiteAlloc	Estimate Subtotal
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TOTAL WBS 4610

535	0			\$0		\$0		\$0		\$0		\$2,475	\$52,885
535						\$37,450		\$12,960					
Total Hours:													

WBS 4620 Operability Testing

Cost Code: 900 Other Project Costs
00000002 Operability Testing
AVERENG Note: 10.5% average and is based upon W-314 Phase I&II and AZ-101 estimates.

Subtotal 00

1126				\$0		\$78,820		\$0		\$0		\$0	\$78,820
1126								\$0					
Total Hours:													

Total Cost Code: 900

1,126	0			\$0		\$78,820		\$0		\$0		\$0	\$78,820
1,126								\$0					
Total Hours:													

TOTAL WBS 4620

1,126	0			\$0		\$78,820		\$0		\$0		\$0	\$78,820
1,126								\$0					
Total Hours:													

WBS 4720 Operation Preparation

Cost Code: 900 Other Project Costs
00000002 Other Project Costs
AVERENG Note: 6.3% average and is based upon W-314 Phase I&II and AZ-101 estimates. It includes Readiness Review, Risk Assessment, Work Package Preparation/ Procedure Preparation, and Training.

Subtotal 00

677				\$0		\$47,390		\$0		\$0		\$0	\$47,390
677								\$0					
Total Hours:													

Total Cost Code: 900

677	0			\$0		\$47,390		\$0		\$0		\$0	\$47,390
677								\$0					
Total Hours:													

241-C-103 Organic Removal
4 Operating Contractor Expense
47 Operations

ROM - Study Estimate
241-C-103 Organic Removal
ESTIMATE DETAIL BY WBS / COST CODE

[illegible]

Cost Code:	900	Other Project Costs					
220000002	DISPOSAL		5000 GAL	0	0	0	0
	Note :	AS PROVIDED BY ENGINEERING TRANSPORTATION & DISPOSAL BASED UPON 5,000 GALLONS @ \$250/GALLON.					
	TRANSPORTATION		1 LOT	560	0	0	0
220000008	Note :	Based upon 3 operators, 2 Hprt's, 1 Indust. Hyg., 1 Pic 2 days/ea. per 1,000 gallon transfer x 5 transfers = 7 persons x 16m't's x 5 transfers = 560m'h's This is manours for pumping into the LR-56.					
AVEROPER					250	0	0
					1250000	0	12500000
						0	33850

Subtotal 92 Construction Management									
	560		\$0		\$1,250,250		\$0		\$1,283,850
Total Hours:	560			\$33,600	\$0		\$0		\$0
Total Cost Code: 900									
	560	0	\$0		\$1,250,250		\$0		\$1,283,850
Total Hours:	560			\$33,600	\$0		\$0		\$0
TOTAL WBS 4730									
	560	0	\$0		\$1,250,250		\$0		\$1,283,850
Total Hours:	560			\$33,600	\$0		\$0		\$0

Cost Code:	900	Other Project Costs			
00000002	Operating Expenses	1	LOT	2200	132000
VEROPER	Note: This is based upon 4 Operators, 1 HPT, 2 PF, 1 ELEC, 1 Indust. Hyg., 2PIC'S For 25 days each. @ \$60/hour. 11 persons x 8mh's x 25 days =2200 mh's These manhours are for pumping and processing the liquids.	0	0	0	0
					33132
					165132

subtotal 00			
2200	\$0	\$0	\$165,132
ubtotal 00			

ROM - Study Estimate
241-C-103 Organic Removal
ESTIMATE DETAIL BY WBS / COST CODE

Acct # Craft ID	Description	Quantity	Unit	Baseline	Manhours	SWP-Adj	Labor	Const Equip	Material	S/C	Procured Equip	General Cond	OH&P & Site Alloc	Estimate Subtotal
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Total Hours:				2200			\$132,000		\$0		\$0		\$33,132	
Total Cost Code: 900				2,200		0	\$132,000	\$0	\$0		\$0		\$33,132	\$165,132
				2,200										
TOTAL WBS 4740				2,200		0	\$132,000	\$0	\$0		\$0		\$33,132	\$165,132
				2,200										

WBS 4750 ORR

Cost Code: 900				21429			1500000	0	0	0	0	0	0	1500000
00000002 ORR														
AVERENG														
Subtotal 00				21429			\$1,500,000	\$0	\$0		\$0		\$0	\$1,500,000

Total Hours:				21429			\$1,500,000		\$0		\$0		\$0	
Total Cost Code: 900				21,429		0	\$1,500,000	\$0	\$0		\$0		\$0	\$1,500,000
				21,429										
TOTAL WBS 4750				21,429		0	\$1,500,000	\$0	\$0		\$0		\$0	\$1,500,000
				21,429										

TOTAL 241-C-103 Organic Removal

Total Hours:	51,181	5,082	\$44,732	\$1,250,250	\$194,606	\$574,843	\$6,719,280
	56,262	\$3,794,863	\$296,766	\$563,220			

APPENDIX B**COST****LDUA – Light Duty Utility Arm**

The LDUA has been deployed 1 time here at Hanford in Tank T-106 in 1996. The deployment was through a 12" riser (LDUA requires a 12" minimum size riser) and outside of a pit (in other words there was no pit entry). LDUA's reach is about 13.5' in C-103. An end effector has been built to extend another 7' in either size tank. The amount of weight that it can pick up is between 50 – 75 lbs. The actual costs for the deployment were updated in 1998 and are as follows for 1 deployment (the cost of the arm is not included):

1. Installation = 2 week mission = \$150K
This installation however was in a very clean tank farm tank. The costs could go higher in a farm that is highly contaminated.
2. Training = \$75K (4-6 persons)
Training would be ~\$75K or even less if they could round up the crew that was trained on LDUA initially. FMEF is already setup for training and even has an outside area for training in the wind.
3. An ORR would need to be performed on the 1st tank = \$200 - \$300K.
This would not be a repeat cost if tanks were cleaned out consecutively and without an extended period of time between entries. An extended period of time would probably require a new readiness assessment each time.
4. End Effectors (about 12ea.) are available. If new ones are required = \$200-\$300K/ea.
The reason that they are so expensive is because the materials must be pedigreed, spark resistant, etc. Some could cost less, in their fabrication, but would be very simple ones.
5. For additional deployments = \$150K/ea per riser.
Assuming there are risers available at the right places a 1,000,000 gallon tank would probably only require 4 deployments. More could be required if the risers are not in the right place on the tank.

Note: LDUA's are deployed at ORNL and ID sites. ORNL's cost for deployment is now down to \$50-70K/ea. but are in different type tanks than Hanford. Flam Gas is not an issue there but is at Hanford.

DRAFT Summary

First Installation (In clean farm)	\$150,000
Training (4-6 persons)	75,000
Operational Readiness Review	300,000
3 additional risers (SST)	450,000
Burial (200 CF of RMW)	<u>25,000</u>
Total	\$1,000,000

Assume that existing end effectors are adequate for the mission.

Definitive design engineering for Balance Of Plant, escalation, contingency, and overview CCTV's. It should be noted however that the \$150K includes installation, 2 weeks of operation, decontamination, and breakdown of equipment. The LUDA system and 9 end effectors is Government Furnished Equipment as it already exists on site. There is a glovebox over the LDUA that allows for end effector changes. There is a spraying system for cleaning. The \$1M (above) is similar in magnitude to the deployment estimates that were generated for the AX-104 sampling mission for the Hanford Tank Initiative.

APPENDIX C
ENVIRONMENTAL PERMITTING CHECKLIST

APPENDIX C

ENVIRONMENTAL PERMITTING CHECKLIST

INTRODUCTION

The Environmental Permits, Approvals, and Requirements (EReqs) Checklist is a general purpose tool for identifying environmental standards and determining their applicability to Hanford Site work. The EReqs Checklist is updated as necessary to account for new or changed federal and state regulations, significant permit and approval conditions, and other relevant environmental mandates. Table C-1 of this appendix presents a completed EReqs Checklist, showing the results of the environmental applicability determinations for projects and activities that support removal or organic from 241-C-103. The last column of Table C-1 indicates whether an environmental permit, approval or requirement was found to be potentially applicable to this work.

A substantial body of experience has been gained in obtaining environmental permits and approvals for facilities within the River Protection Project (RPP). In addition to providing a reliable source of scientific and technical expertise, this experience base can be used to help estimate the level of effort needed to satisfy applicable environmental standards. Information about resources and, more importantly, duration's and timeframes associated with different types of environmental actions will be needed when developing cost, schedule, and staffing plans for removal of organic from 241-C-103.

Table C-2 lists significant environmental actions which, based on the draft scoping study received, have been found to be potentially applicable to this activity. For each environmental action, Table C-2 lists various tasks that may be necessary to obtain relevant permits or approvals, or to otherwise demonstrate compliance with applicable standards. For each listed task, the table provides estimates for labor, other costs, and duration:

- Labor represents the approximate number of direct labor hours that experienced, qualified RPP personnel would require, on average, to complete the task. The labor estimates include all staff time and do not allocate effort to types of personnel (e.g., scientist, clerical, and manager).
- Other costs are indicated if significant "purchased" expenses can be anticipated for the particular task. Direct RPP labor hours are not included in the other cost estimates. Other costs may include items such as facilities, equipment, materials, printing, travel, laboratory, subcontractors, and hired services.
- Duration describes the approximate amount of time needed, from start to finish, to complete the task. Duration is generally independent of the labor effort, and in most cases is controlled by external factors such as agency review times, mandatory periods for public notice and/or hearings, or preset approval cycles (e.g., semi-annual permit renewal). Duration's for multiple tasks are not necessarily additive; some tasks are sequential but others may be able to proceed in parallel.

The information in Table C-2 is intended for managers and planners to use for initial planning purposes and to anticipate significant work, schedule, and resource constraints that may affect their projects and activities. Not all of the identified environmental actions or tasks will be applicable to each particular project or activity, and the estimates only represent “typical” levels of effort. The estimates should be treated as approximations that must be further refined for detailed project- and activity-specific planning.

Estimated Cost For Permitting and Approvals = \$157,640.

Estimated Cost For Engineering and Readiness Support = \$34,720¹.

Subpart BB – Contingent Cost of \$100K include in operation/installation cost during pumping².

K. S. Tollefson, River Protection Project (RPP) Environmental Services, has expertise in the respective environmental programs and can offer additional information about the permitting requirements for C-103 organic removal.

¹ This item is included under Readiness Activity Costs.

² This item is assumed as part of the Operational Costs.

**Table C-1. Environmental Permits, Approvals, and Requirements Checklist
for Removal of Organic From Tank 241-C-103.**

Environment or media	Permit, approval or requirement	Citation	Agency	Affected actions	Potentially applicable
National Environmental Policy Act and Related Reviews	NEPA Documentation	40 CFR 1500 to 1508 10 CFR 1021 DOE Order 451.1A	DOE	Title II Design (Projects); Procurement	Yes
	NEPA 216 Process/ External Procurement	10 CFR 1021.216	DOE	Environmental Critique before letting external contract	No
Washington State Environmental Policy Act	SEPA Documentation	WAC 197-11	Ecology	Actions requiring issuance of permits, licenses, or other approvals by state or local authorities	Yes
Other Tribal, Cultural, Historic, and Environmental Planning and Assessments	American Indian Policies Review	42 USC 1966 DOE Order 1230.2	DOE BIA	Actions impacting tribal interests, culture, environment, or resources	No
	Cultural Resources Review	10 CFR 1021 36 CFR 63 36 CFR 800 43 CFR 7 16 USC 461-470aa 42 USC 1996 42 USC 4321	DOE State Historic Preservation Office	Any surface disturbance, building modifications, or other actions affecting areas of archaeological or historic significance; Facility changes affecting Historic Register eligibility	Yes
	Ecological Compliance Review	10 CFR 1021 50 CFR 17 50 CFR 402.6 16 USC 703-712 16 USC 1531 DOE Order 5484.1 WAC 232-12	USFWS Ecology	Surface disturbances, construction, excavation, or other actions that modify habitats or could affect threatened or endangered species	Yes
	Preoperational Monitoring of Facility or Site	DOE Order 5400.1	DOE	Determination of baseline environmental conditions prior to new operations	Yes
	Excavation Permit	36 CFR 800	DOE	Any surface disturbance or excavation	Yes
	DOE Acquisition/ ES&H Management	48 CFR 915 and 970	DOE	Integrating Projects with ISMS	No
	Price-Anderson Amendments Act	10 CFR 820	DOE	Facility corrections and operational readiness	No
All Air Emissions	Air Operating Permit	WAC 173-401	Ecology EPA WDOH	Construction or operations with potential to emit regulated compounds to air	Yes
Radioactive Air Emissions	Source Review/NOC; NESHAPs	40 CFR 61, Subpart H	EPA	Construction or operations with potential to emit radionuclides	Yes
	Source Review/NOC; Radionuclides and BARCT/ALARACT	WAC 246-247	WDOH	Construction or operations with potential to emit radionuclides	Yes
Nonradioactive Air Emissions	Prevention of Significant Deterioration	WAC 173-400	Ecology	Construction or operations with potential to degrade existing air quality	Yes
	New Source Review	WAC 173-400	Ecology	Construction of new sources and modification of existing sources of air emissions	Yes
	Toxic Air Pollutants; NOC and T-BACT	WAC 173-460	Ecology	Construction or operations with potential to emit TAPs	Yes
	Outdoor/Unconfined Burning; Burn Permit	WAC 173-425 BCAA Reg. 1, Article 5	Hanford Fire Department BCAA	Open burning	No

**Table C-1. Environmental Permits, Approvals, and Requirements Checklist
for Removal of Organic From Tank 241-C-103.**

Environment or media	Permit, approval or requirement	Citation	Agency	Affected actions	Potentially applicable
Drinking Water Supply	System ID Number; Engineer Report, Plans and Specifications	WAC 246-290	WDOH	Construction or operation of a source for public or worker drinking water	No
	Operator Certification	WAC 246-292	WDOH	Operation of a drinking water supply	No
Domestic Waste Water Disposal	Septic Systems Design Approval	WAC 246-272	WDOH	Construction or operation of septic disposal systems with <14,500 gal/day capacity	No
	Septic Systems Design Approval	WAC 173-216 and -240	Ecology	Construction or operation of septic disposal systems with >14,500 gal/day capacity	No
	Pretreatment Permit	40 CFR 403 WAC 173-220 City Ordinance	Ecology City of Richland	Discharge of waste water to public sanitary sewage treatment system	No
	Wastewater Treatment Facility Permit; Discharge Standards; Operator Certification	40 CFR 122 WAC 173-216 and -240 WAC 173-221 WAC 173-230	Ecology EPA	Construction or operation of facility for treatment and disposal of sanitary sewage	No
Waste Water Disposal to Ground and Soil Column	Groundwater Quality Standards	WAC 173-200	Ecology	Disposal of pollutants that could affect groundwater	No
	State Waste Discharge Permit	WAC 173-216 and -240	Ecology	Construction or operation of facilities that discharge waste water to ground	No
	Underground Injection Control	WAC 173-218	Ecology	Construction or operation of facilities that dispose of waste water in underground wells	No
Construction and Significant Actions In or Near Surface Water	Floodplain/Wetland Assessment	10 CFR 1022	DOE	Surface disturbances in floodplain or near wetlands	No
	U.S. Army Corps of Engineers Permit	33 CFR 325	USACE	Construction or operations in or near a river, lake, or other surface water	No
	Nationwide Permits	33 CFR 330	USACE	Construction or operations in or near a river or waterway	No
	Wild & Scenic River Section 10 Permit	33 CFR 320 33 CFR 322	USACE	Construction or operations in or near a designated or candidate wild or scenic river	No
	Hanford Reach Study Act Notification	PL 100-605	U.S. Park Service	Construction within 1/4 mile of the Columbia River	No
	Hydraulic Projects Permit	WAC 220-110	State Dept. of Fisheries	Construction or operations in or near waters of the state	No
	Shoreline Development Permit	WAC 173-14 to -20	Benton County	Construction or operations in or near waters of the state	No
	Aquatic Lands Lease	WAC 332-30	State Dept. of Natural Resources	Construction or operations in or near waters of the state	No

**Table C-1. Environmental Permits, Approvals, and Requirements Checklist
for Removal of Organic From Tank 241-C-103.**

Environment or media	Permit, approval or requirement	Citation	Agency	Affected actions	Potentially applicable
Waste Water Disposal to Surface Water	NPDES Permit; Categorical Treatment Standards	40 CFR 122 40 CFR 405 to 471	EPA	Construction or operation of facilities that treat and dispose waste water to rivers, lakes, and other surface waters	No
	Certification of NPDES Permit	40 CFR 121 WAC 173-225	EPA Ecology	EPA-issued NPDES permits must be certified by Ecology	No
	Stormwater General Permit under Waste Discharge General Permit Program	40 CFR 122	EPA	Construction or operations that could contribute pollutants to stormwaters that discharge to surface water	No
	Short-Term Water Quality Modification Approval	WAC 173-201A	Ecology	Construction or operations that could modify the quality class of a surface water	No
Radioactive Materials and Waste Management	General Radiation Protection and Monitoring Programs	DOE Order 5400.1 DOE Order 5400.5 DOE Order 490	DOE	Construction or operations with potential to emit radionuclides	Yes
	Reprocessing of Spent Nuclear Fuel	Atomic Energy Act DOE Order 5820.2A DOE Order 6430.1A DOE Order 435.1	DOE	Construction or operation of facilities for storing, treating, processing, and managing spent nuclear fuel	No
	Management of High-Level and Low-Level Radioactive Wastes	10 CFR 962 40 CFR 191 DOE Order 5820.2A DOE Order 6430.1A DOE Order 435.1	DOE EPA Nuclear Regulatory Commission	Construction or operation of facilities for storing, packaging, transporting, and disposing of high and low level wastes	Yes
Solid and Dangerous Waste Management	Solid Waste Facility Permit	WAC 173-304 and -351	Ecology Benton-Franklin Health Dept.	Construction and operation of facilities that manage solid and municipal wastes	No
	Waste Oils	WAC 173-303	Ecology	Receipt, storage, transport, recycling, blending, or burning of waste oils	No
	Dangerous Waste Notice of Intent	WAC 173-303-281	Ecology	Expansion, construction, or modification and operation of dangerous waste TSD facility	No
	Interim Status and Final Status Standards	WAC 173-303 40 CFR 264, 265, and 270	Ecology EPA	Construction, expansion, or modification of dangerous waste TSD facility	Yes
	Permits for Trials and Demonstrations	WAC 173-303-807, -808 and -809	Ecology	Trial burns, land treatment demonstrations, and research involving dangerous waste	No
	Miscellaneous Requirements for Dangerous Waste Management	WAC 173-303-071 WAC 173-303-140 WAC 173-303-335 WAC 173-303-610 WAC 173-303-645 WAC 173-303-646 40 CFR 268	Ecology EPA	Exclusions for treatability test samples; Land disposal restrictions; Construction quality assurance for dangerous waste impoundment, pile or landfill; Partial or final closure of TSD facility; Monitoring and corrective actions for dangerous waste releases	Yes

**Table C-1. Environmental Permits, Approvals, and Requirements Checklist
for Removal of Organic From Tank 241-C-103.**

Environment or media	Permit, approval or requirement	Citation	Agency	Affected actions	Potentially applicable
Hazardous Substances and Petroleum Products	Toxic Substances	40 CFR 720	EPA	Activities that produce toxic substances must submit pre-manufacturing notification	No
	Polychlorinated Biphenyls	40 CFR 761	EPA	Generation and management of wastes containing regulated PCBs	No
	Ozone Depleting Substances; Spent Fluorocarbons; Volatile Organic Compounds	40 CFR 82 WAC 173-303-506 WAC 173-490	EPA Ecology	Facilities or operations which handle or recycle spent fluorocarbons, handle or may release ozone depleting substances, or store volatile organic compounds	No
	Asbestos	40 CFR 61, Subpart M BCAA Reg. 1, Article 8	EPA BCAA	Removal, management, and disposal of asbestos containing materials	No
	Bulk Fertilizers; Insecticides, Pesticides, Rodenticides, Fungicides, Herbicides	WAC 16-201 WAC 16-228 to -232	State Dept. of Agriculture	Bulk storage of fertilizers; Use, application, storage and disposal of insect, pest, and vegetation control chemicals	No
	Underground Storage Tanks	WAC 173-360	Ecology	Construction and operation of underground tanks that store oil and hazardous chemical products	No
	Oil Spill Prevention Planning and Response	40 CFR 112 WAC 173-180A to -181	EPA Ecology	Construction and operation of facilities that store or handle bulk oils near surface waters	No
	Pollution Prevention, Waste Minimization, and Community Right-to-Know Notification and Reporting	DOE Order 5400.1 DOE Order 5820.2A 40 CFR 355 and 372 WAC 173-307	DOE EPA Ecology	Facilities and operations which use hazardous substances, generate or manage solid and hazardous wastes, in excess of threshold quantities	Yes
	Notification and Remediation of Environmental Releases	40 CFR 300 and 302 WAC 173-303-145 WAC 173-340	EPA Ecology	Unpermitted releases of oils and hazardous substances to the environment in excess of threshold quantities	Yes

Table C-2. Estimated Levels of Effort for Environmental Actions and Tasks
to Support Removal of Separable Organic from Tank 241-C-103.

Estimates for the Most Likely Environmental Actions and Tasks	Labor	Other Cost	Duration
National Environmental Policy Act			
Review/Approve Adequacy of Existing NEPA Documentation	40 h	-----	1 month
State Environmental Policy Act			
Request/Document Lead Agency Concurrence with NEPA Adequacy	40 h	\$3,000	1 month
Cultural Resources Review			
Confirm/Document Coverage by Cultural Resources Exemption	6 h	-----	½ month
Ecological Compliance Review			
Confirm/Document Coverage by Blanket Biological Review	6 h	-----	½ month
Preoperational Monitoring of Facility or Site			
Prepare/Issue Documentation and Summary Report	80 h	-----	1 month
Hanford Site Air Operating Permit			
Request/Support Minor Modification of AOP	60 h	-----	1 month
Radioactive Air Emissions; Washington State (WDOH)			
Prepare/Submit NOC; Support WDOH Approval (Short Form NOC, or Simple to Moderately Complex NOC)	650 h	\$2,000	6 months
Radioactive Air Emissions; Federal (EPA)			
Prepare/Submit NOC; Support EPA Approval	60 h	-----	1 month
Non-Radioactive Air Emissions; Washington State (Ecology)			
Prepare PSD/NSR; Request/Document Ecology Concurrence	120 h	-----	2 months
Prepare/Submit NOC; Support Ecology Approval (Simple to Moderately Complex NOC)	650 h	\$2,000	8 months
Dangerous Waste Interim Status and Final Status Permit			
Request/Support Part A Interim Status Modification	120 h	-----	4 months
40 CFR 265.1050, Subpart BB - "Air Emission Standards for Equipment Leaks" (Includes WAP revision, Labeling & Monitoring Requirements)		100k	10 months
Project-/Activity-Specific Environmental Planning			
Prepare Environmental Strategy and Planning Summary	60 h	-----	1 month
Prepare and Issue Environmental Plan	200 h	-----	3 months
Update Environmental Plan Annually (Simple to Moderately Complex)	60 h	-----	1 month
Environmental Compliance and Readiness Support			
Provide Guidance/Issue Resolution During Conceptual Design	5 h/wk	-----	8 weeks
Provide Guidance/Issue Resolution During Definitive Design	5 h/wk	-----	24 months
Review Work Packages/ECNs During Construction	5 h/wk	-----	24 months
Support Onsite Inspections During Construction	3 h/wk	-----	24 weeks
Support Readiness Assessment/Operational Readiness Review	3 h/wk	-----	16 weeks
Provide Interpretation/Issue Resolution During Operational Startup	3 h/wk	-----	4 weeks

Acronyms

AOP	Air operating permit
Ecology	Washington State Department of Ecology
ECN	Engineering Change Notice
EPA	U.S. Environmental Protection Agency
NEPA	<i>National Environmental Policy Act of 1969</i>
NOC	Notice of construction
NSR	New source review
PSD	Prevention of significant deterioration
WDOH	Washington State Department of Health

Notes:

Estimates in this table are provided for initial planning purposes only. The estimates should be treated as approximations that must be further refined for detailed project- and activity-specific planning.

All labor estimates are provided in hours (h) unless indicated otherwise. Labor estimates account for all staff time, including professional and administrative.

Other costs indicate estimated expenses for significant support that may need to be purchased to accomplish the particular task (e.g., facilities, equipment, materials, printing, travel, laboratory, subcontractors).

Hourly Rate assumed to be \$70.00.

Conceptual/Definitive Design Duration assumed to be four months.

Construction Duration assumed to be six months.

Operational readiness review assumed to be one month.

Operational startup assumed to be one month.

[illegible]