S

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 636877

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	S A Krieg NUMATEC 376-0971 H6-12	[] Yes [X] No	7/9/98
	6. Project Title/No./Work Order No. HTI/D25E4	7. Bldg./Sys./Fac. No. NA	8. Approval Designator NA
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) HNF-2693 Revision 0	10. Related ECN No(s). NA	11. Related PO No. NA

12a. Modification Work	12b. Work Package No.	12c. Modification Work Complete	12d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 12b) [X] No (NA Blks. 12b, 12c, 12d)	NA	NA Design Authority/Cog. Engineer Signature & Date	NA Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

13b. Design Baseline Document? [] Yes [X] No

Revisions to body of document; Replace table 1; Add figure 1; Add tables A-1 through A-5; revise appendices A, B, and C; add telecon memo to appendix E.

14a. Justification (mark one)

Criteria Change	[X]	Design Improvement	[]	Environmental	[]	Facility Deactivation	[]
As-Found	[]	Facilitate Const	[]	Const. Error/Omission	[]	Design Error/Omission	[]

14b. Justification Details

New waste retrieval rates (table A-5) resulted in recalculation of data in study.

15. Distribution (include name, MSIN, and no. of copies)

See distribution sheet

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ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): 636877

16. Design Verification Required	17. Cost Impact				18. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION		NA	
[] Yes	Additional	[] $	Additional	[] $	Improvement	[]
[X] No	Savings	[] $	Savings	[] $	Delay	[]

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
NA		

21. Approvals

Signature	Date	Signature	Date
Design Authority		Design Agent	
Cog. Eng. D L Becker	7-20-98	PE	
Cog. Mgr. R W ROOT	7/21/98	QA	
QA		Safety	
Safety		Design	
Environ.		Environ.	
Other		Other	
L B McDaniel	7/17/98		
S A Krieg	7/15/98		
		DEPARTMENT OF ENERGY	
		Signature or a Control Number that tracks the Approval Signature	
		ADDITIONAL	

AX Tank Farm Waste Retrieval Alternatives Cost Estimates

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U.S. Department of Energy Contract DE-AC06-96RL13200

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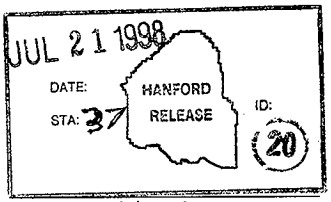
Key Words: Hanford Tanks Initiative, single-shell tanks, retrieval

Abstract: This report presents the estimated costs associated with retrieval of the wastes from the four tanks in AX Tank Farm. The engineering cost estimates developed for this report are based on previous cost data prepared for Project W-320 and the HTI 241-C-106 Heel Retrieval System. The costs presented in this report address only the retrieval of the wastes from the four AX Farm tanks. This includes costs for equipment procurement, fabrication, installation, and operation to retrieve the wastes. The costs to modify the existing plant equipment and systems to support the retrieval equipment are also included. The estimates do not include operational costs associated with pumping the waste out of the waste receiver tank (241-AY-102) between AX Farm retrieval campaigns or transportation, processing, and disposal of the retrieved waste.



Release Approval Date Release Stamp

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RECORD OF REVISION	(1) Document Number HNF-2693	Page 1

(2) Title
AX Tank Farm Waste Retrieval Alternatives Cost Estimates

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
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Revision 1

AX TANK FARM WASTE RETRIEVAL ALTERNATIVES COST ESTIMATES

July 1998

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

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ALC	Air lift circulator
BOP	Balance of Plant
CCTV	Closed-circuit television
D&D	Decontamination and decommissioning
DOE	U.S. Department of Energy
DST	Double-shell tank
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
FDNW	Fluor Daniel Northwest
HTI	Hanford Tanks Initiative
HVAC	Heating, ventilating, and air conditioning
LLCE	Long-length contaminated equipment
ORR	Operational Readiness Review
PHMC	Project Hanford Management Contractor
PNNL	Pacific Northwest National Laboratory
PPS	Past-Practice Sluicing
ROM	Rough order of magnitude
RPECA	Retrieval Performance Evaluation Criteria Alternatives
TWRS	Tank Waste Remediation System

AX TANK FARM WASTE RETRIEVAL ALTERNATIVES COST ESTIMATES

1.0 INTRODUCTION

1.1 BACKGROUND

In 1996, the U.S. Department of Energy (DOE) implemented a five-year demonstration project known as the Hanford Tanks Initiative (HTI). The scope of HTI is to: (1) demonstrate alternate retrieval technologies for tank waste; (2) retrieve hard-heel waste from tank 241-C-106 and assess compliance with retrieval performance evaluation criteria for that activity; (3) characterize residual waste in tank 241-AX-104 and assess compliance with retrieval performance criteria for that tank; and (4) develop retrieval performance evaluation criteria supporting readiness to close single-shell tanks (SSTs) in the future. The HTI mission is to minimize technical uncertainties and programmatic risks buy conducting demonstrations to characterize and remove tank waste using technologies and methods that will be needed in the future to carry out tank waste remediation and tank farm closure.

The HTI team is comprised of representatives from the Project Hanford Management Contractors (PHMC), Pacific Northwest National Laboratory (PNNL), and private consultants. The team is working closely with the Washington State Department of Ecology (Ecology), various northwest stakeholders, and native American tribes to identify and develop waste retrieval performance criteria for subsequent formulation of acceptable closure criteria and standards for tank farms.

1.2 PURPOSE AND SCOPE

The purpose of this task is to develop the estimated costs associated with retrieval of the wastes from the four tanks in AX Tank Farm. The *Waste Retrieval and Transfer Engineering Data Package for the Tank Waste Remediation System Environmental Impact Statement* (Fredenburg 1995) served as a basis for retrieval data in the Tank Waste Remediation System (TWRS) Environmental Impact Statement (EIS). The sluicing cost data in that document were developed from Project W-320. To evaluate the impacts of retrieval alternatives associated with the Retrieval Performance Evaluation Criteria Alternatives (RPECA), additional costing information needs to be developed.

The engineering cost estimates developed for this report are based on previous cost data prepared for Project W-320 and the HTI 241-C-106 Heel Retrieval System. The costs presented in this report address only the retrieval of the wastes from the four AX farm tanks. This includes costs for equipment procurement, fabrication, installation, and operation to

retrieve the wastes. The costs to modify the existing plant equipment and systems to support the retrieval equipment are also included. The estimates do not include operational costs associated with pumping the waste out of the waste receiver tank (241-AY-102) between AX Farm retrieval campaigns or transportation, processing, and disposal of the retrieved waste.

The overall AX Farm waste flow path is shown in Figure 1. Only the costs associated with the items under the "Retrieve AX Farm Waste" block are included in this study.

Water spray/salt-well pumping is currently under consideration as the baseline retrieval process for sound (non-leaking) SSTs containing salt cake, however the current baseline retrieval process is Past-Practice Sluicing (PPS). Evaluation of Salt Well pumping was not included in this study because 1) it is inconsistent with current baseline retrieval process and 2) it would be unable to retrieve tanks 241-AX-101 and 241-AX-103 down to a residual waste volume of 10.2 m^3 (360 $ft^{3)}$ due to the insolubles in the tanks. If salt well pumping were to become the baseline retrieval process and resulted in lower costs for retrieving the salt cake in 241-AX-101 and 241-AX-103, the cost reduction would apply only to the 102 m^3 (3,600 ft^3) residual waste retrieval level, since salt well pumping technology is incapable of retrieving down to 10.2 m^3 (360 ft^3) of residual waste.

2.0 SUMMARY

Cost estimates are presented for three levels of waste retrieval. These retrieval levels are 102 m^3 (3,600 ft^3), 10.2 m^3 (360 ft^3), and 1.0 m^3 (36 ft^3) of residual waste in each tank. The cost estimates are rough order of magnitude (ROM) estimates prepared by HTI engineers for comparative purposes in the evaluation of RPECA and are not for budgetary use. The estimated expense and capital costs , including escalation and contingency, for the three levels of waste retrieval are summarized in Table 1. Details of the estimates are included in Appendices A through D.

The data are also broken down by Decontamination and Decommissioning (D&D) costs, PHMC operating costs, PHMC operating worker-hours, and PHMC installation worker-hours. The summary of this data breakdown is shown in Table 2. Details of these cost and worker-hour breakdowns are included in Appendix D. The costs include both contingency and escalation. The worker-hours include contingency only.

Figure 1. AX Tank Farm Waste Process Flowchart.

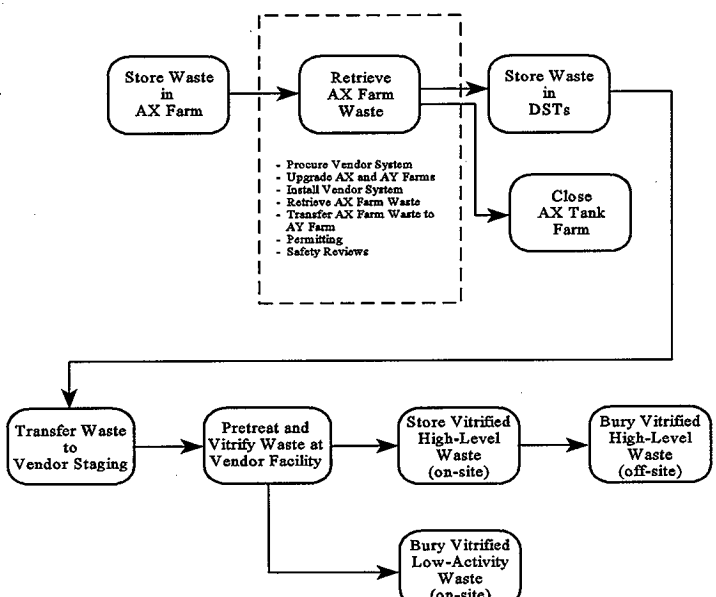

Table 1. Tank Waste Retrieval Cost Summary Estimate For AX Farm - K$.

	Task description	3,600 ft^3 (1)		360 ft^3 (1)		36 ft^3 (1)	
		EXP(2)	CAP(3)	EXP(2)	CAP(3)	EXP(2)	CAP(3)
1	LLCE removal of tank equipment	843	1,075	1,162	1,656	1,162	1,656
2	Purchase/install sluicing systems and equipment for tanks AX-101 and AX-103	18,446	4,000	18,446	4,000	18,446	4,000
3	Design/install control room for sluicers	109	95	109	95	109	95
4	Purchase and install vehicle retrieval system in AX-104	3,042	5,500	5,942	5,500	5,942	5,500
5	Design/fabricate/install HVAC system for tanks AX-101, 102, 103, and 104.	282	700	382	700	382	700
6	Design/install 2000 ft of 4 in. dia waste transfer lines.	455	455	490	490	490	490
7	Design/install new waste transfer jumper pit on west side of AX farm	284	50	284	50	284	50
8	Refurbish 11 pits in AX and AY farms	11,500	2,000	14,500	2,000	14,500	2,000
9	PHMC BOP modifications/installations	3,476	896	4,223	1,120	4,223	1,120
10	Safety & Permitting	1,393	NA	1,393	NA	1,393	NA
11	Sluicing Operational Costs	2,409	NA	2,470	NA	2,470	NA
12	Vehicle Operational Costs	592	NA	3,699	NA	10,871	NA
	SUB-TOTAL	42,831	14,771	53,100	15,611	60,272	15,611
	TOTAL	57,602		68,711		75,883	
	TOTAL WITH CONTINGENCY & ESCALATION	114,964		137,136		151,450	

BOP = Balance of Plant
HVAC = Heating, ventilating, and air conditioning
LLCE = Long-length contaminated equipment
PHMC = Project Hanford Management Contractor
[1]Cubic feet of residual waste
[2]Expense Costs
[3]Capital Costs.

Table 2. Estimated AY Farm Cost and Worker-Hour Breakdown (all 4 tanks).

	102 m^3 (3,600 ft^3)	10.2 m^3 (360 ft^3)	1.0 m^3 (36 ft^3)
PHMC operating cost	$5,449,000	$12,729,000	$18,553,000
PHMC operating worker-hours	38,619	66,760	128,726
PHMC installation worker-hours	241,970	325,528	325,528
D&D	$1,008,000	$1,184,000	$1,184,000

D&D = Decontamination and decommissioning
PHMC = Project Hanford Management Contractor.

A summary of the retrieval methods that are assumed to be used on each of the tanks for the three residual waste levels is shown in Table 3. Note that tanks 241-AX-102 and 241-AX-104 are assumed leakers and that the current waste inventory in 241-AX-104 is less than 102 m^3 (3,600 ft^3). The current waste volume inventories in the AX Farm tank are as follows:

241-AX-101 2,839,000 L (750,000 gal)
241-AX-102 124,900 L (33,000 gal)
241-AX-103 423,900 L (112,000 gal)
241-AX-104 26,495 L (7,000 gal).

Table 3. AX Farm Retrieval Methods.

Residual waste	241-AX-101	241-AX-102	241-AX-103	241-AX-04
102 m^3 (3,600 ft^3)	*PPS	Vehicle	*PPS	NA
10.2 m^3 (360 ft^3)	*PPS/Vehicle	Vehicle	*PPS/Vehicle	Vehicle
1.0 m^3 (36 ft^3)	*PPS/Vehicle	Vehicle	*PPS/Vehicle	Vehicle

NA = Not applicable
*Past-Practice Sluicing (PPS) includes two sluicers in each tank.

3.0 RETRIEVAL SYSTEMS DESCRIPTIONS

An updated PPS system is employed by project W320 as the method to remove the majority of the high-heat waste from tank 241-C-106. For AX Farm retrieval, the W-320 sluicing process is modified by using two sluicers in tanks 241-AX-101 and 241-AX-103.

This is made necessary by the air lift circulators (ALCs) that obstruct portions of the tanks from the sluicing jets and to improve the sluicing efficiency. Double-shell tank (DST) 241-AY-102 is the receiver tank for the waste retrieved from AX Farm. Only one of the sluicers will be in operation at any given time. Tank 241-AY-102 will be charged with about 1,514,000 L (400,000 gal) of water that will be recirculated to AX Farm at a rate of 1,135 L/min (300 gal/min) through new waste transfer lines.

The vehicle retrieval system is a "second generation" version of the 241-C-106 Heel Retrieval System. This system consists of a retrieval vehicle that is lowered into the tank through a riser and retrieves the waste with a sluicing head employing high pressure water jets to break up the waste. The system includes tools that can clean the sides of the tank, clean the internal and external ALC surfaces, and cut-off the thermocouple wells that protrude below the ALCs.

4.0 RISKS AND UNCERTAINTIES

There are considerable risks and uncertainties associated with assuming that the vehicle-based retrieval system is capable of retrieving waste to the required degree. It is unlikely that a volume of 1.0 m^3 (36 ft^3) of residual waste can be achieved with current technologies. The 1996 National Research Council report *Barriers To Science, Technical Management of the Department of Energy Environmental Remediation Program* (NRC 1996) contains the following statement regarding retrieval of Hanford tank wastes: "The committee has seen no analysis demonstrating that essentially complete waste removal is technically achievable or even advisable for all of many of the tanks." The statement remains as true today as it was two years ago. Operation of the Project W-320 sluicing system in tank 241-C-106 (scheduled to start in August 1998) and operation of the HTI 241-C-106 Heel Retrieval System vehicle (scheduled to start in October 1999) will provide factual data on the capabilities of these systems to retrieve waste from the Hanford SSTs. The data in this study should be reviewed and updated at the conclusion of those projects. Several of the more important risks/uncertainties related to this study are listed below:

1. **Technical Capability.** There are considerable risks in assuming that any currently available technology can retrieve waste to a level approaching 1.0 m^3 (36 ft^3). The effectiveness of the vehicle-based retrieval system has not yet been demonstrated in a Hanford waste tank and remains unknown. Further, there is considerable uncertainty that removal to these levels can be verified.

2. **Tank Obstructions.** There are also considerable uncertainties associated with the ability of the vehicle-based system to retrieve waste among the 22 ALCs that are in the AX Farm tanks. There is space for the vehicle to operate below the ALCs (after the thermocouple wells have been cut), but the umbilical management problems will be challenging.

3. **Air Lift Circulators.** The question of the ability of the vehicle to remove the waste from the interior of the 76-cm (30-in.) diameter ALCs (pipe) also remains unanswered and un-demonstrated. To achieve the 1.0 m^3 (36 ft^3) residual waste volume, essentially all of the waste will have to be removed from the interior and exterior surfaces of the ALCs.

4. **Water Limitations.** An additional risk associated with the estimates presented in this report is the uncertainty in assuming that the vehicle based retrieval system will be capable of reducing the waste inventory to 1.0 m^3 (36 ft^3) without using excess amounts of water in the retrieval process. Water addition limitations could be a barrier to achieving a final clean-out to 1.0 m^3 (36 ft^3) of waste.

5. **Operational Time.** Another uncertainty involves the assumed operating times required for the vehicle based system to clean out the tanks to the various residual waste levels. The assumed times (and associated retrieval rates) are based on engineering judgement, discussions with personnel familiar with the 241-C-106 heel retrieval task, and experience at the Gunite and Associated Tanks (GAAT) at Oak Ridge National Laboratory. Increased retrieval times would drive up the costs and the potential increase in cost could be dramatic for the 1.0 m^3 (36 ft^3) case.

6. **Salt Cake Sluicing.** Past sluicing experience at Hanford has been with sludge types of waste. The assumption that PPS will retrieve the large majority of the salt cake from tanks 241-AX-101 and 241-AX-103 is not backed up with actual experience. This lack of experience along with the limited knowledge of the present salt cake properties results in significant uncertainties in the ability of the sluicing system to perform satisfactorily.

5.0 ASSUMPTIONS

The assumptions listed below were adopted as the planning basis for the cost estimates developed in this report.

1. PPS will not be an acceptable retrieval process for tanks 241-AX-102 and 241-AX-104 because 1) they are classified as leakers and 2) the small volumes of waste in these tanks can be more cost effectively retrieved by a vehicle system.

2. PPS will be the process used to retrieve the waste from tanks 241-AX-101 and 241-AX-103 to 102 m^3 (3,600 ft^3) of residual waste.

3. The "next generation" vehicle-based HTI 241-C-106 Heel Retrieval System will be used to retrieve the wastes from tanks 241-AX-102 and 241-AX-104.

4. PPS will not be capable of retrieving tanks 241-AX-101 and 241-AX-103 to 10.2 m^3 (360 ft^3) or less of residual waste. There are 22 ALCs in each of the AX Farm tanks. These are 76-cm (30-in.) diameter pipes that "shadow" a significant portion of the tank volume from the sluicing jet and limit the amount of waste that can be retrieved without removal of the ALCs.

5. Retrieval to the 1.0 m^3 (36 ft^3) residual waste level will employ the same techniques as for the 10.2 m^3 (360 ft^3) level. The difference is the additional operating time required to accomplish the desired residual waste level.

6. Tank 241-AY-102 will be the receiver tank for all of the retrieved waste.

7. The W-320 slurry distributer in tank 241-AY-102 will be reused for AX Farm retrieval.

8. The W-320 Slurry pump in tank 241-AY-102 will be replaced with a new pump appropriately sized for retrieval of AX Farm (radiation damage will render the W-320 pump unusable).

9. A new above ground waste transfer pit will be required for flow diversion (using jumpers) from the AX Farm tanks.

10. Retrieval of tank 241-C-106 hard heel, by HTI, will successfully demonstrate the capability of the retrieval system to reach the 10.2 m^3 (360 ft^3) residual waste volume.

11. Waste transportation, processing, and disposal costs are part(s) of other work packages.

6.0 WASTE MEASUREMENT TECHNIQUES

There are two developed, practical technologies for obtaining volume measurements of the waste (see Appendix E telecon memo). These technologies include the use of surface measurement tools and subsequent calculation of the waste volume. The surface measurement methods are photogrammetry and video cameras. These provide topographical maps of the waste surface that results in conservative estimates the actual waste volume. Surface roughness of the waste, actual location of the tank walls and floor (relative to the waste surface), and waste adhering to the surfaces of the ALC all contribute to the inaccuracies of

the measurements. The best accuracy that can be expected from using these systems in the AX farm tanks is about 10.2 m^3 ± 5.1 m^3 (360 ft^3 ± 180 ft^3).

In summary, there is no practical system that can measure residual waste volumes down to 1.0 m^3 (36 ft^3). To illustrate the problem, a thin film of waste 0.013 cm (0.005 in.) thick evenly distributed over the interior surfaces of the tank walls and floor, and the ALCs results in 1.0 m^3 (36 ft^3) of residual waste.

A third system (Structured Light System) has the potential to measure residual waste volumes down to 5.1 m^3 ±2.6 m^3 (180 ft^3 ±90 ft^3), but requires development and repackaging for use in a AX farm tank. The Structured Light System could be used in conjunction with vehicle on-board sensors to improve the overall accuracy, but it would not approach 1.0 m^3 (36 ft^3). Typical vehicle on-board sensors include video cameras, magnetometers, and waste depth gages. Development of a structured light system is not currently funded.

7.0 REFERENCES

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APPENDIX A

COST ESTIMATE DETAILS FOR 102 m^3 (3,600 ft^3) RESIDUAL WASTE LEVEL

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APPENDIX A

102 m^3 (3,600 ft^3) COST DETAILS

Retrieval to 102 m^3 (3,600 ft^3) Residual Waste--Cost Summary. (2 Sheets)

	Task description	Cost
1	LLCE removal of tank equipment	1,918,000
2	Procurement and installation of sluicing systems and equipment for tanks 241-AX-101 and 241-AX-103	22,446,000
3	Design/fabricate/install control room (trailer) for sluicers	204,000
4	Purchase and install vehicle retrieval system in 241-AX-104	8,542,000
5	Design/fabricate/install HVAC system for tanks 241-AX-101, 102, and 103	982,000
6	Design/install approximately 610 m (2,000 ft) of 10-cm (4-in.) diameter waste transfer lines between 241-AY-102 and 241-AX-101, 102, and 103	910,000
7	Design/install new waste transfer jumper pit on west side of AX farm (Manderbach 1997a)	334,000
8	Decontaminate and clean out 9 pits in AX and AY farms based on W-320 experience.	13,500,000
9	PHMC BOP modifications/installations	4,372,000
10	Safety and Permitting	1,393,000
11	Sluicing Operational Costs	2,409,000
12	Vehicle Operational Costs	592,000
	TOTAL	57,602,000

BOP = Balance of Plant
CCTV = Closed-circuit television
HVAC = Heating, ventilating, and air conditioning
LLCE = Long-length contaminated equipment
PHMC = Project Hanford Management Contractor.

Contingency and escalation are assumed to be the same as used by Fluor Daniel Northwest (FDNW) in the preparation of the Project Design Concepts (May 1997). These are as follows:

Escalation is 5.3 percent for FY 1999 through FY 2006 (8 years) for a total escalation of 51.2 percent.

32 percent contingency

TOTAL RETRIEVAL COST $57,602,000 X 1.512 X 1.32 = $114,964,000

DB\3600-TBL

1. 102 m^3 (3,600 ft^3) Long-Length Contaminated Equipment Removal

There are 6 pieces of Long-Length Contaminated Equipment (LLCE) that will be removed from the tank pits in AX farm. These will be removed with the existing LLCE system and packaged for burial or disposal as required.

The estimated cost for the setup of the LLCE, removal of the item from the waste tank, packaging, and burial/storage is $418,000 for the initial item based on the slurry pump and sluicer removal estimates contained in Manderbach (1997a). Costs for subsequent items are $300,000 each accounting for lessons learned on the initial removal.

Tank 241-AY-102 slurry pump removal	$418,000
Tank 241-AX-101 pit 01A steam coil	$300,000
Tank 241-AX-101 pit 01B Sluicer	$300,000
Tank 241-AX-102 pit 02A Sluicer	$300,000
Tank 241-AX-102 pit 02B Pump	$300,000
Tank 241-AX-103 pit 03A Sluicer	$300,000
TOTAL (for 102 m^3 [3,600 ft^3] case)	$1,918,000

DB\3600LLCE

2. 102 m^3 (3,600 ft^3) Sluicing Equipment Fabricate/Installation Costs

The cost estimate for the design/fabrication and installation of sluicing systems on tanks 241-AX-101 and 241-AX-102 is based on the enhanced sluicing cost estimate for 241-C-106 prepared by FDNW for Job no. E20144 (file no. Z437SAE2) (summary sheet attached). The estimate was modified as detailed below to more accurately reflect the AX farm conditions.

The total projected cost estimate without escalation or contingency is $34,140,000 including site allocations. The following items were removed from the estimate as redundant or not applicable:

Regulatory compliance	1,281,000
Accident analysis	650,000
Pump pit 241-C-06A	2,303,000
Heel pit 241-C-06B	1,967,000
Sluice pit 241-C-06C	1,922,000
Enc'd pipe pump to heel pit	298,000
Enc'd pipe heel to sluice pit	223,000
Heel jet removal	618,000
Sluicer removal	594,000
Vendor perform retrieval	2,000,000
Vendor Demobilization	500,000
Ready tank for closure	2,500,000
SUB-TOTAL	14,856,000

The following items were added to the estimate to account for operation in two tanks:

Vendor equipment	2,000,000
Vendor equipment installation	1,162,000
SUB-TOTAL	3,162,000

TOTAL (34,140,000 + 3,162,000 - 14,856,000) = $22,446,000

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SORT	DESCRIPTION	ESCALATED TOTAL COST	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
DESH	DE&S HANFORD, INC.	820,000	30	250,000	1,070,000
FDNW	FLUOR DANIEL NORTHWEST	17,290,000	33	5,780,000	23,070,000
LMHC	LOCKHEED MARTIN HANFORD CORP.	1,080,000	30	320,000	1,400,000
NHI	NUMATEC HANFORD CORPORATION	9,270,000	33	3,100,000	12,370,000
	SUBTOTAL	28,460,000	33	9,450,000	37,910,000
SITE	SITE ALLOCATIONS	5,680,000	33	1,850,000	7,530,000
	ROUNDING	(40,000)			(40,000)
	TOTAL PROJECT COST (TPC)	34,140,000	33	11,300,000	45,400,000

TYPE OF ESTIMATE: ORDER OF MAGNITUDE 4/7/97	REMARKS: Subject to change.
FDNW LEAD ESTIMATOR: [signature] ESTIMATING MANAGER: [signature]	
PROJECT MANAGER: [signature] for M. Mascovich 4/8/97	
CLIENT	

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

3. 102 m^3 (3,600 ft^3) Sluicer Control Room

The estimated cost for the control room/lunch room is taken from the 1994 W-320 estimate (Job no. W-320/ER4319 page 23 attached). One control room for the sluicer systems used in tanks 241-AX-101 and 241-AX-103 is adequate. This control room would be located outside the tank farm boundaries.

The W-320 control room was not installed (a mobile office was modified) so the costs for the control room are not included in the later estimates.

From page 23 of the estimate (rounded) $204,000

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KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-320/ER4319
FILE NO. W320PBB7

** IEST - INTERACTIVE ESTIMATING **
TANK 241-C-106 SLUICING REVISION #1
40% PRELIMINARY ESTIMATE
DOE_R04 - COST CODE ACCOUNT SUMMARY

DATE 10/21/94 07:56:21
BY GDC/JPM/DKH/CDL/KDE

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
3490	AY EQUIPMENT	7860	0	7860	0.00	0	7860	20	1572	9432
3510	HYDRAULIC TRAILER/STRONGBACK	493220	0	493220	0.00	0	493220	1	6438	499658
3560	CENRTIC FABRICATION	660184	0	660184	0.00	0	660184	2	14198	674382
4212	CNTRL RM INSTR. INSTALLATION	713564	0	713564	1.60	11417	724981	25	181246	906227
4221	TRANSFER LINE	1259047	271846	1530893	1.60	24495	1555387	25	388369	1943757
4222	SERVICE BLDG.	6403	1306	7709	1.61	124	7833	20	1567	9399
4223	CONTROL RM/LUNCH RM	204417	41701	246118	1.60	3938	250056	20	50011	300067
4313	CORE DRILLS	499806	0	499806	3.61	18043	517849	28	144076	661925
4314	PIT SLEEVE/EMBEDS	102622	0	102622	3.61	3704	106326	30	31898	138225
4315	JUMPERS	372617	0	372617	3.61	13451	386068	30	115821	501889
4322	ENCASED PIPING INSTALLATION	254481	0	254481	3.61	9187	263668	30	79100	342769
4324	C- FARM INSTRUMENT AIR & VENT	39131	0	39131	3.61	1412	40543	30	12163	52706
4330	C-FARM ELECTRICAL	869740	0	869740	3.61	31397	901137	20	180227	1081365
4341	MASF MOCK-UP	247311	0	247311	3.61	8928	256239	20	51248	307487
4343	SLUICING EQUIP.	512504	0	512504	3.61	18501	531005	30	159302	690307
4351	CHILLER SKID	40418	0	40418	3.61	1459	41877	30	12563	54440
4352	PROCESS SKID	237120	0	237120	3.61	8560	245680	22	53764	299446
4353	EXHAUST SYSTEM	4549	0	4549	3.61	164	4713	30	1414	6127
4354	FOG SUPRESSION SYS	54897	0	54897	3.61	1981	56878	25	14221	71099
4356	DIRECTED AIR SYSTEM	13308	0	13308	3.61	481	13789	25	3447	17235
4357	EXISTING AIR INLET MOD'S	7917	0	7917	3.61	286	8203	25	2051	10254
4411	MISC PADS	218925	0	218925	3.89	8516	227441	25	56924	284364
4412	MISC. INSTRUMENTATION	134525	0	134525	3.89	5233	139758	30	41927	181685
4413	PIT SLEEVE/ EMBEDS	35161	0	35161	3.89	1368	36529	30	10959	47488
4414	JUMPERS	248235	0	248235	3.89	9657	257892	30	77368	335259
4416	PIT BACKFILL	711	0	711	3.94	28	739	30	222	960
4421	EXCAVATION - PIPING	8459	0	8459	3.89	329	8788	30	2637	11425
4422	ENCASED PIPING INSTALLATION	48398	0	48398	3.89	1883	50281	30	15084	65365
4423	BACKFILL PIPING	2339	0	2339	3.89	91	2430	30	729	3159
4430	AY-FARM ELECTRICAL	366957	0	366957	3.89	14274	381231	20	76247	457479
4509	HVAC SKID PROCUREMENT	857899	0	857899	2.46	21104	879003	20	175801	1054803
4510	SLUICING EQUIP.PROCUREMENT	1017615	0	1017615	2.46	25033	1042648	15	156398	1199046
4543	SLUICING EQUIPMENT C-106	2581207	0	2581207	2.46	63498	2644705	15	396706	3041410
4604	COLD TESTING	1505123	0	1505123	0.12	1749	1506872	10	155567	1662439
4605	FABRICATION/INSTALLATION	3307896	0	3307896	0.14	4597	3312493	11	376368	3688864
4606	GENERAL CONSTRUCTION SUPPORT-ERS	936509	0	936509	2.17	20322	956831	20	191366	1148197
4610	CONTAINER TRAILER FAB CTC	49598	0	49598	0.00	0	49598	10	4960	54558
4700	GENERAL CONSTRUCTION SUPPORT-SLUICE	384220	0	384220	2.17	8338	392558	20	78512	471069
4777	GENERAL & TECH. SERVICES-SLUICING	589588	0	589588	2.17	12795	602383	20	120477	722858
TOTAL 700	SPECIAL EQUIP/PROCESS SYSTEM	19783677	314853	20098530	1.77	356343	20454872	17	3576571	24031443

4. 102 m^3 (3,600 ft^3) Vehicle Retrieval System Costs

Vendor Costs

The vendor cost estimate is based on the two vendor systems currently being designed for the retrieval of the heel in tank 241-C-106. This also assumes that the same type of service contract will be used to procure the retrieval systems for the AX farm as is being used for the procurement of the 241-C-106 vehicle retrieval system.

Vendor supplied system/equipment

Design, fabrication, testing, and delivery of a vehicle based retrieval system ready to install in the AX farm (based on discussions with HTI 241-C-106 Heel Retrieval System Engineers). $5,500,000

Pre-operational work at AX farm

Operational Readiness Review (ORR), training, and acceptance testing based on 6-month duration. Three person vendor crew, four shifts, and four person home office support on one shift.

Labor (16 persons @ $75/hr for 24 weeks)	$1,152,000
Per diem (16 persons @ $80/day for 24 weeks)	$30,700

Warehouse and office rental in the Tri-Cities area.

Twelve month duration based on the use of one vehicle in 241-AX-102. $60,000

Sub-total	$6,700,000

PHMC Bid and Award

Based on HTI 241-C-106 Heel Retrieval System costs $200,000

PHMC Contract Management

Based on HTI 241-C-106 Heel Retrieval System costs $400,000

PHMC ORR/ATP

Based on HTI 241-C-106 Heel Retrieval System costs $400,000

Sub-total	$1,000,000

Installation Costs

The estimated cost to install a vehicle based retrieval system in 241-AX-104 is assumed to be the same as for Tank 241-C-106. The installation costs in 241-C-106 is from sheet 17 (attached) of the HTI baseline estimate. This does not include the costs to modify the farm/tank for acceptance of the vehicle system.

Sub-Total	$842,500
TOTAL	$8,542,000

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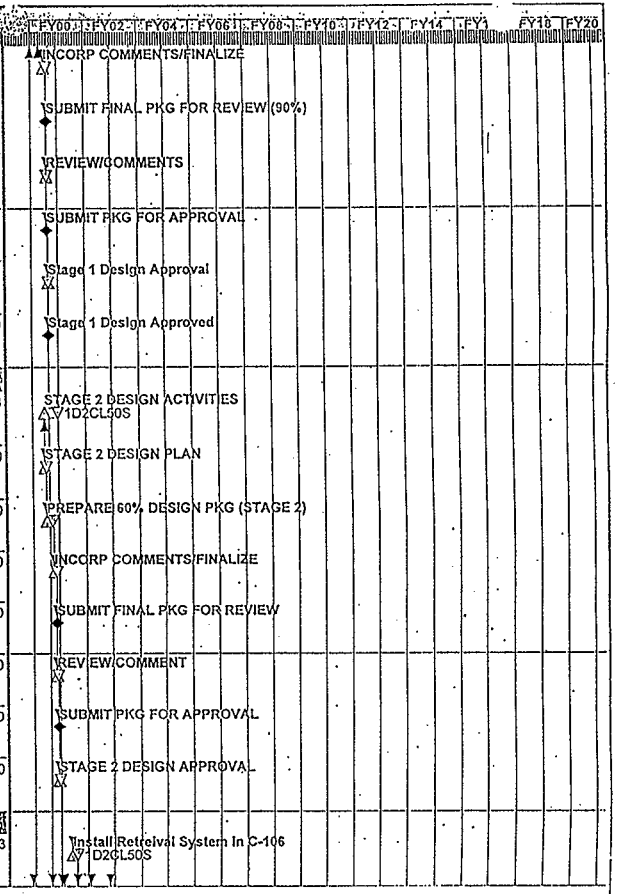
Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Budgeted Cost
R255OS0135	INCORP COMMENTS/FINALIZE	25	25	0	29MAR99	30APR99	0.00
R255OS0140	SUBMIT FINAL PKG FOR REVIEW (90%)	0	0	0		30APR99	0.00
R255OS0145	REVIEW/COMMENTS	10	10	0	03MAY99	14MAY99	0.00
R255OS0150	SUBMIT PKG FOR APPROVAL	0	0	0		14MAY99	0.00
R255OS0155	Stage 1 Design Approval	10	10	0	17MAY99	28MAY99	0.00
R255OS0160	Stage 1 Design Approved	0	0	0		28MAY99	0.00
1.1.3.1.02.05.05.03.01.02	Stage 2 Design						
R255OS0205	STAGE 2 DESIGN ACTIVITIES	130*	130*	0	11MAR99	14SEP99	1,315,718.08
R255OS0210	STAGE 2 DESIGN PLAN	20	20	0	11MAR99	07APR99	0.00
R255OS0215	PREPARE 60% DESIGN PKG (STAGE 2)	60	60	0	08APR99	01JUL99	0.00
R255OS0220	INCORP COMMENTS/FINALIZE	30	30	0	06JUL99	16AUG99	0.00
R255OS0225	SUBMIT FINAL PKG FOR REVIEW	0	0	0		16AUG99	0.00
R255OS0230	REVIEW/COMMENT	10	10	0	17AUG99	30AUG99	0.00
R255OS0235	SUBMIT PKG FOR APPROVAL	0	0	0		30AUG99	0.00
R255OS0240	STAGE 2 DESIGN APPROVAL	10	10	0	31AUG99	14SEP99	0.00
1.1.3.1.02.05.05.03.02	Construction						
R255OS0301	Install Retreival System In C-106	42	42	0	06MAR00	02MAY00	842,441.33



5. 102 m^3 (3,600 ft^3) HVAC System Design/Installation Costs

The estimate for a new AX farm HVAC system is based on the FDNW W-320 HVAC skid estimate contained in file no. W320PDA4, job no. W-320/P7448M (page 14 attached). Assume the AX farm HVAC is of the same magnitude and will cost the same. The increased cost of connecting to the 3 tanks in AX farm is offset by the reduced design costs associated with using the existing W-320 design.

AX Farm HVAC System	1 ea
TOTAL	$982,000

DB\3600HVAC

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
4509AB	PROCESS BUILDING PROCUREMENT	494446	0	494446	1.74	8603	503049	5	25152	528202
4509AC	CHILLER SKID PROCUREMENT	280231	0	280231	1.74	4876	285107	5	14255	299362
SUBTOTAL 4509	HVAC SKID PROCUREMENT	982030	0	982030	1.74	17087	999117	5	49955	1049073
4510AB	PURCHASE PUMP	1140475	0	1140475	1.74	19844	1160319	15	174048	1334367
4510AC	ELECTRICAL EQUIPMENT PROCUREMENT	629535	0	629535	1.73	10894	640429	15	95552	735981
SUBTOTAL 4510	SLUICING EQUIP.PROCUREMENT	1770010	0	1770010	1.74	30738	1800748	15	269600	2070348
454310	SLUICING EQUIPMENT C-106	804052	0	804052	1.74	13991	818043	25	204511	1022553
SUBTOTAL 4543	SLUICING EQUIPMENT C-106	804052	0	804052	1.74	13991	818043	25	204511	1022553
SUBTOTAL 45	EXPENSE PROCUREMENT	4113496	0	4113496	1.50	61816	4175312	13	553563	4728875
461500	PIT DECON - MOCK-UP	329246	0	329246	0.00	0	329246	30	98774	428020
461510	PIT DECON - C-106 FARM	520252	0	520252	0.00	0	520252	30	156076	676328
461520	PIT DECON - AY-102 FARM	527252	0	527252	0.00	0	527252	30	158176	685428
SUBTOTAL 4615	PIT DECON	1376750	0	1376750	0.00	0	1376750	30	413026	1789776
SUBTOTAL 46	PIT DECON	1376750	0	1376750	0.00	0	1376750	30	413026	1789776
470000	CONSTRUCTION SERVICES - CTD	62326	0	62326	0.00	0	62326	0	0	62326
470010	GENERAL CONSTRUCTION SUPPORT	762849	0	762849	2.35	17902	780751	18	140760	921510
SUBTOTAL 4700	CONSTRUCTION SERVICES	825175	0	825175	2.17	17902	843077	17	140760	983836
477700	EQUIPMENT USAGE	315813	0	315813	2.61	8243	324056	20	64811	388867
477710	MANAGEMENT SUPPORT FOR CONSTR	496445	0	496445	2.61	12957	509402	20	101880	611283
477720	CF SUPPORT	999967	0	999967	2.61	26099	1026066	20	205214	1231279
477730	QUALITY SUPPORT	161500	0	161500	2.61	4215	165715	20	33143	198858
SUBTOTAL 4777	GENERAL & TECH. SERVICES	1973725	0	1973725	2.61	51514	2025239	20	405048	2430287
SUBTOTAL 47	CONSTRUCTION SERVICES	2798900	0	2798900	2.48	69416	2868316	19	545808	3414123

6. 102 m^3 (3,600 ft^3) Waste Transfer Line

Description	Length
241-AY-102	
Pit 02A to new valve pit	76 m (250 ft)
Pit 02E to new valve pit	72 m (235 ft)
241-AX-101	
Pit 01A to new valve pit	67 m (220 ft)
Pit 01B to new valve pit	61 m (200 ft)
Pit 01D to new valve pit	56 m (185 ft)
241-AX-102	
Pit 02A to new valve pit	58 m (190 ft)
Pit 02B to new valve pit	50 m (165 ft)
241-AX-103	
Pit 03A to new valve pit	38 m (125 ft)
Pit 03C to new valve pit	41 m (135 ft)
Pit 03D to new valve pit	29 m (95 ft)
241-AX-104	
None Required for 3,600 case	--
Total line length	555 m (1,820 ft)
Cost	$910,000

Note 1: Fabrication and installation cost for the waste transfer line is $3,279/m ($1,000/ft) for a double line based on W-320 experience.

Note 2: Each pit above requires core drill and nozzle installation, i.e., 10 each for the 102 m^3 (3,600 ft^3) case.

\3600.LIN

7. 102 m^3 (3,600 ft^3) Pit Design/Installation Costs

The estimate for a new AX farm above grade transfer line (jumper) pit is based on the pit cover block fabrication and caisson/slab support for the manipulator arm costs contained in the *Cost Normalization Unit Estimates* (Manderbach 1997a). Assume same cover block costs and that the pit will cost the same as the manipulator slab.

Cover block	$102,000
Pit	$232,000
TOTAL	$334,000

DB\3600.PIT

8. 102 m^3 (3,600 ft^3) Pit Decontamination Costs

For the 102 m^3 (3,600 ft^3) case, 8 pits in AX farm and the pump pit at 241-AY-102 are used for the retrieval activities.

Discussed the condition and radiation levels in the pits with Dave Bragg in a Telecon 4/20/98 as summarized below.

Dave is not aware on any record of the activities that have been carried out in the last 15 years in the pits. Dave indicated that the pits probably haven't been opened in the last 15-20 years. Dave has no information on the pits as compared to the 241-C-106 pits that were decontaminated for Project W-320. Dave stated that John W. Bailey might have some recollection of the AX farm retrieval sluicing activities and that he would be a good source to try. John Bailey indicated that the pits in AX farm should be in better condition than those in C Farm (the drains should work).

For the purposed of preparing this estimate, will assume that the pits are in comparable condition to the 241-C-106 pits. From the FDNW estimate for the Vehicle Based Retrieval System, Job no. E20144 (file Z437SAF2), the allocated cost for decontamination of the pits is $1,500,000 each (page 7, item 7E-4 attached).

TOTAL	(9 pits)	$13,500,000

DB\3600.DCN

WBS 310 (ON SITE CONSTRUCTION) A CONTINGENCY OF 33% HAS BEEN APPLIED BECAUSE OF LIMITED INFORMATION AVAILABLE ON THE RADIATION LEVELS THAT WILL BE ENCOUNTERED DURING PIPE INSTALLATION, PIT MODIFICATIONS AND DECONTAMINATION, PIT MODIFICATIONS, AND UNDERGROUND OBSTRUCTIONS THAT MAY BE ENCOUNTERED DURING CONSTRUCTION. THE ENHANCED SLUICER COST IS BASED UPON VERBAL ALLOWANCES PROVIDED BY THE ENGINEER AND WITHOUT VENDOR INPUT.

6. ROUNDING

THE PROJECT COST SUMMARY REPORT IS SUMMARIZED AND ADJUSTED/ROUNDED AS FOLLOWS:
THE ESCALATED TOTAL COST COLUMN, CONTINGENCY TOTAL COLUMN AND TOTAL DOLLARS COLUMN SUB-TOTALS ARE SUMMARIZED BY CONTRACTOR. THE COLUMN SUBTOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $1,000/$10,000. THE PROJECT TOTAL SUMMARY LINE TOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $10,000/$100,000.

7. REMARKS

MAJOR ASSUMPTIONS WHICH HAVE BEEN MADE IN THE PREPARATION OF THIS ESTIMATE ARE AS FOLLOWS:

A.) THE TEMPORARY CHANGE ROOM TRAILER, MOBILE DRILL RIG AND ASSOCIATED EQUIPMENT, VACUUM TRUCK (GUZZLER), AND CRANES WILL BE FURNISHED TO THE PROJECT AT NO COST EXCEPT FOR THE SET UP COSTS.
B.) BURNOUT COSTS ARE NOT INCLUDED IN THIS COST ESTIMATE BY DIRECTION OF PHMC. IF BURNOUT IS ADDED ITS COST IS APPROXIMATELY $2.5M AND IS BASED UPON AN ASSUMED 10mr READING AT THE UPPER SECTION OF THE CASING AND 25mr AT THE LOWER SECTION OF THE CASING, (REF. C.C. MAIL). OTHER CONSTRUCTION WORK, INSIDE THE FARM FENCE, WAS ESTIMATED AS 10mr. RAD LEVELS ABOVE 25mr IS NOT ANTICIPATED.
C.) ALL CONTAMINATED SOIL WAS ASSUMED TO BE LOW RAD AND WAS ESTIMATED AS BACKFILL ONLY (BURIAL IN BARRELS NOT INCL.).
D.) THE TOTAL NUMBER OF DRAWINGS, BY DISCIPLINE, AND AN ALLOWANCE OF 150 MAN HOURS EOCH WAS PROVIDED BY ENGINEERING.
E.) ITEMS THAT ARE NOT INCLUDED IN THIS COST ESTIMATE:
1. FLAMMABLE GAS. IT IS ASSUMED THAT THIS WAS COVERED IN THE W-320 PROJECT.
2. CONTROL ROOM. THE CONTROL ROOM PROVIDED IN W-320 WILL BE USED.
3. AFTER OPERATIONS IS COMPLETE, THE EQUIPMENT WILL BE ABANDONED IN PLACE (EXCEPT ENHANCED SLUICER).
4. CLEANING, PAINTING AND OTHER SIMILAR MODIFICATIONS OF PITS. AN ALLOWANCE OF $1.5M (BASED UPON W-320 LESSONS LEARNED) PER PIT FOR DECONTAMINATION IS INCLUDED.
5. THE HVAC SYSTEM THAT W-320 INSTALLED IS NOT MODIFIED AND IS NOT INCLUDED IN THIS COST ESTIMATE.
6. SPARE PARTS.
7. ADDITIONAL REMOTE CAMERAS AS THIS WAS INSTALLED BY W-320.
F.) PIPING ALLOWANCES ARE FOR NORMAL PIPING AND ARE NOT ASME, SECTION 3 (N-STAMPED).
G.) W-320 REPLACEMENT ITEMS FOR FAILED EQUIPMENT ARE AN ENGINEERING ALLOWANCE OF $300,000.
H.) EXISTING PIT CONDITIONS ARE UNKNOWN AND THE WASH DOWN ALLOWANCE OF 200MH IS ONLY AN ALLOWANCE. IT SHOULD BE NOTED THAT PROJECT W-320 EXPERIENCED HIGHER MANHOURS DUE TO POOR PIT CONDITIONS.
I.) AN ALLOWANCE OF APPROXIMATELY $.5M (BASED ON W-320 LESSONS LEARNED) PER PIT FOR DECONTAMINATION IS INCLUDED.
J.) ESCALATION IS BASED ON A MIDPOINT OF ALL STAGES OF CONSTRUCTION (4-1-99).

9. 102 m^3 (3.600 ft^3) BOP Mods/Installation

The unit costs used in this section were taken from the FDNW *Cost Normalization Unit Estimates* (Manderbach 1997a).

Waste Transfer Line Jumpers

Six jumpers will be required in the new transfer pit to route the six lines coming from the 3 tanks (241-AX-101, 241-AX-102, and 241-AX-103).

Eight jumpers will be required for the pits in AX farm and two required at 241-AY-102.

TOTAL JUMPERS REQUIRED 16 @ $56,000 ea

TOTAL COST $896,000

Cover Block Removal

Remove the cover blocks from the eight pits in AX farm (3 on each tank)

Remove/replace the cover blocks from the pump pit on 241-AY-102 for replacement of the pump due to radiation damage and the sluice pit for core drilling.

TOTAL COVER BLOCKS REMOVED 10 @ $77,300 ea

TOTAL COST $773,000

Cover Block Fabrication

Fabricate and install new cover blocks for the eight pits in AX farm (3 each on 241-AX-101, 241-AX-103, and 2 each on 241-AX-102).

TOTAL COVER BLOCKS FABRICATED 8 @ $102,500 ea

TOTAL COST $820,000

Cover Block Disposal

Dispose of the eight cover blocks removed from the pits in AX farm (3 on each tank).

TOTAL COVER BLOCKS DISPOSED 8 @ $54,800 ea

TOTAL COST $438,000

Greenhouse Setup/Teardown

Setup and teardown of greenhouses and shield walls on the eight pits in AX farm and two pits at 241-AY-102.

TOTAL GREENHOUSE SETUP/TEARDOWN 10 @ $79,400 ea

TOTAL COST $794,000

Pit Core Drill

Core drill the 8 pits in AX farm and two pits at 241-AY-102 for the waste transfer lines.

TOTAL CORE DRILLS 10 @ $29,200 ea

TOTAL COST $292,000

Concrete Pads

Install concrete mounting pads at the 3 AX farm tanks. Assume 9.3 m^2 (100 ft^2) total at each tank.

TOTAL CONCRETE PADS 27.9 m^2 @ $860 m^2 (300 ft^2 @ $79 ft^2)

TOTAL COST $24,000

CCTV Installation/Removal

Install CCTV units in the three AX farm tanks.

TOTAL CCTV INSTALLATIONS 3 @ $52,000 ea

TOTAL COST $156,000

241-AY-102 Pump Replacement

Replace the supernate pump in 241-AY-102 (due to radiation damage). The cover block removal, pump removal, and greenhouse setup/teardown are covered in the previous items. Assume pump disposal cost are comparable to cover block disposal costs from Manderbach (1997a).

241-AY-102 PUMP INSTALLATION	1 each @ $125,000
241-AY-102 PUMP DISPOSAL	1 each @ $54,800
TOTAL COST	$179,000

TOTAL PHMC BOP COSTS $4,372,000

\3600BOP

10. 102 m^3 (3,600 ft^3) Safety and Permitting Costs

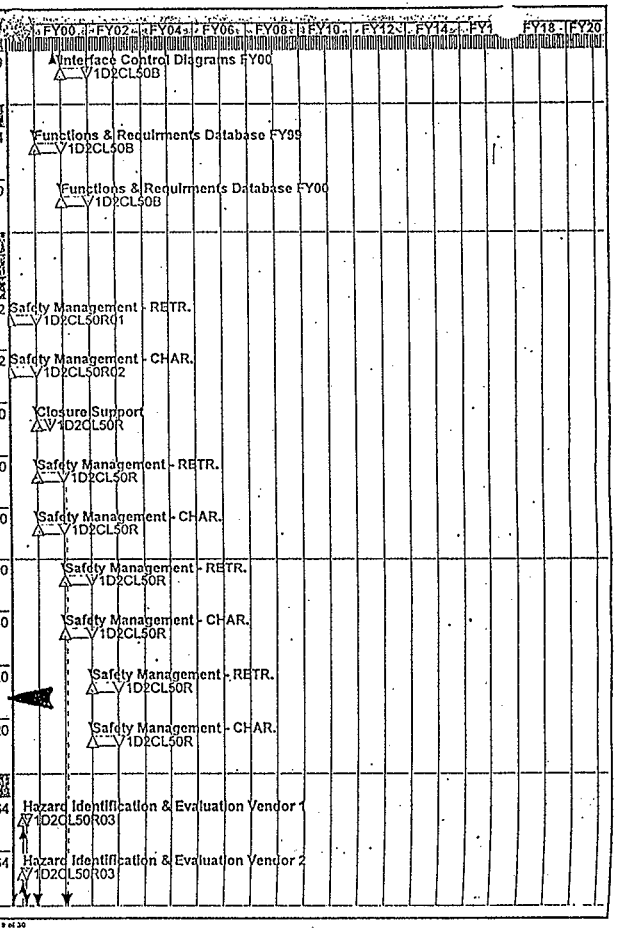
The estimates for the safety and permitting costs are based on the HTI heel retrieval baseline estimate (pages 9, 10, 11 attached). The AX farm retrieval safety efforts are considered to be approximately double those of the baseline estimate. Additionally, $750,000 is included for Basis of Interim Operation (BIO) amendment activities. The estimate is also based on a 3-year project duration.

Safety	
Management (assuming 3-year duration)	180,000
USQ	15,000
HI&E	48,000
Safety Equipment Lists	52,000
BIO amendment	750,000
SUB TOTAL	$1,045,000
Permitting	
Management	90,000
NEPA supplement analysis	N/A
Air Permits (NOC) $43k ea tank	129,000
Air Permits (NOC) $43k ea for the pits at each tank	129,000
SUB TOTAL	348,000
TOTAL	$1,393,000

BIO = Basis of Interim Operation
HI&E = Hazard identification and evaluation
NEPA = National Environmental Policy Act
NOC = Notice of Construction
USQ = Unreviewed Safety Question.

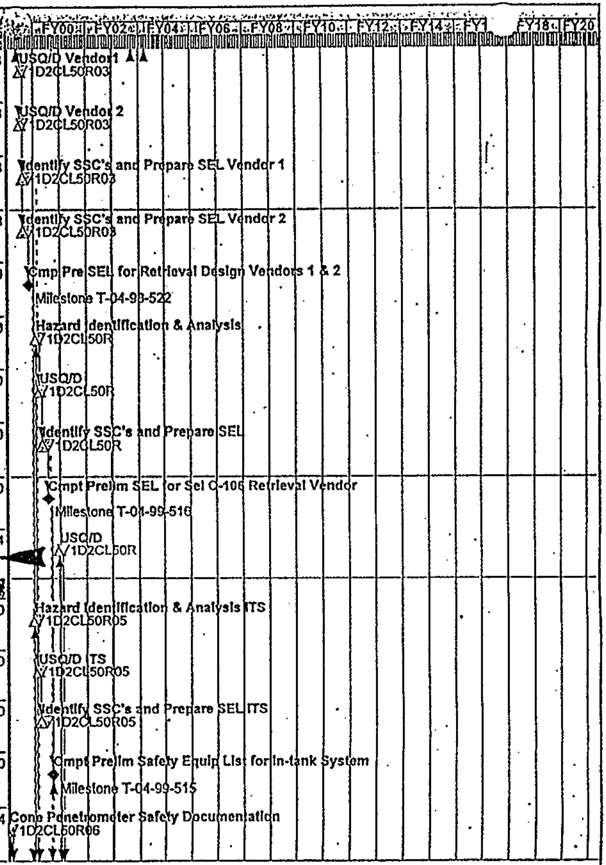
DB\3600.SAF

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Budgeted Cost
R255OB0250	Interface Control Diagrams FY00	251	251	0	01OCT99	29SEP00	119,394.59
1.1.3.1.02.05.02.03 F & R Database							
R255OB0345	Functions & Requirments Database FY99	251	251	0	01OCT98	30SEP99	121,909.34
R255OB0350	Functions & Requirments Database FY00	251	251	0	01OCT99	29SEP00	119,394.59
1.1.3.1.02.05.03 Safety / Permitting							
1.1.3.1.02.05.03.01 Safety							
1.1.3.1.02.05.03.01.01 Safety Oversight							
R255OR0115	Safety Management - RETR.	251	251	0	01OCT97	30SEP98	48,950.72
R255OR0120	Safety Management - CHAR.	251	251	0	01OCT97	30SEP98	48,950.72
R255OR0130	Closure Support	124	124	0	01OCT98	31MAR99	44,815.80
R255OR0135	Safety Management - RETR.	251	251	0	01OCT98	30SEP99	48,120.80
R255OR0140	Safety Management - CHAR.	251	251	0	01OCT98	30SEP99	48,120.80
R255OR0145	Safety Management - RETR.	251	251	0	01OCT99	29SEP00	46,737.60
R255OR0150	Safety Management - CHAR.	251	251	0	01OCT99	29SEP00	46,737.60
R255OR0155	Safety Management - RETR.	250	250	0	02OCT00	28SEP01	59,077.20
R255OR0160	Safety Management - CHAR.	250	250	0	02OCT00	28SEP01	59,077.20
1.1.3.1.02.05.03.01.02 Retrieval Safety							
R255OR0251	Hazard Identification & Evaluation Vendor 1	32	32	0	18FEB98	02APR98	23,494.64
R255OR0253	Hazard Identification & Evaluation Vendor 2	32	32	0	18FEB98	02APR98	23,494.64

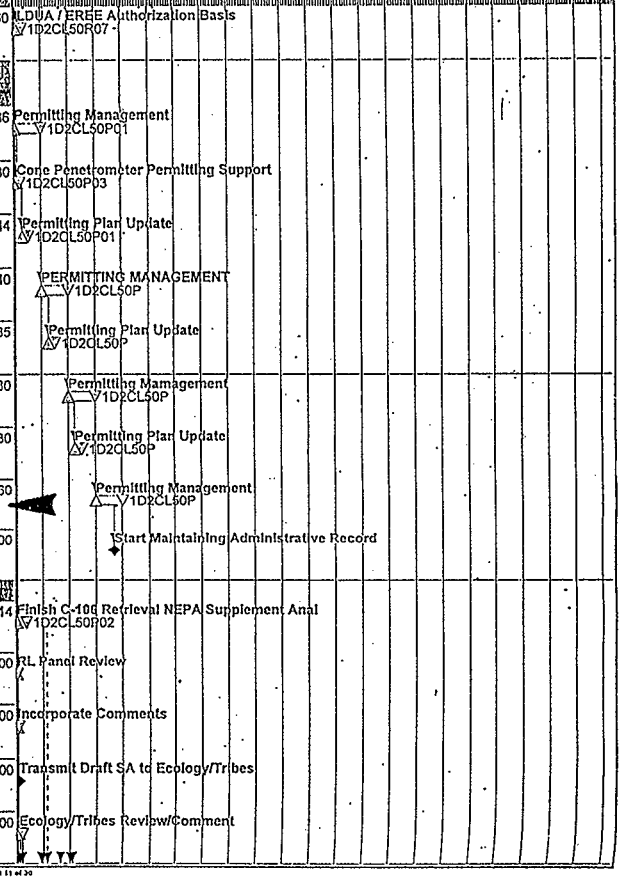


Sheet 9 of 30

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Budgeted Cost
R255OR0255	USQ/D Vendor1	20	20	0	03APR98	30APR98	7,530.88
R255OR0257	USQ/D Vendor 2	20	20	0	03APR98	30APR98	7,530.88
R255OR0259	Identify SSC's and Prepare SEL Vendor 1	60	60	0	01MAY98	28JUL98	26,029.68
R255OR0261	Identify SSC's and Prepare SEL Vendor 2	60	60	0	01MAY98	28JUL98	26,029.68
R255OR0262	Cmp Pre SEL for Retrieval Design Vendors 1 & 2	0	0	0		28JUL98	0.00
R255OR0263	Hazard Identification & Analysis	40	40	0	29OCT98	29DEC98	23,531.60
R255OR0265	USQ/D	20	20	0	30DEC98	27JAN99	7,403.20
R255OR0267	Identify SSC's and Prepare SEL	60	60	0	28JAN99	22APR99	25,382.40
R255OR0268	Cmpt Prelim SEL for Sel C-106 Retrieval Vendor	0	0	0		23APR99	0.00
R255OR0270	USQ/D	40	40	0	15SEP99	09NOV99	7,254.24
1.1.3.1.02.05.03.01.03 Characterization Safety [illegible]							
R255OR0360	Hazard Identification & Analysis ITS	40	40	0	01OCT98	25NOV98	22,474.00
R255OR0365	USQ/D ITS	20	20	0	30NOV98	29DEC98	6,874.40
R255OR0370	Identify SSC's and Prepare SEL ITS	60	60	0	30DEC98	25MAR99	23,796.00
R255OR0380	Cmpt Prelim Safety Equip List for In-tank System	0	0	0		15JUN99	0.00
R255OR0390	Cone Penetrometer Safety Documentation	26	26	0	01OCT97	05NOV97	10,589.24



Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Budgeted Cost
R255OR0400	LDUA / EREE Authorization Basis	40	40	0	17NOV97	16JAN98	15,405.60
1.1.3.1.02.05.03.02	Permitting						
1.1.3.1.02.05.03.02.01	Permitting Oversight						
R255OP0110	Permitting Management	251	251	0	01OCT97	30SEP98	24,475.36
R255OP0115	Cone Penetrometer Permitting Support	19	19	0	03NOV97	01DEC97	3,594.30
R255OP0120	Permitting Plan Update	62	62	0	02JAN98	31MAR98	14,459.44
R255OP0125	PERMITTING MANAGEMENT	251	251	0	01OCT98	30SEP99	24,060.40
R255OP0130	Permitting Plan Update	62	62	0	04JAN99	31MAR99	14,408.85
R255OP0135	Permitting Mamagement	251	251	0	01OCT99	29SEP00	23,368.80
R255OP0140	Permitting Plan Update	63	63	0	04JAN00	31MAR00	14,408.30
R255OP0145	Permitting Management	250	250	0	02OCT00	28SEP01	29,538.60
R255OP0150	Start Maintaining Administrative Record	0	0	0	13JUN01		0.00
1.1.3.1.02.05.03.02.02	Retrieval Permitting						
R255OP0225	Finish C-106 Retrieval NEPA Supplement Anal	94	94	0	01OCT97	17FEB98	18,063.14
R255OP0236	RL Panel Review	1	1	0	01OCT97	01OCT97	0.00
R255OP0237	Incorporate Comments	14	14	0	02OCT97	21OCT97	0.00
R255OP0238	Transmit Draft SA to Ecology/Tribes	0	0	0		21OCT97	0.00
R255OP0239	Ecology/Tribes Review/Comment	35	35	0	22OCT97	11DEC97	0.00



Sheet 11 of 30

11. 102 m^3 (3,600 ft^3) Sluicer Operational Costs

The estimate for operating the sluicer in tanks 241-AX-101 and 241-AX-103 is based on the data in tables A1 through A-5. Estimates are based on operating 7 days per week and 24 hours per day.

AX-101 Operational time 167.4 days (23.9 weeks)

AX-103 Operational time 54.6 days (7.8 weeks)

5 person crew X 4 shifts X 40 hrs/wk X 31.7 weeks X $95/hr

TOTAL $2,409,000

DB\3600.OPS

12. 102 m^3 (3,600 ft^3) Vehicle Operational Costs

For the 102 m^3 (3,600 ft^3) case, the vehicle is used only in 241-AX-102.

The estimate for operating the vehicle in tank 241-AX-102 is based on the data in tables A1 through A-5.

AX-102 Operational Time 0.4 days (0.06 weeks)

The vendor labor costs are based on a 3 man crew, 4 shifts, and a 4 man home office support for 0.06 weeks of retrieval time (the labor through the ORR is included with in the installation costs)

There are an additional 4 weeks of time required for the dismantling and removal of the retrieval system for a total of 8 weeks.

16 persons @$75/hr X 40 hrs/wk for 4.06 weeks	$195,000
Per diem (12 persons @ $80/day X 7 days/wk X 4,06 wk)	$ 27,000

PHMC labor costs are for a 6 man crew, four shifts, for the 4.06 weeks retrieval and dismantling time.

24 persons @ $95/hr X 40 hr/wk for 4.06 weeks	$370,000
TOTAL	$592,000

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CALCULATED WASTE RETRIEVAL TIMES FOR AX TANK FARM ARE BASED ON THE FOLLOWING INITIAL WASTE VOLUME INVENTORIES.

AX-101	750,000 gals.
AX-102	33,000 gals
AX-103	112,000 gals
AX-104	7,000 gals

The waste retrieval times are based on the rates shown in table A-5. The rates are based on the assumption that an offsite retrieval vendor will design, fabricate, and operate the vehicle retrieval system similar to the C-106 Heel retrieval system (PHMC personnel will operate the sluicing system). The retrieval rates are net rates and include maintenance downtime and operating efficiencies. The retrieval time is calculated assuming that the retrieval system is operated 24 hours per day, 7 days per week.

The vehicle system retrieval rates in table A-5 were developed in discussions with retrieval personnel working with the HTI C-106 Heel Retrieval vendor and are based on engineering judgement, vendor experience, and experience at the Savanna River "Gunnite and Associated Tanks" (GAAT) retrieval project. The Sluicing system retrieval times are based on past experience with sluicing the Single Shell Tanks in the 1960's and 1970's.

Table A-1. Retrieval Times for 241-AX-101 (Based on Table A-5).

Retrieval Method	Retrieved volume (gals)	Retrieval rate (gal/min)	Retrieval time (days)
Sluice	750,000 - 27,000	3.0	167.4
Sluice	27,000 - 17,000	2.5	2.8
Vehicle	17,000 - 2,700	0.5	19.9
Vehicle	2,700 - 2,100	0.5	0.8
Vehicle	2100 - 270	0.015	84.7

Table A-2. Retrieval Times for 241-AX-102 (Based on Table A-5).

Retrieval method	Retrieved volume (gals)	Retrieval rate (gal/min)	Retrieval time (days)
Vehicle	33,000 -27,000	10.0	0.4
Vehicle	27,000 - 17,000	6.5	1.1
Vehicle	17,000 - 2,700	0.5	19.9
Vehicle	2,700 - 2,100	0.5	0.8
Vehicle	2100 - 270	0.015	84.7

Table A-3. Retrieval Times for 241-AX-103 (Based on Table A-5).

Retrieval method	Retrieved volume (gals)	Retrieval rate (gal/min)	Retrieval time (days)
Sluice	112,000 - 27,000	3.0	54.6
Sluice	27,000 - 17,000	2.5	2.8
Vehicle	17,000 - 2,700	0.5	19.9
Vehicle	2,700 - 2,100	0.5	0.8
Vehicle	2100 - 270	0.015	84.7

Table A-4. Retrieval Times for 241-AX-104 (Based on Table A-5).

Retrieval method	Retrieved volume (gals)	Retrieval rate (gal/min)	Retrieval time (days)
Vehicle	7,000 - 2,700	0.5	6.0
Vehicle	2,700 - 2,100	0.5	0.8
Vehicle	2100 - 270	0.015	84.7

Table A-5. AX Farm Assumed Retrieval Rates.
(Gallons per minute)

Waste volume (gal)	Salt cake		Sludge	
	PPS	Vehicle	PPS	Vehicle
>27,000	3.0	10[1]	3.0	10[1]
27,000 to 17,000	2.5	6.5	2.5	6.5
17,000 TO 2700	0.25[2]	0.5	0.25[2]	0.5
2,700 to 2,100	0.0	0.5	0.0	0.5
2100 TO 270	0.0	0.015	0.0	0.015

[1]Vehicle used above 27,000 gal only on AX-102 (assumed leaker).

[2]For Past Practice Sluicing (PPS), the retrieval rate in the AX farm tanks drops to zero at 5000 gallons of residual waste due to the "shadow effect" of the air lift circulators and inefficiencies at low waste volumes.

[3]3600 ft^3 = 27,000 gal; 360 ft^3 = 2,700 gal; 36 ft^3 = 270 gal.

[4]Due to lack of experience with sluicing salt cake at Hanford, the rate of salt cake retrieval is assumed to be the same as for sludge.

[5]The residual sluicing heel achieved in the 1970's (using 3 sluicers) exceeded 10.2 m^3 (360 ft^3) in all four AX farm tanks.

APPENDIX B

COST ESTIMATE DETAILS FOR 10.2 m^3 (360 ft^3) RESIDUAL WASTE LEVELS

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APPENDIX B

10.2 m^3 (360 ft^3) COST DETAILS

Retrieval to 10.2 m^3 (360 ft^3) Residual Waste--Cost Summary. (2 Sheets)

	Task description	Cost
1	LLCE removal of tank equipment	2,818,000
2	Procurement and installation of sluicing systems and equipment for tanks 241-AX-101 and 241-AX-103	22,446,000
3	Design/fabricate/install control room for sluicers	204,000
4	Purchase vehicle retrieval system and install in all 4 AX farm tanks	11,442,000
5	Design/fabricate/install HVAC system for tanks 241-AX-101, 102, 103, and 104.	1,082,000
6	Design/install approximately 610 m (2,000 ft) of 10-cm (4-in. diameter waste transfer lines between 241-AY-102 and 241-AX-101, 102, 103, and 104	980,000
7	Design/install new waste transfer jumper pit on west side of AX farm	334,000
8	Decontaminate and clean out 11 pits in AX and AY farms based on W-320 experience.	16,500,000
9	PHMC BOP modifications/installations	5,343,000
10	Safety and Permitting	1,393,000
11	Sluicing Operational Costs	2,470,000
12	Vehicle Operational Costs	3,699,000
	TOTAL	68,711,000

BOP = Balance of plant
CCTV = Closed-Circuit Television
HVAC = Heating, ventilating, and air conditioning
LLCE = Long-Length Contaminated Equipment
PHMC = Project Hanford Management Contractor
TBD = To be determined.

Contingency and escalation are assumed to be the same as used by FDNW in the preparation of the Project Design Concepts (May 1997). These are as follows:

Escalation is 5.3 percent for FY 1999 through FY 2006 (8 years) for a total escalation of 51.2 percent

32 percent contingency

TOTAL RETRIEVAL COST $68,711,000 X 1.512 X 1.32

= $137,136,000

DB\360-TBL

1. 10.2 m^3 (360 ft^3) Long-Length Contaminated Equipment Removal

There are 6 pieces of Long-Length Contaminated Equipment (LLCE) that will be removed from the tank pits in AX farm. These will be removed with the existing LLCE system and packaged for burial or disposal as required.

The slurry pump in 241-AY-102 requires removal for replacement due to radiation damage.

In addition, one of the sluicers in 241-AX-101 and 241-AX-103 will need to be removed to provide access for the vehicle.

The estimated cost for the setup of the LLCE, removal of the item from the waste tank, packaging, and burial/storage is $418,000 for the initial item based on Manderbach (1997a). Costs for subsequent items are $300,000 each.

Tank 241-AY-102 slurry pump removal	$418.000
Tank 241-AX-101 pit 01A steam coil	$300,000
Tank 241-AX-101 pit 01B Sluicer	$300,000
Tank 241-AX-102 pit 02A Sluicer	$300,000
Tank 241-AX-102 pit 02B Pump	$300,000
Tank 241-AX-103 pit 03A Sluicer	$300,000
Tank 241-AX-104 pit 04A Sluicer	$300,000
Remove 241-AX-101 new sluicer for vehicle access	$300,000
Remove 241-AX-103 new sluicer for vehicle access	$300,000
TOTAL (for 10.2 m^3 [360 ft^3] case)	$2,818,000

DB\360LLCE

2. 10.2 m^3 (360 ft^3) Sluicing Equipment fabricate/installation costs

The cost estimate for the design/fabrication and installation of sluicing systems on tanks 241-AX-101 and 241-AX-102 is based on the enhanced sluicing cost estimate for 241-C-106 prepared by FDNW for Job no. E20144 (file no. Z437SAE2) (summary sheet attached). The estimate was modified as detailed below to more accurately reflect the AX farm conditions.

The Total projected cost estimate without escalation or contingency is $34,140,000 including site allocations. The following items were removed from the estimate as redundant or not applicable:

Regulatory compliance	1,281,000
Accident analysis	650,000
Pump pit 241-C-06A	2,303,000
Heel pit 241-C-06B	1,967,000
Sluice pit 241-C-06C	1,922,000
Enc'd pipe pump to heel pit	298,000
Enc'd pipe heel to sluice pit	223,000
Heel jet removal	618,000
Sluicer removal	594,000
Vendor perform retrieval	2,000,000
Vendor Demobilization	500,000
Ready tank for closure	2,500,000
SUB-TOTAL	14,856,000

The following items were added to the estimate to account for operation in two tanks:

Vendor equipment	2,000,000
Vendor equipment installation	1,162,000
SUB-TOTAL	3,162,000

TOTAL (34,140,000 + 3,162,000 - 14,856,000) = $22,446,000

DB\360.SLU

FLUOR DANIEL NORTHWEST, INC.
NUMATEC HANFORD CORPORATION
JOB NO. E20144
FILE NO. Z4375AE2

** IEST - INTERACTIVE ESTIMATING **
CONCEPT 1 - ENHANCED SLUICING
ORDER OF MAGNITUDE
PHMCR01 - PROJECT COST SUMMARY

PAGE 1 OF 20
DATE 04/07/97 17:51:46
BY TLH, JJH, RHO, CDL

SORT	DESCRIPTION	ESCALATED TOTAL COST	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
DESH	DE&S HANFORD, INC.	820,000	30	250,000	1,070,000
FDNW	FLUOR DANIEL NORTHWEST	17,290,000	33	5,780,000	23,070,000
LMHC	LOCKHEED MARTIN HANFORD CORP.	1,080,000	30	320,000	1,400,000
NHI	NUMATEC HANFORD CORPORATION	9,270,000	33	3,100,000	12,370,000
	SUBTOTAL	28,460,000	33	9,450,000	37,910,000
SITE	SITE ALLOCATIONS	5,680,000	33	1,850,000	7,530,000
	ROUNDING	(40,000)			(40,000)
	TOTAL PROJECT COST (TPC)	34,140,000	33	11,300,000	45,400,000

TYPE OF ESTIMATE: ORDER OF MAGNITUDE — 4/7/97	REMARKS: Subject to change.
FDNW LEAD ESTIMATOR: TW — ESTIMATING MANAGER: [signature]	
PROJECT MANAGER: [signature] for M. MASOCKACH — 4/8/97	
CLIENT	

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

3. 10.2 m^3 (360 ft^3) Sluicer Control Room

The estimated cost for the control room/lunch room is taken from the 1994 W-320 estimate (Job no. W-320/ER4319 page 23 attached). One control room for the systems used in tanks 241-AX-101 and 241-AX-103 is adequate. This control room would be located outside the tank farm boundaries.

The W-320 control room was not installed (a mobile office was modified) so the costs for the control room are not included in the later estimates.

From page 23 of the estimate (rounded) $204,000

DB\360.CNT

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-320/ER4319
FILE NO. W320PB07

** IEST - INTERACTIVE ESTIMATING **
TANK 241-C-106 SLUICING REVISION #1
40% PRELIMINARY ESTIMATE
DOE_R04 - COST CODE ACCOUNT SUMMARY

DATE 10/21/94 07:56:21
BY GDC/JPH/DKH/CDL/KDE

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
3490	AY EQUIPMENT	7860	0	7860	0.00	0	7860	20	1572	9432
3510	HYDRAULIC TRAILER/STRONGBACK	493220	0	493220	0.00	0	493220	1	6438	499658
3560	CENRTIC FABRICATION	660184	0	660184	0.00	0	660184	2	14198	674382
4212	CNTRL RM INSTR. INSTALLATION	713564	0	713564	1.60	11417	724981	25	181246	906227
4221	TRANSFER LINE	1259047	271846	1530893	1.60	24495	1555387	25	388369	1943757
4222	SERVICE BLDG.	6403	1306	7709	1.61	124	7833	20	1567	9399
4223	CONTROL RM/LUNCH RM	204417	41701	246118	1.60	3938	250056	20	50011	300067
4313	CORE DRILLS	499806	0	499806	3.61	18043	517849	28	144076	661925
4314	PIT SLEEVE/EMBEDS	102622	0	102622	3.61	3704	106326	30	31898	138225
4315	JUMPERS	372617	0	372617	3.61	13451	386068	30	115821	501889
4322	ENCASED PIPING INSTALLATION	254481	0	254481	3.61	9187	263668	30	79100	342769
4324	C- FARM INSTRUMENT AIR & VENT	39131	0	39131	3.61	1412	40543	30	12163	52706
4330	C-FARM ELECTRICAL	869740	0	869740	3.61	31397	901137	20	180227	1081365
4341	MASF MOCK-UP	247311	0	247311	3.61	8928	256239	20	51248	307487
4343	SLUICING EQUIP.	512504	0	512504	3.61	18501	531005	30	159302	690307
4351	CHILLER SKID	40418	0	40418	3.61	1459	41877	30	12563	54440
4352	PROCESS SKID	237120	0	237120	3.61	8560	245680	22	53764	299446
4353	EXHAUST SYSTEN	4549	0	4549	3.61	164	4713	30	1414	6127
4354	FOG SUPRESSION SYS	54897	0	54897	3.61	1981	56878	25	14221	71099
4356	DIRECTED AIR SYSTEN	13308	0	13308	3.61	481	13789	25	3447	17235
4357	EXISTING AIR INLET MOD'S	7917	0	7917	3.61	286	8203	25	2051	10254
4411	MISC PADS	218925	0	218925	3.89	8516	227441	25	56924	284364
4412	MISC. INSTRUMENTATION	134525	0	134525	3.89	5233	139758	30	41927	181685
4413	PIT SLEEVE/ EMBEDS	35161	0	35161	3.89	1368	36529	30	10959	47488
4414	JUMPERS	248235	0	248235	3.89	9657	257892	30	77368	335259
4416	PIT BACKFILL	711	0	711	3.94	28	739	30	222	960
4421	EXCAVATION - PIPING	8459	0	8459	3.89	329	8788	30	2637	11425
4422	ENCASED PIPING INSTALLATION	48398	0	48398	3.89	1883	50281	30	15084	65365
4423	BACKFILL PIPING	2339	0	2339	3.89	91	2430	30	729	3159
4430	AY-FARM ELECTRICAL	366957	0	366957	3.89	14274	381231	20	76247	457479
4509	HVAC SKID PROCUREMENT	857899	0	857899	2.46	21104	879003	20	175801	1054803
4510	SLUICING EQUIP.PROCUREMENT	1017615	0	1017615	2.46	25033	1042648	15	156398	1199046
4543	SLUICING EQUIPMENT C-106	2581207	0	2581207	2.46	63498	2644705	15	396706	3041410
4604	COLD TESTING	1505123	0	1505123	0.12	1749	1506872	10	155567	1662439
4605	FABRICATION/INSTALLATION	3307896	0	3307896	0.14	4597	3312493	11	376368	3688864
4606	GENERAL CONSTRUCTION SUPPORT-ERS	936509	0	936509	2.17	20322	956831	20	191366	1148197
4610	CONTAINER TRAILER FAB CTC	49598	0	49598	0.00	0	49598	10	4960	54558
4700	GENERAL CONSTRUCTION SUPPORT-SLUICE	384220	0	384220	2.17	8338	392558	20	78512	471069
4777	GENERAL & TECH. SERVICES-SLUICING	589588	0	589588	2.17	12795	602383	20	120477	722858
TOTAL 700	SPECIAL EQUIP/PROCESS SYSTEN	19783677	314853	20098530	1.77	356343	20454872	17	3576571	24031443

4. 10.2 m^3 (360 ft^3) Vehicle Retrieval System costs

Vendor Costs

The vendor cost estimate is based on the two vendor systems currently being designed for the retrieval of the heel in tank 241-C-106. This also assumes that the same type of service contract will be used to procure the retrieval systems for the AX farm as is being used for the procurement of the 241-C-106 vehicle retrieval system.

Vendor supplied system/equipment

Design, fabrication, testing, and delivery of a vehicle based retrieval system ready to install in the AX farm (based on discussions with HTI 241-C-106 Heel Retrieval System Engineers).

$5,500,000

Pre-operational work at AX farm

ORR, training, and acceptance testing based on 6 month duration. Three person vendor crew, four shifts, and four person home office support on one shift.

Labor (16 persons @ $75/hr for 24 weeks)	$1,152,000
Per diem (16 persons @ $80/day for 24 weeks)	$30,700

Warehouse and office rental in the Tri-Cities area.

Eighteen month duration based on the use of one vehicle that is moved tank to tank

$90,000

Sub-total	$6,772,000

PHMC Bid and Award

Based on HTI 241-C-106 Heel Retrieval System costs	$200,000

PHMC Contract Management

Based on HTI 241-C-106 Heel Retrieval System costs	$400,000

PHMC ORR/ATP

Based on HTI 241-C-106 Heel Retrieval System costs		$400,000
Three additional ATP/OTPs after vehicle moved		$300,000
	Sub-total	$1,300,000

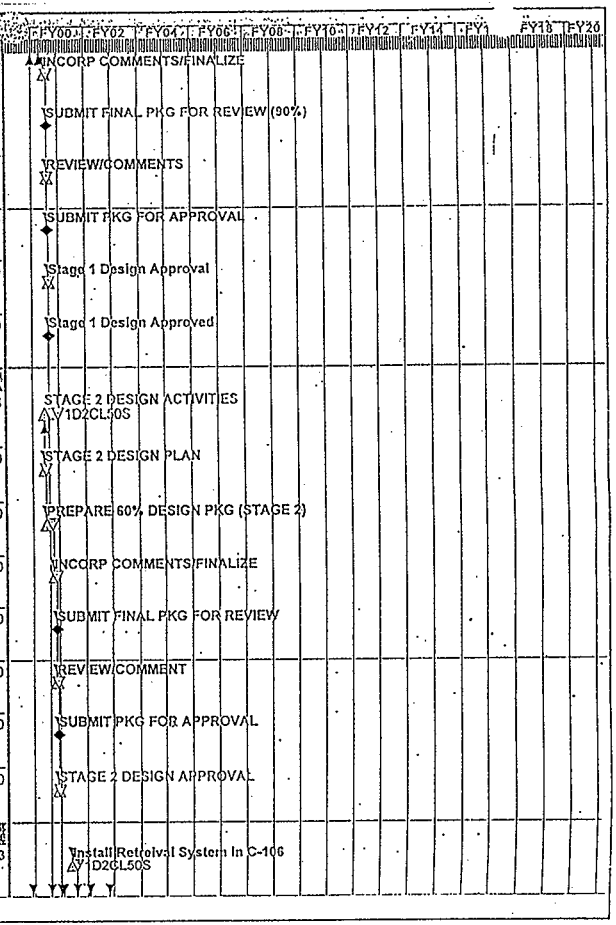
Installation Costs

The estimated cost to install a vehicle based retrieval system in 241-AX-101, 102.103, and. 104 is assumed to be the same as for tank 241-C-106. The installation costs in 241-C-106 is from sheet 17 (attached) of the HTI baseline estimate. This does not include the costs to modify the farm/tank for acceptance of the vehicle system.

	Four at	$842,500 each
	Sub-total	$3,370,000
	TOTAL	$11,442,000

DB\360.VEH

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Budgeted Cost
R255OS0135	INCORP COMMENTS/FINALIZE	25	25	0	29MAR99	30APR99	0.00
R255OS0140	SUBMIT FINAL PKG FOR REVIEW (90%)	0	0	0		30APR99	0.00
R255OS0145	REVIEW/COMMENTS	10	10	0	03MAY99	14MAY99	0.00
R255OS0150	SUBMIT PKG FOR APPROVAL	0	0	0		14MAY99	0.00
R255OS0155	Stage 1 Design Approval	10	10	0	17MAY99	28MAY99	0.00
R255OS0160	Stage 1 Design Approved	0	0	0		28MAY99	0.00
1.1.3.1.02.05.05.03.01.02	Stage 2 Design						
R255OS0205	STAGE 2 DESIGN ACTIVITIES	130*	130*	0	11MAR99	14SEP99	1,315,718.08
R255OS0210	STAGE 2 DESIGN PLAN	20	20	0	11MAR99	07APR99	0.00
R255OS0215	PREPARE 60% DESIGN PKG (STAGE 2)	60	60	0	08APR99	01JUL99	0.00
R255OS0220	INCORP COMMENTS/FINALIZE	30	30	0	06JUL99	16AUG99	0.00
R255OS0225	SUBMIT FINAL PKG FOR REVIEW	0	0	0		16AUG99	0.00
R255OS0230	REVIEW/COMMENT	10	10	0	17AUG99	30AUG99	0.00
R255OS0235	SUBMIT PKG FOR APPROVAL	0	0	0		30AUG99	0.00
R255OS0240	STAGE 2 DESIGN APPROVAL	10	10	0	31AUG99	14SEP99	0.00
1.1.3.1.02.05.05.03.02	Construction						
R255OS0301	Install Retreival System in C-106	42	42	0	06MAR00	02MAY00	842,441.33



5. 10.2 m^3 (360 ft^3) HVAC System Design/Installation Costs

The estimate for a new AX farm HVAC system is based on the FDNW W-320 HVAC skid estimate contained in file no. W320PDA4, job no. W-320/P7448M (page 14 attached). This is the same as for the 102 m^3 (3,600 ft^3) case with an additional $100,000 to connect the system to 241-AX-104.

AX Farm HVAC System for three tanks	$982,000
Additional cost to connect to 241-AX-104	$100,000
TOTAL	$1,082,000

DB\360HVAC

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-320/P7448H
FILE NO. W320PDA4

** IEST - INTERACTIVE ESTIMATING **
TANK 241-C-106 SLUICING
90% PRELIMINARY ESTIMATE
DOE_R02 - WORK BREAKDOWN STRUCTURE SUMMARY

DATE 07/25/95 15:11:06
BY KE/DH/JH/LR/CL/RO/KR

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
4509AD	PROCESS BUILDING PROCUREMENT	494446	0	494446	1.74	8603	503049	5	25152	528202
4509AC	CHILLER SKID PROCUREMENT	80231	0	280231	1.74	4876	285107	5	14255	299362
	SUBTOTAL 4509 HVAC SKID PROCUREMENT	[illegible]	0	982030	1.74	17087	999117	5	49955	1049073
4510AB	PURCHASE PUMP	1140475	0	1140475	1.74	19844	1160319	15	174048	1334367
4510AC	ELECTRICAL EQUIPMENT PROCUREMENT	629535	0	629535	1.73	10894	640429	15	95552	735981
	SUBTOTAL 4510 SLUICING EQUIP.PROCUREMENT	1770010	0	1770010	1.74	30738	1800748	15	269600	2070348
454310	SLUICING EQUIPMENT C-106	804052	0	804052	1.74	13991	818043	25	204511	1022553
	SUBTOTAL 4543 SLUICING EQUIPMENT C-106	804052	0	804052	1.74	13991	818043	25	204511	1022553
	SUBTOTAL 45 EXPENSE PROCUREMENT	4113496	0	4113496	1.50	61816	4175312	13	553563	4728875
461500	PIT DECON - HOOK-UP	329246	0	329246	0.00	0	329246	30	98774	428020
461510	PIT DECON - C-106 FARM	520252	0	520252	0.00	0	520252	30	156076	676328
461520	PIT DECON - AY-102 FARM	527252	0	527252	0.00	0	527252	30	158176	685428
	SUBTOTAL 4615 PIT DECON	1376750	0	1376750	0.00	0	1376750	30	413026	1789776
	SUBTOTAL 46 PIT DECON	1376750	0	1376750	0.00	0	1376750	30	413026	1789776
470000	CONSTRUCTION SERVICES - CTD	62326	0	62326	0.00	0	62326	0	0	62326
470010	GENERAL CONSTRUCTION SUPPORT	762849	0	762849	2.35	17902	780751	18	140760	921510
	SUBTOTAL 4700 CONSTRUCTION SERVICES	825175	0	825175	2.17	17902	843077	17	140760	983836
477700	EQUIPMENT USAGE	315813	0	315813	2.61	8243	324056	20	64811	388867
477710	MANAGEMENT SUPPORT FOR CONSTR	496445	0	496445	2.61	12957	509402	20	101880	611283
477720	CF SUPPORT	999967	0	999967	2.61	26099	1026066	20	205214	1231279
477730	QUALITY SUPPORT	161500	0	161500	2.61	4215	165715	20	33143	198858
	SUBTOTAL 4777 GENERAL & TECH. SERVICES	1973725	0	1973725	2.61	51514	2025239	20	405048	2430287
	SUBTOTAL 47 CONSTRUCTION SERVICES	2798900	0	2798900	2.48	69416	2868316	19	545808	3414123

6. 10.2 m^3 (360 ft^3) Waste Transfer Line

Description	Length
241-AY-102	
Pit 02A to new valve pit	76 m (250 ft)
Pit 02E to new valve pit	72 m (235 ft)
241-AX-101	
Pit 01A to new valve pit	67 m (220 ft)
Pit 01B to new valve pit	61 m (200 ft)
Pit 01D to new valve pit	56 m (185 ft)
241-AX-102	
Pit 02A to new valve pit	58 m (190 ft)
Pit 02B to new valve pit	50 m (165 ft)
241-AX-103	
Pit 03A to new valve pit	38 m (125 ft)
Pit 03C to new valve pit	41 m (135 ft)
Pit 03D to new valve pit	29 m (95 ft)
241-AX-104	
Pit 04A to new valve pit	__ m (90 ft)
Pit 04D to new valve pit	21 m (70 ft)
TOTAL LINE LENGTHS IN FEET	598 m (1,960 ft)
COST	$980,000

Note 1: Fabrication and installation cost for the waste transfer line is $3,279/m ($1,000/ft) for a double line.

Note 2: Each pit above requires core drill and nozzle installation, i.e., 12 each for the 10.2 m^3 (360 ft^3) case.

\360.LIN

7. 10.2 m^3 (360 ft^3) Pit Design/Installation Costs

The estimate for a new AX farm above grade transfer line (jumper) pit is based on the pit cover block fabrication and caisson/slab support for the manipulator arm costs contained in the *Cost Normalization Unit Estimates* (Manderbach 1997a). Assume same cover block costs and that the pit will cost the same as the manipulator slab.

Cover block	$102,000
Pit	$232,000
TOTAL	$334,000

DB\360.PIT

8. 10.2 m^3 (360 ft^3) Pit Decontamination Costs

For the 10.2 m^3 (360 ft^3) case, 10 pits in AX farm and the pump pit at 241-AY-102 are used for the retrieval activities.

Discussed the condition and radiation levels in the pits with Dave Bragg in a Telecon 4/20/98 as summarized below.

Dave is not aware on any record of the activities that have been carried out in the last 15 years in the pits. Dave indicated that the pits probably haven't been opened in the last 15-20 years. Dave has no information on the pits as compared to the 241-C-106 pits that were decontaminated for Project W-320. Dave stated that John W. Bailey might have some recollection of the AX farm retrieval sluicing activities and that he would be a good source to try. John Bailey indicated that the pits in AX farm should be in better condition that those in C Farm (the drains should work).

For the purposed of preparing this estimate, will assume that the pits are in comparable condition to the 241-C-106 pits. From the FDNW estimate for the Vehicle Based Retrieval System, Job no. E20144 (file Z437SAF2), the allocated cost for decontamination of the pits is $1,500,000 each (page 7, item 7E-4 attached).

TOTAL	(11 pits)	$16,500,000

DB\360.DCN

WDS.310 (ON SITE CONSTRUCTION) A CONTINGENCY OF 33% HAS BEEN APPLIED BECAUSE OF LIMITED INFORMATION AVAILABLE ON THE RADIATION LEVELS THAT WILL BE ENCOUNTERED DURING PIPE INSTALLATION, PIT MODIFICATIONS AND DECONTAMINATION, PIT MODIFICATIONS, AND UNDERGROUND OBSTRUCTIONS THAT MAY BE ENCOUNTERED DURING CONSTRUCTION. THE ENHANCED SLUICER COST IS BASED UPON VERBAL ALLOWANCES PROVIDED BY THE ENGINEER AND WITHOUT VENDOR INPUT.

6. ROUNDING

THE PROJECT COST SUMMARY REPORT IS SUMMARIZED AND ADJUSTED/ROUNDED AS FOLLOWS:
THE ESCALATED TOTAL COST COLUMN, CONTINGENCY TOTAL COLUMN AND TOTAL DOLLARS COLUMN SUB-TOTALS ARE SUMMARIZED BY CONTRACTOR. THE COLUMN SUBTOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $1,000/$10,000. THE PROJECT TOTAL SUMMARY LINE TOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $10,000/$100,000.

7. REMARKS

MAJOR ASSUMPTIONS WHICH HAVE BEEN MADE IN THE PREPARATION OF THIS ESTIMATE ARE AS FOLLOWS:

A.) THE TEMPORARY CHANGE ROOM TRAILER, MOBILE DRILL RIG AND ASSOCIATED EQUIPMENT, VACUUM TRUCK (GUZZLER), AND CRANES WILL BE FURNISHED TO THE PROJECT AT NO COST EXCEPT FOR THE SET UP COSTS.
B.) BURNOUT COSTS ARE NOT INCLUDED IN THIS COST ESTIMATE BY DIRECTION OF PHMC. IF BURNOUT IS ADDED ITS COST IS APPROXIMATELY $2.5M AND IS BASED UPON AN ASSUMED 10mr READING AT THE UPPER SECTION OF THE CASING AND 25mr AT THE LOWER SECTION OF THE CASING, (REF. C.C. MAIL). OTHER CONSTRUCTION WORK, INSIDE THE FARM FENCE, WAS ESTIMATED AS 10mr. RAD LEVELS ABOVE 25mr IS NOT ANTICIPATED.
C.) ALL CONTAMINATED SOIL WAS ASSUMED TO BE LOW RAD AND WAS ESTIMATED AS BACKFILL ONLY (BURIAL IN BARRELS NOT INCL.).
D.) THE TOTAL NUMBER OF DRAWINGS, BY DISCIPLINE, AND AN ALLOWANCE OF 150 MAN HOURS EQCH WAS PROVIDED BY ENGINEERING.
E.) ITEMS THAT ARE NOT INCLUDED IN THIS COST ESTIMATE:
    1. FLAMMABLE GAS. IT IS ASSUMED THAT THIS WAS COVERED IN THE W-320 PROJECT.
    2. CONTROL ROOM. THE CONTROL ROOM PROVIDED IN W-320 WILL BE USED.
    3. AFTER OPERATIONS IS COMPLETE, THE EQUIPMENT WILL BE ABANDONED IN PLACE (EXCEPT ENHANCED SLUICER).
    4. CLEANING, PAINTING AND OTHER SIMILAR MODIFICATIONS OF PITS. AN ALLOWANCE OF $1.5M (BASED UPON W-320 LESSONS LEARNED) PER PIT FOR DECONTAMINATION IS INCLUDED.
    5. THE HVAC SYSTEM THAT W-320 INSTALLED IS NOT MODIFIED AND IS NOT INCLUDED IN THIS COST ESTIMATE.
    6. SPARE PARTS.
    7. ADDITIONAL REMOTE CAMERAS AS THIS WAS INSTALLED BY W-320.
F.) PIPING ALLOWANCES ARE FOR NORMAL PIPING AND ARE NOT ASME, SECTION 3 (N-STAMPED).
G.) W-320 REPLACEMENT ITEMS FOR FAILED EQUIPMENT ARE AN ENGINEERING ALLOWANCE OF $300,000.
H.) EXISTING PIT CONDITIONS ARE UNKNOWN AND THE WASH DOWN ALLOWANCE OF 200MH IS ONLY AN ALLOWANCE. IT SHOULD BE NOTED THAT PROJECT W-320 EXPERIENCED HIGHER MANHOURS DUE TO POOR PIT CONDITIONS.
I.) AN ALLOWANCE OF APPROXIMATELY $.5M (BASED ON W-320 LESSONS LEARNED) PER PIT FOR DECONTAMINATION IS INCLUDED.
J.) ESCALATION IS BASED ON A MIDPOINT OF ALL STAGES OF CONSTRUCTION (4-1-99).

9. 10.2 m^3 (360 ft^3) BOP Mods/Installation

The unit costs used in this section were taken from the FDNW *Cost Normalization Unit Estimates* (Manderbach 1997a).

Waste Transfer Line Jumpers

Eight jumpers will be required in the new transfer pit to route the eight lines coming from the 4 tanks (241-AX-101, 241-AX-102, 241-AX-103, and 241-AX-104).

Ten jumpers will be required for the pits in AX farm and two required at 241-AY-102.

TOTAL JUMPERS REQUIRED 20 @ $56,000 ea

TOTAL COST $1,120,000

Cover Block Removal

Remove the cover blocks from the ten pits in AX farm (3 each on 241-AX-101 and 241-AX-103; 2 each on 241-AX-102 and 241-AX-104)

Remove/replace the cover blocks from the pump pit on 241-AY-102 for replacement of the pump due to radiation damage and the sluice pit for core drilling.

TOTAL COVER BLOCKS REMOVED 12 @ $77,300 ea

TOTAL COST $928,000

Cover Block Fabrication

Fabricate and install new cover blocks for the ten pits in AX farm (3 each on 241-AX-101, 241-AX-103, and 2 each on 241-AX-102, 241-AX-104).

TOTAL COVER BLOCKS FABRICATED 10 @ $102,500 ea

TOTAL COST $1,025,000

Cover Block Disposal

Dispose of the ten cover blocks removed from the pits in AX farm.

TOTAL COVER BLOCKS DISPOSED 10 @ $54,800 ea

TOTAL COST $548,000

Greenhouse Setup/Teardown

Setup and teardown of greenhouses and shield walls on the ten pits in AX farm and two pits at 241-AY-102.

TOTAL GREENHOUSE SETUP/TEARDOWN 12 @ $79,400 ea

TOTAL COST $953,000

Pit Core Drill

Core drill the 10 pits in AX farm and two pits at 241-AY-102 for the waste transfer lines.

TOTAL CORE DRILLS 12 @ $29,200 ea

TOTAL COST $350,000

Concrete Pads

Install concrete mounting pads at the 4 AX farm tanks. Assume 9.3 m^2 (100 ft^2) total at each tank.

TOTAL CONCRETE PADS 37.2 m^2 @ $850/$m^2$ (400 ft^2 @ $79 ft^2)

TOTAL COST $32,000

CCTV Installation/Removal

Install CCTV units in the four AX farm tanks.

TOTAL CCTV INSTALLATIONS 4 @ $52,000 ea

TOTAL COST $208,000

241-AY-102 Pump Replacement

Replace the supernate pump in 241-AY-102 (due to radiation damage). The cover block removal, pump removal, and greenhouse setup/teardown are covered in the previous items. Assume pump disposal cost are comparable to cover block disposal costs from Manderbach (1997a).

241-AY-102 PUMP INSTALLATION	1 each @ $125,000
241-AY-102 PUMP DISPOSAL	1 each @ $54,800
TOTAL COST	$179,000

TOTAL PHMC BOP Modifications/Installations $5,343,000

\360BOP

10. 10.2 m^3 (360 ft^3) Safety and Permitting Costs

The estimates for the safety and permitting costs are based on the HTI heel retrieval baseline estimate (pages 9, 10, 11 attached). The AX farm retrieval safety efforts are considered to be approximately double those of the baseline estimate. Additionally, $750,000 is included for USQ amendment activities. The estimate is also based on a 3-year project duration.

Safety

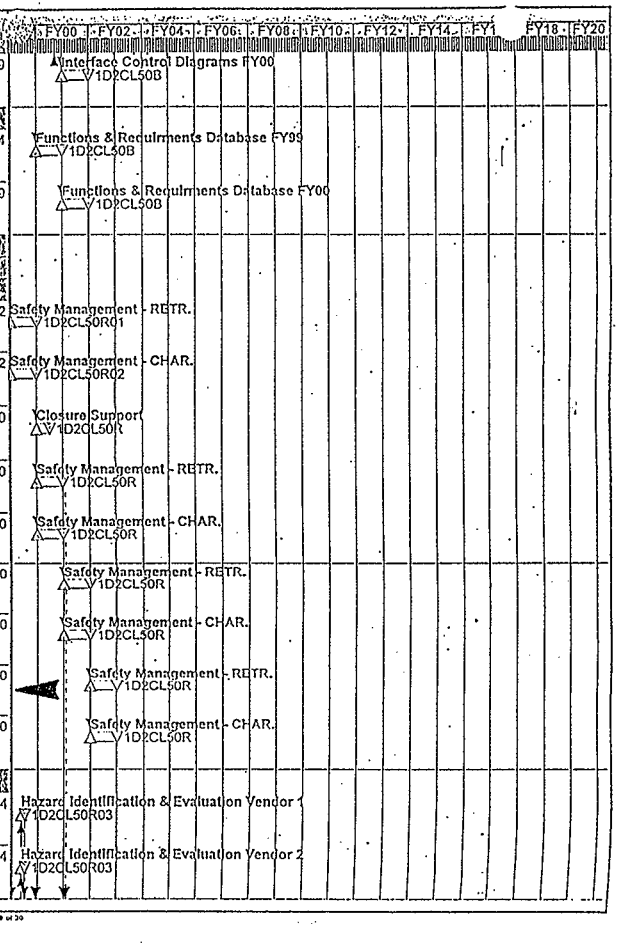
Management (assuming 3-year duration)	180,000
USQ	15,000
HI&E	48,000
Safety Equipment Lists	52,000
BIO amendment	750,000
Sub-total	$1,045,000

Permitting

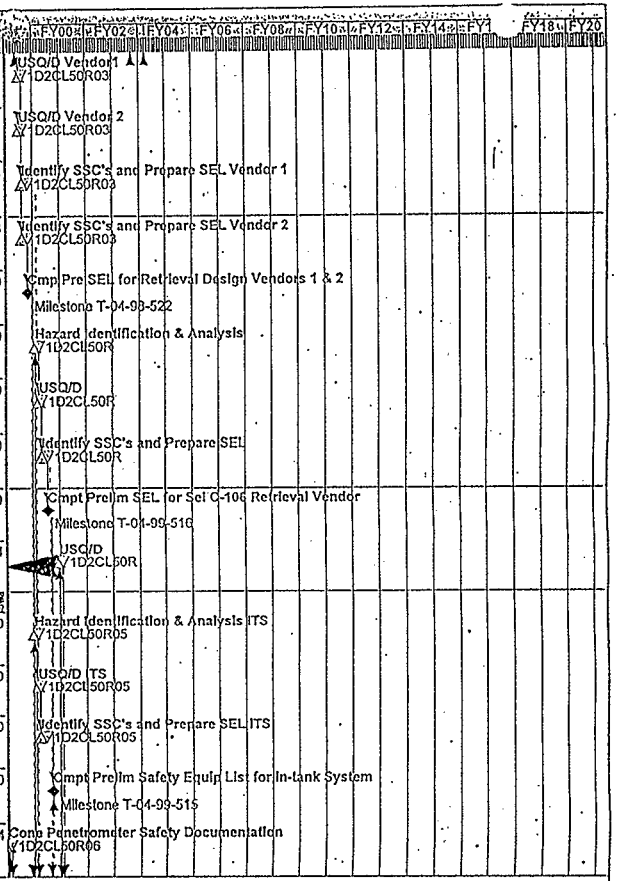
Management	90,000
NEPA supplement analysis	N/A
Air Permits (NOC) $43k ea tank	129,000
Air Permits (NOC) for the pits at each tank ($43k ea)	129,000
Sub-total	$ 348,000
TOTAL	$1,393,000

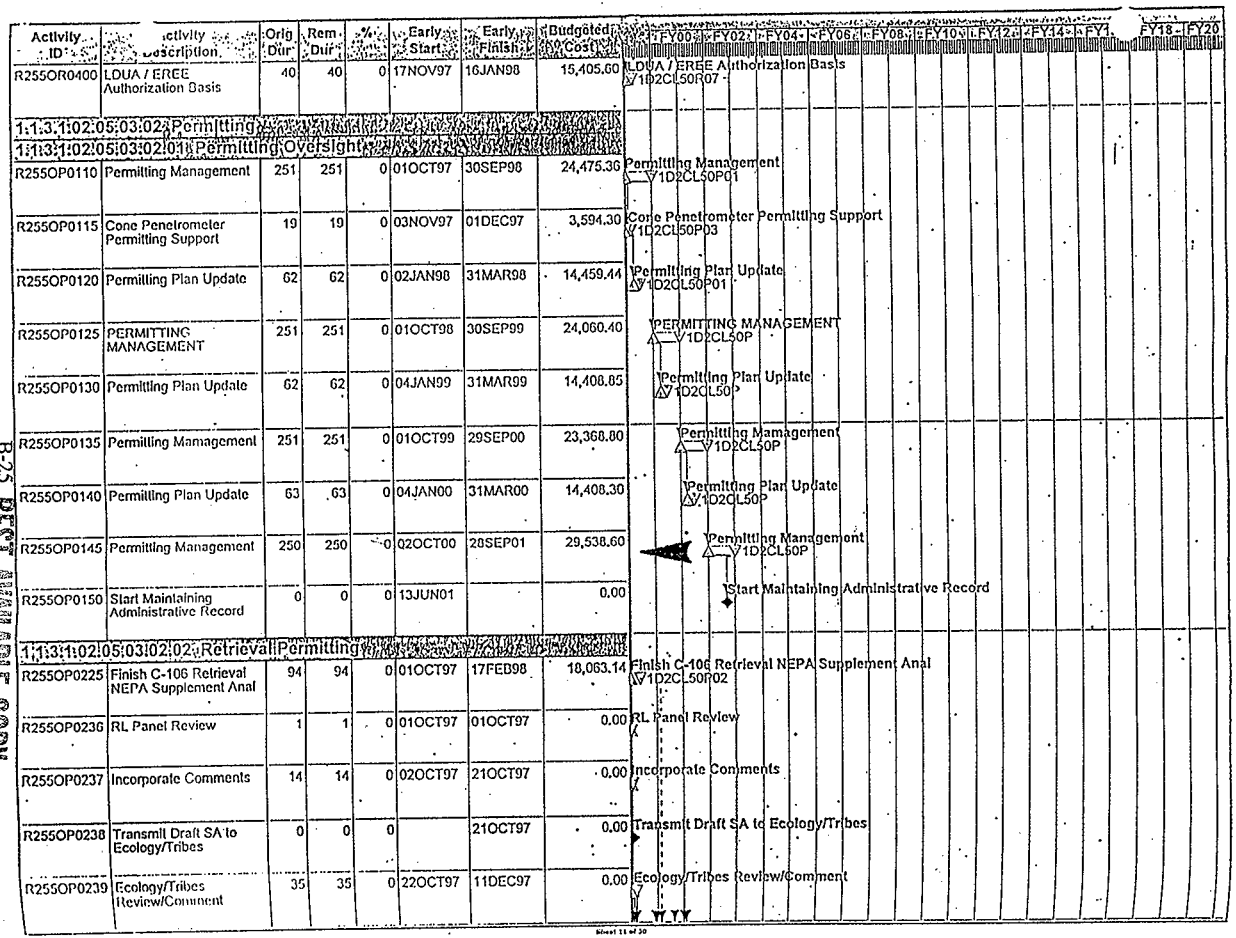
DB\360.SAF

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Budgeted Cost
R255OB0250	Interface Control Diagrams FY00	251	251	0	01OCT99	29SEP00	119,394.59
1.1.3.1.02.05.02.03 F & R Database							
R255OB0345	Functions & Requirments Database FY99	251	251	0	01OCT98	30SEP99	121,909.34
R255OB0350	Functions & Requirments Database FY00	251	251	0	01OCT99	29SEP00	119,394.59
1.1.3.1.02.05.03 Safety / Permitting							
1.1.3.1.02.05.03.01 Safety							
1.1.3.1.02.05.03.01.01 Safety Oversight							
R255OR0115	Safety Management - RETR.	251	251	0	01OCT97	30SEP98	48,950.72
R255OR0120	Safety Management - CHAR.	251	251	0	01OCT97	30SEP98	48,950.72
R255OR0130	Closure Support	124	124	0	01OCT98	31MAR99	44,815.80
R255OR0135	Safety Management - RETR.	251	251	0	01OCT98	30SEP99	48,120.80
R255OR0140	Safety Management - CHAR.	251	251	0	01OCT98	30SEP99	48,120.80
R255OR0145	Safety Management - RETR.	251	251	0	01OCT99	29SEP00	46,737.60
R255OR0150	Safety Management - CHAR.	251	251	0	01OCT99	29SEP00	46,737.60
R255OR0155	Safety Management - RETR.	250	250	0	02OCT00	28SEP01	59,077.20
R255OR0160	Safety Management - CHAR.	250	250	0	02OCT00	28SEP01	59,077.20
1.1.3.1.02.05.03.01.02 Retrieval Safety							
R255OR0251	Hazard Identification & Evaluation Vendor 1	32	32	0	18FEB98	02APR98	23,494.64
R255OR0253	Hazard Identification & Evaluation Vendor 2	32	32	0	18FEB98	02APR98	23,494.64



Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Budgeted Cost
R255OR0255	USQ/D Vendor1	20	20	0	03APR98	30APR98	7,530.88
R255OR0257	USQ/D Vendor 2	20	20	0	03APR98	30APR98	7,530.88
R255OR0259	Identify SSC's and Prepare SEL Vendor 1	60	60	0	01MAY98	28JUL98	26,029.68
R255OR0261	Identify SSC's and Prepare SEL Vendor 2	60	60	0	01MAY98	28JUL98	26,029.68
R255OR0262	Cmp Pre SEL for Retrieval Design Vendors 1 & 2	0	0	0		28JUL98	0.00
R255OR0263	Hazard Identification & Analysis	40	40	0	29OCT98	29DEC98	23,531.60
R255OR0265	USQ/D	20	20	0	30DEC98	27JAN99	7,403.20
R255OR0267	Identify SSC's and Prepare SEL	60	60	0	28JAN99	22APR99	25,382.40
R255OR0268	Cmpt Prelim SEL for Sel C-106 Retrieval Vendor	0	0	0		23APR99	0.00
R255OR0270	USQ/D	40	40	0	15SEP99	09NOV99	7,254.24
1.1.1.3.1.02.05.03.01.03	Characterization Safety						
R255OR0360	Hazard Identification & Analysis ITS	40	40	0	01OCT98	25NOV98	22,474.00
R255OR0365	USQ/D ITS	20	20	0	30NOV98	29DEC98	6,874.40
R255OR0370	Identify SSC's and Prepare SEL ITS	60	60	0	30DEC98	25MAR99	23,796.00
R255OR0380	Cmpt Prelim Safety Equip List for In-tank System	0	0	0		15JUN99	0.00
R255OR0390	Cone Penetrometer Safety Documentation	26	26	0	01OCT97	05NOV97	10,589.24





Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Budgeted Cost
R255OR0400	LDUA / EREE Authorization Basis	40	40	0	17NOV97	16JAN98	15,405.60
1.1.3.1.02.05.03.02	Permitting						
1.1.3.1.02.05.03.02.01	Permitting Oversight						
R255OP0110	Permitting Management	251	251	0	01OCT97	30SEP98	24,475.36
R255OP0115	Cone Penetrometer Permitting Support	19	19	0	03NOV97	01DEC97	3,594.30
R255OP0120	Permitting Plan Update	62	62	0	02JAN98	31MAR98	14,459.44
R255OP0125	PERMITTING MANAGEMENT	251	251	0	01OCT98	30SEP99	24,060.40
R255OP0130	Permitting Plan Update	62	62	0	04JAN99	31MAR99	14,408.85
R255OP0135	Permitting Management	251	251	0	01OCT99	29SEP00	23,368.80
R255OP0140	Permitting Plan Update	63	63	0	04JAN00	31MAR00	14,408.30
R255OP0145	Permitting Management	250	250	0	02OCT00	28SEP01	29,538.60
R255OP0150	Start Maintaining Administrative Record	0	0	0	13JUN01		0.00
1.1.3.1.02.05.03.02.02	Retrieval Permitting						
R255OP0225	Finish C-106 Retrieval NEPA Supplement Anal	94	94	0	01OCT97	17FEB98	18,063.14
R255OP0236	RL Panel Review	1	1	0	01OCT97	01OCT97	0.00
R255OP0237	Incorporate Comments	14	14	0	02OCT97	21OCT97	0.00
R255OP0238	Transmit Draft SA to Ecology/Tribes	0	0	0		21OCT97	0.00
R255OP0239	Ecology/Tribes Review/Comment	35	35	0	22OCT97	11DEC97	0.00

Sheet 11 of 30

11. 10.2 m^3 (360 ft^3) Sluicer Operational Costs

The estimate for operating the sluicer in tanks 241-AX-101 and 241-AX-103 is based on the data in tables A-1 through A-5. Estimates are based on operating 7 days per week and 24 hours per day.

AX-101 Operational time 170.2 days (24.3 wks)

AX-103 Operational time 57.4 days (8.2 wks)

5 person crew X 4 shifts X 40 hrs/wk X 32.5 weeks X $95/hr

TOTAL $2,470,000

DB\360.OPS

12. 10.2 m^3 (360 ft^3) Vehicle Operational Costs

For the 10.2 m^3 (360 ft^3) case, the vehicle is used in all four AX farm tanks. The estimate for vehicle operating time is based on the data in tables A-1 through A-5.

AX-101 Operational time	19.9 days
AX-102 Operational time	21.4 days
AX-103 Operational time	19.9 days
AX-104 Operational time	6.0 days
Total	67.2 days (9.6 wks)

The vendor labor costs are based on a 3 man crew, 4 shifts, and a 4 man home office support for 9.6 weeks of retrieval time at each tank (the labor through the ORR is included with in the installation costs).

There are 4 weeks required to move the system from tank to tank.

There are an additional 4 weeks of time required for the dismantling and removal of the retrieval system.

The total time required is:

Retrieve four tanks	9.6 weeks	
Move system 3 times	12 weeks	
Dismantle system	4 weeks	
TOTAL	25.6 weeks	
16 persons @$75/hr X 40 hr/wk for 25.6 weeks		$1,229,000
Per diem (12 persons @$80/day)		$172,000
	Sub-total	$1,401,000

PHMC labor costs are for a 6 man crew, four shifts, for the 25.6 weeks retrieval and dismantling time.

24 persons @ $95/hr for 25.2 weeks		$2,298,,000
	TOTAL	$3,699,000

DB\360VEH.OPS

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APPENDIX C

COST ESTIMATE DETAILS FOR 1.0 m^3 (36 ft^3) RESIDUAL WASTE LEVEL

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APPENDIX C

1.0 m^3 (36 ft^3) COST DETAILS

Retrieval to 1.0 m^3 (36 ft^3) Residual Waste--Cost Summary. (2 Sheets)

	Task Description	Cost
1	LLCE removal of tank equipment	2,818,000
2	Procurement and installation of sluicing systems and equipment for tanks 241-AX-101 and 241-AX-103	22,446,000
3	Design/fabricate/install control room for sluicers	204,000
4	Purchase and install vehicle retrieval system in 241-AX-104	11,442,000
5	Design/fabricate/install HVAC system for tanks 241-AX-101, 102, 103, and 104.	1,082,000
6	Design/install approximately 610 m (2,000 ft) of 10-cm (4-in.) diameter waste transfer lines between 241-AY-102 and 241-AX-101, 102, 103, and 104.	980,000
7	Design/install new waste transfer jumper pit on west side of AX farm	334,000
8	Decontaminate and clean out 11 pits in AX and AY farms based on W-320 experience.	16,500,000
9	PHMC BOP modifications/installations	5,343,000
10	Safety and Permitting	1,393,00
11	Sluicing Operational Costs	2,470,000
12	Vehicle Operational Costs	10,871,000
	TOTAL	75,883,000

BOP = Balance of Plant
CCTV = Closed-circuit television
HVAC = Heating, ventilating, and air conditioning
LLCE = Long-length contaminated equipment
PHMC = Project Hanford Management Contractor.

Contingency and escalation are assumed to be the same as used by FDNW in the preparation of the Project Design Concepts (May 1997). These are as follows:

Escalation is 5.3 percent for FY 1999 through FY 2006 (8 years) for a total escalation of 51.2 percent

32 percent contingency

TOTAL RETRIEVAL COST 75,883,000 X 1.512 X 1.32

= $151,450,000

DB\36-TBL

1. 1.0 m^3 (36 ft^3) Long-Length Contaminated Equipment Removal

There are 6 pieces of Long-Length Contaminated Equipment (LLCE) that will be removed from the tank pits in AX farm. These will be removed with the existing LLCE system and packaged for burial or disposal as required.

The slurry pump in 241-AY-102 requires removal for replacement, due to radiation damage.

In addition, one of the sluicers in 241-AX-101 and 241-AX-103 will need to be removed to provide access for the vehicle.

The estimated cost for the setup of the LLCE, removal of the item from the waste tank, packaging, and burial/storage is $418,000 for the initial item based on Manderbach (1997a). Costs for subsequent items are $300,000 each.

Tank 241-AY-102 slurry pump removal	$418.000
Tank 241-AX-101 pit 01A steam coil	$300,000
Tank 241-AX-101 pit 01B Sluicer	$300,000
Tank 241-AX-102 pit 02A Sluicer	$300,000
Tank 241-AX-102 pit 02B Pump	$300,000
Tank 241-AX-103 pit 03A Sluicer	$300,000
Tank 241-AX-104 pit 04A Sluicer	$300,000
Remove 241-AX-101 new sluicer for vehicle access	$300,000
Remove 241-AX-103 new sluicer for vehicle access	$300,000
TOTAL (for 1.0 m^3 [36 ft^3] case)	$2,818,000

DB\36LLCE

2. 1.0 m^3 (36 ft^3) Sluicing Equipment Fabricate/Installation Costs

The cost estimate for the design/fabrication and installation of sluicing systems on tanks 241-AX-101 and 241-AX-102 is based on the enhanced sluicing cost estimate for 241-C-106 prepared by FDNW for Job no. E20144 (file no. Z437SAE2) (summary sheet attached). The estimate was modified as detailed below to more accurately reflect the AX farm conditions.

The Total projected cost estimate without escalation or contingency is $34,140,000 including site allocations. The following items were removed from the estimate as redundant or not applicable:

Regulatory compliance	1,281,000
Accident analysis	650,000
Pump pit 241-C-06A	2,303,000
Heel pit 241-C-06B	1,967,000
Sluice pit 241-C-06C	1,922,000
Enc'd pipe pump to heel pit	298,000
Enc'd pipe heel to sluice pit	223,000
Heel jet removal	618,000
Sluicer removal	594,000
Vendor perform retrieval	2,000,000
Vendor Demobilization	500,000
Ready tank for closure	2,500,000
SUB-TOTAL	14,856,000

The following items were added to the estimate to account for operation in two tanks:

Vendor equipment	2,000,000
Vendor equipment installation	1,162,000
SUB-TOTAL	3,162,000

TOTAL (34,140,000 + 3,162,000 - 14,856,000) = $22,446,000

DB\36.SLU

FLUOR DANIEL NORTHWEST, INC.
NUMATEC HANFORD CORPORATION
JOB NO. E20144
FILE NO. Z437SAE2

** IEST - INTERACTIVE ESTIMATING **
CONCEPT 1 - ENHANCED SLUICING
ORDER OF MAGNITUDE
PNHCR01 - PROJECT COST SUMMARY

PAGE 1 OF 20
DATE 04/07/97 17:51:46
BY TLH, JJM, RHO, CDL

SORT	DESCRIPTION	ESCALATED TOTAL COST	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
DESH	DE&S HANFORD, INC.	820,000	30	250,000	1,070,000
FDNW	FLUOR DANIEL NORTHWEST	17,290,000	33	5,780,000	23,070,000
LMHC	LOCKHEED MARTIN HANFORD CORP.	1,080,000	30	320,000	1,400,000
NHI	NUMATEC HANFORD CORPORATION	9,270,000	33	3,100,000	12,370,000
	SUBTOTAL	28,460,000	33	9,450,000	37,910,000
SITE	SITE ALLOCATIONS	5,680,000	33	1,850,000	7,530,000
	ROUNDING	(40,000)			(40,000)
TOTAL PROJECT COST (TPC)		34,140,000	33	11,300,000	45,400,000

TYPE OF ESTIMATE	ORDER OF MAGNITUDE 4/7/97	REMARKS: Subject to change.
FDNW LEAD ESTIMATOR	TW — ESTIMATING MANAGER [signature]	
PROJECT MANAGER	[signature] for M. Mausolbach Per Telecon 4/8/97	
CLIENT		

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

3. 1.0 m^3 (36 ft^3) Sluicer Control Room

The estimated cost for the control room/lunch room is taken from the 1994 W-320 estimate (Job no. W-320/ER4319 page 23 attached). One control room for the systems used in tanks 241-AX-101 and 241-AX-103 is adequate. This control room would be located outside the tank farm boundaries.

The W-320 control room was not installed (a mobile office was modified) so the costs for the control room are not included in the later estimates.

From page 23 of the estimate (rounded) $204,000

DB\36.CNT

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-320/ER4319
FILE NO. W320PBB7

** IEST - INTERACTIVE ESTIMATING **
TANK 241-C-106 SLUICING REVISION #1
40% PRELIMINARY ESTIMATE
DOE_R04 - COST CODE ACCOUNT SUMMARY

PAGE 23 OF 32
DATE 10/21/94 07:56:21
BY GDC/JPH/DKH/CDL/KDE

COST CODE/WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
3490	AY EQUIPMENT	7860	0	7860	0.00	0	7860	20	1572	9432
3510	HYDRAULIC TRAILER/STRONGBACK	493220	0	493220	0.00	0	493220	1	6438	499658
3560	CENRTIC FABRICATION	660184	0	660184	0.00	0	660184	2	14198	674382
4212	CNTRL RM INSTR. INSTALLATION	713564	0	713564	1.60	11417	724981	25	181246	906227
4221	TRANSFER LINE	1259047	271846	1530893	1.60	24495	1555387	25	388369	1943757
4222	SERVICE BLDG.	6403	1306	7709	1.61	124	7833	20	1567	9399
4223	CONTROL RM/LUNCH RM	204417	41701	246118	1.60	3938	250056	20	50011	300067
4313	CORE DRILLS	499806	0	499806	3.61	18043	517849	28	144076	661925
4314	PIT SLEEVE/EMBEDS	102622	0	102622	3.61	3704	106326	30	31898	138225
4315	JUMPERS	372617	0	372617	3.61	13451	386068	30	115821	501889
4322	ENCASED PIPING INSTALLATION	254481	0	254481	3.61	9187	263668	30	79100	342769
4324	C- FARM INSTRUMENT AIR & VENT	39131	0	39131	3.61	1412	40543	30	12163	52706
4330	C-FARM ELECTRICAL	869740	0	869740	3.61	31397	901137	20	180227	1081365
4341	MASF MOCK-UP	247311	0	247311	3.61	8928	256239	20	51248	307487
4343	SLUICING EQUIP.	512504	0	512504	3.61	18501	531005	30	159302	690307
4351	CHILLER SKID	40418	0	40418	3.61	1459	41877	30	12563	54440
4352	PROCESS SKID	237120	0	237120	3.61	8560	245680	22	53764	299446
4353	EXHAUST SYSTEM	4549	0	4549	3.61	164	4713	30	1414	6127
4354	FOG SUPRESSION SYS	54897	0	54897	3.61	1981	56878	25	14221	71099
4356	DIRECTED AIR SYSTEM	13308	0	13308	3.61	481	13789	25	3447	17235
4357	EXISTING AIR INLET MOD'S	7917	0	7917	3.61	286	8203	25	2051	10254
4411	MISC PADS	218925	0	218925	3.89	8516	227441	25	56924	284364
4412	MISC. INSTRUMENTATION	134525	0	134525	3.89	5233	139758	30	41927	181685
4413	PIT SLEEVE/ EMBEDS	35161	0	35161	3.89	1368	36529	30	10959	47488
4414	JUMPERS	248235	0	248235	3.89	9657	257892	30	77368	335259
4416	PIT BACKFILL	711	0	711	3.94	28	739	30	222	960
4421	EXCAVATION - PIPING	8459	0	8459	3.89	329	8788	30	2637	11425
4422	ENCASED PIPING INSTALLATION	48398	0	48398	3.89	1883	50281	30	15084	65365
4423	BACKFILL PIPING	2339	0	2339	3.89	91	2430	30	729	3159
4430	AY-FARM ELECTRICAL	366957	0	366957	3.89	14274	381231	20	76247	457479
4509	HVAC SKID PROCUREMENT	857899	0	857899	2.46	21104	879003	20	175801	1054803
4510	SLUICING EQUIP.PROCUREMENT	1017615	0	1017615	2.46	25033	1042648	15	156398	1199046
4543	SLUICING EQUIPMENT C-106	2581207	0	2581207	2.46	63498	2644705	15	396706	3041410
4604	COLD TESTING	1505123	0	1505123	0.12	1749	1506872	10	155567	1662439
4605	FABRICATION/INSTALLATION	3307896	0	3307896	0.14	4597	3312493	11	376368	3688864
4606	GENERAL CONSTRUCTION SUPPORT-ERS	936509	0	936509	2.17	20322	956831	20	191366	1148197
4610	CONTAINER TRAILER FAB CTC	49598	0	49598	0.00	0	49598	10	4960	54558
4700	GENERAL CONSTRUCTION SUPPORT-SLUICE	384220	0	384220	2.17	8338	392558	20	78512	471069
4777	GENERAL & TECH. SERVICES-SLUICING	589588	0	589588	2.17	12795	602383	20	120477	722858
TOTAL 700	SPECIAL EQUIP/PROCESS SYSTEM	19783677	314853	20098530	1.77	356343	20454872	17	3576571	24031443

4. 1.0 m^3 (36 ft^3) Vehicle Retrieval System costs

Vendor Costs

The vendor cost estimate is based on the two vendor systems currently being designed for the retrieval of the heel in tank 241-C-106. This also assumes that the same type of service contract will be used to procure the retrieval systems for the AX farm as is being used for the procurement of the 241-C-106 vehicle retrieval system.

Vendor supplied system/equipment

Design, fabrication, testing, and delivery of a vehicle based retrieval system ready to install in the AX farm (based on discussions with HTI 241-C-106 Heel Retrieval System Engineers).

$5,500,000

Pre-operational work at AX farm

ORR, training, and acceptance testing based on 6 month duration. Three person vendor crew, four shifts, and four person home office support on one shift.

Labor (16 persons @ $75/hr for 24 weeks)	$1,152,000
Per diem (16 persons @ $80/day for 24 weeks)	$30,700

Warehouse and office rental in the Tri-Cities area.

Eighteen month duration based on the use of one vehicle that is moved tank to tank

$90,000

Sub-total	$6,772,000

PHMC Bid and Award

Based on HTI 241-C-106 Heel Retrieval System costs	$200,000

PHMC Contract Management

Based on HTI 241-C-106 Heel Retrieval System costs	$400,000

PHMC ORR/ATP

Based on HTI 241-C-106 Heel Retrieval System costs		$400,000
Three additional ATP/OTPs after vehicle moved		$300,000
	Sub-total	$1,300,000

Installation Costs

The estimated cost to install a vehicle based retrieval system in 241-AX-101, 102, 103, and 104 is assumed to be the same as for tank 241-C-106. The installation costs in 241-C-106 is from sheet 17 (attached) of the baseline estimate. This does not include the costs to modify the farm/tank for acceptance of the vehicle system.

	Four at	$842,500 each
	Sub-total	$3,370,000
	TOTAL	$11,442,000

DB\36.VEH

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Budgeted Cost
R255OS0135	INCORP COMMENTS/FINALIZE	25	25	0	29MAR99	30APR99	0.00
R255OS0140	SUBMIT FINAL PKG FOR REVIEW (90%)	0	0	0		30APR99	0.00
R255OS0145	REVIEW/COMMENTS	10	10	0	03MAY99	14MAY99	0.00
R255OS0150	SUBMIT PKG FOR APPROVAL	0	0	0		14MAY99	0.00
R255OS0155	Stage 1 Design Approval	10	10	0	17MAY99	28MAY99	0.00
R255OS0160	Stage 1 Design Approved	0	0	0		28MAY99	0.00
1.1.1.1.1.02.05.05.03.04.02	Stage 2 Design	130	130	0	11MAR99	14SEP99	1,315,718.08
R255OS0205	STAGE 2 DESIGN ACTIVITIES	20	20	0	11MAR99	07APR99	0.00
R255OS0210	STAGE 2 DESIGN PLAN	60	60	0	08APR99	01JUL99	0.00
R255OS0215	PREPARE 60% DESIGN PKG (STAGE 2)	30	30	0	06JUL99	16AUG99	0.00
R255OS0220	INCORP COMMENTS/FINALIZE	0	0	0		16AUG99	0.00
R255OS0225	SUBMIT FINAL PKG FOR REVIEW	10	10	0	17AUG99	30AUG99	0.00
R255OS0230	REVIEW/COMMENT	0	0	0		30AUG99	0.00
R255OS0235	SUBMIT PKG FOR APPROVAL	10	10	0	31AUG99	14SEP99	0.00
R255OS0240	STAGE 2 DESIGN APPROVAL	42	42	0	06MAR00	02MAY00	842,441.33
1.1.1.1.1.02.05.05.03.02	Construction						
R255OS0301	Install Retreival System in C-106						

5. 1.0 m^3 (36 ft^3) HVAC System Design/Installation Costs

The estimate for a new AX farm HVAC system is based on the FDNW W-320 HVAC skid estimate contained in file no. W320PDA4, job no. W-320/P7448M (page 14 attached). This is the same as for the 102 m^3 (3,600 ft^3) case with an additional $100,000 to connect the system to 241-AX-104.

AX Farm HVAC System for three tanks	$982,000
Additional cost to connect to 241-AX-104	$100,000
TOTAL	$1,082,000

DB\36HVAC

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. W-320/P7448H
FILE NO. W320PDA4

** IEST - INTERACTIVE ESTIMATING **
TANK 241-C-106 SLUICING
90% PRELIMINARY ESTIMATE
DOE_R02 - WORK BREAKDOWN STRUCTURE SUMMARY

DATE 07/25/95 15:11:06
BY KE/DH/JH/LR/CL/RO/KR

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	ESCALATION TOTAL	SUB TOTAL	CONTINGENCY %	CONTINGENCY TOTAL	TOTAL DOLLARS
4509AB	PROCESS BUILDING PROCUREMENT	494446	0	494446	1.74	8603	503049	5	25152	528202
4509AC	CHILLER SKID PROCUREMENT	280231	0	280231	1.74	4876	285107	5	14255	299362
SUBTOTAL 4509	HVAC SKID PROCUREMENT	982030	0	982030	1.74	17087	999117	5	49955	1049073
4510AB	PURCHASE PUMP	1140475	0	1140475	1.74	19844	1160319	15	174048	1334367
4510AC	ELECTRICAL EQUIPMENT PROCUREMENT	629535	0	629535	1.73	10894	640429	15	95552	735981
SUBTOTAL 4510	SLUICING EQUIP.PROCUREMENT	1770010	0	1770010	1.74	30738	1800748	15	269600	2070348
454310	SLUICING EQUIPMENT C-106	804052	0	804052	1.74	13991	818043	25	204511	1022553
SUBTOTAL 4543	SLUICING EQUIPMENT C-106	804052	0	804052	1.74	13991	818043	25	204511	1022553
SUBTOTAL 45	EXPENSE PROCUREMENT	4113496	0	4113496	1.50	61816	4175312	13	553563	4728875
461500	PIT DECON - HOOK-UP	329246	0	329246	0.00	0	329246	30	98774	428020
461510	PIT DECON - C-106 FARM	520252	0	520252	0.00	0	520252	30	156076	676328
461520	PIT DECON - AY-102 FARM	527252	0	527252	0.00	0	527252	30	158176	685428
SUBTOTAL 4615	PIT DECON	1376750	0	1376750	0.00	0	1376750	30	413026	1789776
SUBTOTAL 46	PIT DECON	1376750	0	1376750	0.00	0	1376750	30	413026	1789776
470000	CONSTRUCTION SERVICES - CTD	62326	0	62326	0.00	0	62326	0	0	62326
470010	GENERAL CONSTRUCTION SUPPORT	762849	0	762849	2.35	17902	780751	18	140760	921510
SUBTOTAL 4700	CONSTRUCTION SERVICES	825175	0	825175	2.17	17902	843077	17	140760	983836
477700	EQUIPMENT USAGE	315813	0	315813	2.61	8243	324056	20	64811	388867
477710	MANAGEMENT SUPPORT FOR CONSTR	496445	0	496445	2.61	12957	509402	20	101880	611283
477720	CF SUPPORT	999967	0	999967	2.61	26099	1026066	20	205214	1231279
477730	QUALITY SUPPORT	161500	0	161500	2.61	4215	165715	20	33143	198858
SUBTOTAL 4777	GENERAL & TECH. SERVICES	1973725	0	1973725	2.61	51514	2025239	20	405048	2430287
SUBTOTAL 47	CONSTRUCTION SERVICES	2798900	0	2798900	2.48	69416	2868316	19	545808	3414123

6. 1.0 m^3 (36 ft^3) Waste Transfer Line

Description	Length
241-AY-102	
Pit 02A to new valve pit	76 m (250 ft)
Pit 02E to new valve pit	72 m (235 ft)
241-AX-101	
Pit 01A to new valve pit	67 m (220 ft)
Pit 01B to new valve pit	61 m (200 ft)
Pit 01D to new valve pit	56 m (185 ft)
241-AX-102	
Pit 02A to new valve pit	58 m (190 ft)
Pit 02B to new valve pit	50 m (165 ft)
241-AX-103	
Pit 03A to new valve pit	38 m (125 ft)
Pit 03C to new valve pit	41 m (135 ft)
Pit 03D to new valve pit	29 m (95 ft)
241-AX-104	
Pit 04A to new valve pit	28 m (90 ft)
Pit 04D to new valve pit	22 (70 ft)
TOTAL LINE LENGTHS	598 m (1,960 ft)
COST	$980,000

Note 1: Fabrication and installation cost for the waste transfer line is $3,279/m ($1,000/ft) for a double line.

Note 2: Each pit above requires core drill and nozzle installation i.e. 12 each for the 1.0 m (36 ft^3) case.

\36.LIN

7. 1.0 m^3 (36 ft^3) Pit Design/Installation Costs

The estimate for a new AX farm above grade transfer line (jumper) pit is based on the pit cover block fabrication and caisson/slab support for the manipulator arm costs contained in the *Cost Normalization Unit Estimates* (Manderbach 1997a). Assume same cover block costs and that the pit will cost the same as the manipulator slab.

Cover block	$102,000
Pit	$232,000
TOTAL	$334,000

DB\36.PIT

8. 1.0 m^3 (36 ft^3) Pit Decontamination Costs

For the 1.0 m^3 (36 ft^3) case, 10 pits in AX farm and the pump pit at 241-AY-102 are used for the retrieval activities.

Discussed the condition and radiation levels in the pits with Dave Bragg in a Telecon 4/20/98 as summarized below.

Dave is not aware on any record of the activities that have been carried out in the last 15 years in the pits. Dave indicated that the pits probably haven't been opened in the last 15-20 years. Dave has no information on the pits as compared to the 241-C-106 pits that were decontaminated for Project W-320. Dave stated that John W. Bailey might have some recollection of the AX farm retrieval sluicing activities and that he would be a good source to try. John Bailey indicated that the pits in AX Farm should be in better condition than those in C Farm (the drains should work).

For the purposed of preparing this estimate, will assume that the pits are in comparable condition to the 241-C-106 pits. From the FDNW estimate for the Vehicle Based Retrieval System, Job no. E20144 (file Z437SAF2), the allocated cost for decontamination of the pits is $1,500,000 each (page 7, item 7E-4 attached).

TOTAL	(11 pits)	$16,500,000

DB\36.DCN

WDS.310 (ON SITE CONSTRUCTION) A CONTINGENCY OF 33% HAS BEEN APPLIED BECAUSE OF LIMITED INFORMATION AVAILABLE ON THE RADIATION LEVELS THAT WILL BE ENCOUNTERED DURING PIPE INSTALLATION, PIT MODIFICATIONS AND DECONTAMINATION, PIT MODIFICATIONS, AND UNDERGROUND OBSTRUCTIONS THAT MAY BE ENCOUNTERED DURING CONSTRUCTION. THE ENHANCED SLUICER COST IS BASED UPON VERBAL ALLOWANCES PROVIDED BY THE ENGINEER AND WITHOUT VENDOR INPUT.

6. ROUNDING

THE PROJECT COST SUMMARY REPORT IS SUMMARIZED AND ADJUSTED/ROUNDED AS FOLLOWS:
THE ESCALATED TOTAL COST COLUMN, CONTINGENCY TOTAL COLUMN AND TOTAL DOLLARS COLUMN SUB-TOTALS ARE SUMMARIZED BY CONTRACTOR. THE COLUMN SUBTOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $1,000/$10,000. THE PROJECT TOTAL SUMMARY LINE TOTALS ARE ADJUSTED/ROUNDED TO THE NEAREST $10,000/$100,000.

7. REMARKS

MAJOR ASSUMPTIONS WHICH HAVE BEEN MADE IN THE PREPARATION OF THIS ESTIMATE ARE AS FOLLOWS:

A.) THE TEMPORARY CHANGE ROOM TRAILER, MOBILE DRILL RIG AND ASSOCIATED EQUIPMENT, VACUUM TRUCK (GUZZLER), AND CRANES WILL BE FURNISHED TO THE PROJECT AT NO COST EXCEPT FOR THE SET UP COSTS.
B.) BURNOUT COSTS ARE NOT INCLUDED IN THIS COST ESTIMATE BY DIRECTION OF PHMC. IF BURNOUT IS ADDED ITS COST IS APPROXIMATELY $2.5M AND IS BASED UPON AN ASSUMED 10mr READING AT THE UPPER SECTION OF THE CASING AND 25mr AT THE LOWER SECTION OF THE CASING, (REF. C.C. MAIL). OTHER CONSTRUCTION WORK, INSIDE THE FARM FENCE, HAS ESTIMATED AS 10mr. RAD LEVELS ABOVE 25mr IS NOT ANTICIPATED.
C.) ALL CONTAMINATED SOIL HAS ASSUMED TO BE LOW RAD AND HAS ESTIMATED AS BACKFILL ONLY (BURIAL IN BARRELS NOT INCL.).
D.) THE TOTAL NUMBER OF DRAWINGS, BY DISCIPLINE, AND AN ALLOWANCE OF 150 MAN HOURS EQCH WAS PROVIDED BY ENGINEERING.
E.) ITEMS THAT ARE NOT INCLUDED IN THIS COST ESTIMATE:
    1. FLAMMABLE GAS. IT IS ASSUMED THAT THIS HAS COVERED IN THE W-320 PROJECT.
    2. CONTROL ROOM. THE CONTROL ROOM PROVIDED IN W-320 WILL BE USED.
    3. AFTER OPERATIONS IS COMPLETE, THE EQUIPMENT WILL BE ABANDONED IN PLACE (EXCEPT ENHANCED SLUICER).
    4. CLEANING, PAINTING AND OTHER SIMILAR MODIFICATIONS OF PITS. AN ALLOWANCE OF $1.5M (BASED UPON W-320 LESSONS LEARNED) PER PIT FOR DECONTAMINATION IS INCLUDED.
    5. THE HVAC SYSTEM THAT W-320 INSTALLED IS NOT MODIFIED AND IS NOT INCLUDED IN THIS COST ESTIMATE.
    6. SPARE PARTS.
    7. ADDITIONAL REMOTE CAMERAS AS THIS WAS INSTALLED BY W-320.
F.) PIPING ALLOWANCES ARE FOR NORMAL PIPING AND ARE NOT ASME, SECTION 3 (N-STAMPED).
G.) W-320 REPLACEMENT ITEMS FOR FAILED EQUIPMENT ARE AN ENGINEERING ALLOWANCE OF $300,000.
H.) EXISTING PIT CONDITIONS ARE UNKNOWN AND THE WASH DOWN ALLOWANCE OF 200MH IS ONLY AN ALLOWANCE. IT SHOULD BE NOTED THAT PROJECT W-320 EXPERIENCED HIGHER MANHOURS DUE TO POOR PIT CONDITIONS.
I.) AN ALLOWANCE OF APPROXIMATELY $.5M (BASED ON W-320 LESSONS LEARNED) PER PIT FOR DECONTAMINATION IS INCLUDED.
J.) ESCALATION IS BASED ON A MIDPOINT OF ALL STAGES OF CONSTRUCTION (4-1-99).

9. 1.0 m^3 (36 ft^3) BOP Mods/Installation

The unit costs used in this section were taken from the FDNW *Cost Normalization Unit Estimates* (Manderbach 1997a).

Waste Transfer Line Jumpers

Eight jumpers will be required in the new transfer pit to route the eight lines coming from the 4 tanks (241-AX-101, 241-AX-102, 241-AX-103, and 241-AX-104).

Ten jumpers will be required for the pits in AX farm and two required at 241-AY-102.

TOTAL JUMPERS REQUIRED 20 @ $56,000 ea

TOTAL COST $1,120,000

Cover Block Removal

Remove the cover blocks from the ten pits in AX farm (3 each on 241-AX-101 and 241-AX-103; 2 each on 241-AX-102 and 241-AX-104)

Remove/replace the cover blocks from the pump pit on 241-AY-102 for replacement of the pump due to radiation damage and the sluice pit for core drilling.

TOTAL COVER BLOCKS REMOVED 12 @ $77,300 ea

TOTAL COST $928,000

Cover Block Fabrication

Fabricate and install new cover blocks for the ten pits in AX farm (3 each on 241-AX-101, 241-AX-103, and 2 each on 241-AX-102, 241-AX-104).

TOTAL COVER BLOCKS FABRICATED 10 @ $102,500 ea

TOTAL COST $1,025,000

Cover Block Disposal

Dispose of the ten cover blocks removed from the pits in AX farm.

TOTAL COVER BLOCKS DISPOSED 10 @ $54,800 ea

TOTAL COST $548,000

Greenhouse Setup/Teardown

Setup and teardown of greenhouses and shield walls on the ten pits in AX farm and two pits at 241-AY-102.

TOTAL GREENHOUSE SETUP/TEARDOWN 12 @ $79,400 ea

TOTAL COST $953,000

Pit Core Drill

Core drill the 10 pits in AX farm and two pits at 241-AY-102 for the waste transfer lines.

TOTAL CORE DRILLS 12 @ $29,200 ea

TOTAL COST $350,000

Concrete Pads

Install concrete mounting pads at the 4 AX farm tanks. Assume 9.3 m^2 (100 ft^2) total at each tank.

TOTAL CONCRETE PADS 37.2 m^2 @ $850/$m^2$ (400 ft^2 @ $79 ft^2)

TOTAL COST $32,000

CCTV Installation/Removal

Install CCTV units in the four AX farm tanks.

TOTAL CCTV INSTALLATIONS 4 @ $52,000 ea

TOTAL COST $208,000

241-AY-102 Pump Replacement

Replace the supernate pump in 241-AY-102 (due to radiation damage). The cover block removal, pump removal, and greenhouse setup/teardown are covered in the previous items. Assume pump disposal cost are comparable to cover block disposal costs from Manderbach (1997a).

241-AY-102 PUMP INSTALLATION	1 each @ $125,000
241-AY-102 PUMP DISPOSAL	1 each @ $54,800
TOTAL COST	$179,000

TOTAL PHMC BOP MODIFICATIONS/INSTALLATIONS $5,343,000

\36BOP

10. 1.0 m^3 (36 ft^3) Safety and Permitting Costs

The estimates for the safety and permitting costs are based on the HTI heel retrieval baseline estimate (pages 9, 10, 11 attached). The AX farm retrieval safety efforts are considered to be approximately double those of the baseline estimate. Additionally, $750,000 is included for BIO amendment activities. The estimate is also based on a 3-year project duration.

Safety

Management (assuming 3-year duration)		180,000
USQ		15,000
HI&E		48,000
Safety Equipment Lists		52,000
BIO amendment		750,000
	Sub-total	$1,045,000

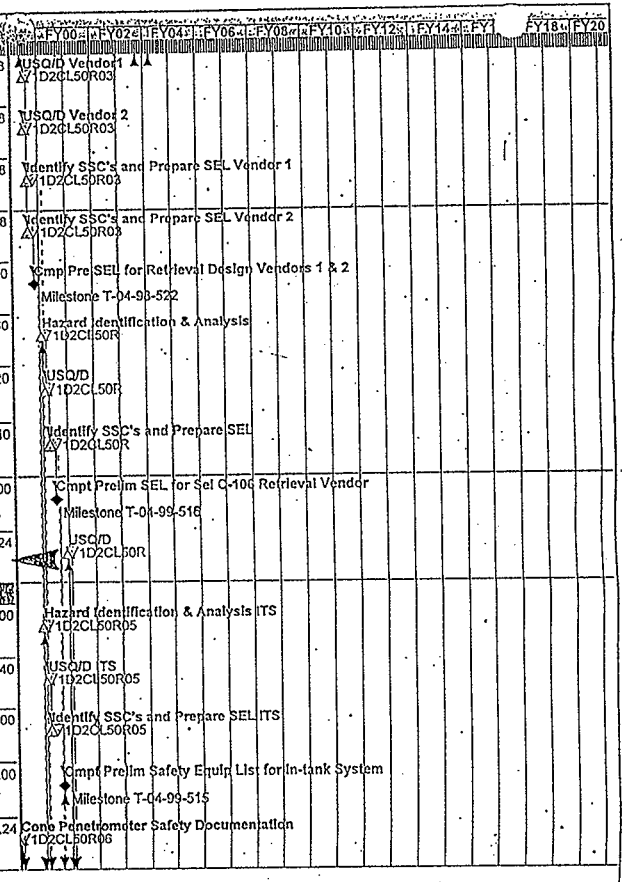
Permitting

Management		90,000
NEPA supplement analysis		N/A
Air Permits (NOC) $43k ea tank		129,000
Air Permits (NOC) for the pits at each tank ($43k ea)		129,000
	Sub-total	$ 348,000
	TOTAL	$1,393,000

DB\36.SAF

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Budgeted Cost	FY00	FY02	FY04	FY06	FY08	FY10	FY12	FY14	FY16	FY18	FY20
R255OB0250	Interface Control Diagrams FY00	251	251	0	01OCT99	29SEP00	119,394.59	Interface Control Diagrams FY00										
1.1.3.1.02.05.02.03	F&R Database																	
R255OB0345	Functions & Requirments Database FY99	251	251	0	01OCT98	30SEP99	121,900.34	Functions & Requirments Database FY99										
R255OB0350	Functions & Requirments Database FY00	251	251	0	01OCT99	29SEP00	119,394.59	Functions & Requirments Database FY00										
1.1.3.1.02.05.03	Safety / Permitting																	
1.1.3.1.02.05.03.01	Safety Management																	
1.1.3.1.02.05.03.01.01	Safety Oversight																	
R255OR0115	Safety Management - RETR.	251	251	0	01OCT97	30SEP98	40,950.72	Safety Management - RETR.										
R255OR0120	Safety Management - CHAR.	251	251	0	01OCT97	30SEP98	40,950.72	Safety Management - CHAR.										
R255OR0130	Closure Support	124	124	0	01OCT98	31MAR99	44,815.80	Closure Support										
R255OR0135	Safety Management - RETR.	251	251	0	01OCT98	30SEP99	40,120.80	Safety Management - RETR.										
R255OR0140	Safety Management - CHAR.	251	251	0	01OCT98	30SEP99	40,120.80	Safety Management - CHAR.										
R255OR0145	Safety Management - RETR.	251	251	0	01OCT99	29SEP00	46,737.60	Safety Management - RETR.										
R255OR0150	Safety Management - CHAR.	251	251	0	01OCT99	29SEP00	46,737.60	Safety Management - CHAR.										
R255OR0155	Safety Management - RETR.	250	250	0	02OCT00	28SEP01	59,077.20	Safety Management - RETR.										
R255OR0160	Safety Management - CHAR.	250	250	0	02OCT00	28SEP01	59,077.20	Safety Management - CHAR.										
1.1.3.1.02.05.03.01.02	Retrieval Safety																	
R255OR0251	Hazard Identification & Evaluation Vendor 1	32	32	0	18FEB98	02APR98	23,494.64	Hazard Identification & Evaluation Vendor 1										
R255OR0253	Hazard Identification & Evaluation Vendor 2	32	32	0	18FEB98	02APR98	23,494.64	Hazard Identification & Evaluation Vendor 2										

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	Budgeted Cost
R255OR0255	USQ/D Vendor1	20	20	0	03APR98	30APR98	7,530.88
R255OR0257	USQ/D Vendor 2	20	20	0	03APR98	30APR98	7,530.88
R255OR0259	Identify SSC's and Prepare SEL Vendor 1	60	60	0	01MAY98	28JUL98	26,029.68
R255OR0261	Identify SSC's and Prepare SEL Vendor 2	60	60	0	01MAY98	28JUL98	26,029.68
R255OR0262	Cmp Pre SEL for Retrieval Design Vendors 1 & 2	0	0	0		28JUL98	0.00
R255OR0263	Hazard Identification & Analysis	40	40	0	29OCT98	29DEC98	23,531.60
R255OR0265	USQ/D	20	20	0	30DEC98	27JAN99	7,403.20
R255OR0267	Identify SSC's and Prepare SEL	60	60	0	28JAN99	22APR99	25,382.40
R255OR0268	Cmpt Prelim SEL for Sel C-106 Retrieval Vendor	0	0	0		23APR99	0.00
R255OR0270	USQ/D	40	40	0	15SEP99	09NOV99	7,254.24
1.1.3.1.02.05.03.01.03 Characterization Safety							
R255OR0360	Hazard Identification & Analysis ITS	40	40	0	01OCT98	25NOV98	22,474.00
R255OR0365	USQ/D ITS	20	20	0	30NOV98	29DEC98	6,874.40
R255OR0370	Identify SSC's and Prepare SEL ITS	60	60	0	30DEC98	25MAR99	23,796.00
R255OR0380	Cmpt Prelim Safety Equip List for In-tank System	0	0	0		15JUN99	0.00
R255OR0390	Cone Penetrometer Safety Documentation	26	26	0	01OCT97	05NOV97	10,509.24



Activity ID	Activity Description	Orig Dir	Rem Dir	%	Early Start	Early Finish	Budgeted Cost
R2550R0400	LDUA / EREE Authorization Basis	40	40	0	17NOV97	16JAN98	15,405.60
1.1.3.1.102.05.03.02	Permitting						
1.1.3.1.102.05.03.02.01	Permitting Oversight						
R2550P0110	Permitting Management	251	251	0	01OCT97	30SEP98	24,475.36
R2550P0115	Cone Penetrometer Permitting Support	19	19	0	03NOV97	01DEC97	3,594.30
R2550P0120	Permitting Plan Update	62	62	0	02JAN98	31MAR98	14,459.44
R2550P0125	PERMITTING MANAGEMENT	251	251	0	01OCT98	30SEP99	24,060.40
R2550P0130	Permitting Plan Update	62	62	0	04JAN99	31MAR99	14,408.05
R2550P0135	Permitting Management	251	251	0	01OCT99	29SEP00	23,368.80
R2550P0140	Permitting Plan Update	63	63	0	04JAN00	31MAR00	14,408.30
R2550P0145	Permitting Management	250	250	0	02OCT00	28SEP01	29,538.60
R2550P0150	Start Maintaining Administrative Record	0	0	0	13JUN01		0.00
1.1.3.1.102.05.03.02.02	Retrieval/Permitting						
R2550P0225	Finish C-106 Retrieval NEPA Supplement Anal	94	94	0	01OCT97	17FEB98	18,063.14
R2550P0236	RL Panel Review	1	1	0	01OCT97	01OCT97	0.00
R2550P0237	Incorporate Comments	14	14	0	02OCT97	21OCT97	0.00
R2550P0238	Transmit Draft SA to Ecology/Tribes	0	0	0		21OCT97	0.00
R2550P0239	Ecology/Tribes Review/Comment	35	35	0	22OCT97	11DEC97	0.00

11. 1.0 m^3 (36 ft^3) Sluicer Operational Costs

The estimate for operating the sluicer in tanks 241-AX-101 and 241-AX-103 is based on the data in tables A-1 through A-5. Estimates are based on operating 7 days per week and 24 hours per day.

AX-101 Operational time 170.2 days (24.3 wks)

AX-103 Operational time 57.4 days (8.2 wks)

5 person crew X 4 shifts X 40 hrs/wk X 32.5 weeks X $95/hr

TOTAL $2,470,000

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12. 1.0 m^3 (36 ft^3) Vehicle Operational Costs

For the 1.2 m^3 (36 ft^3) case, the vehicle is used in all four AX farm tanks. The estimate for vehicle operating time is based on the data in tables A-1 through A-5.

AX-101 Operational time	105.4 days
AX-102 Operational time	106.9 days
AX-103 Operational time	105.4 days
AX-104 Operational time	91.5 days
Total	409.2 days (58.5 wks)

The vendor labor costs are based on a 3 man crew, 4 shifts, and a 4 man home office support for 58.5 weeks of retrieval time at each tank (the labor through the ORR is included with in the installation costs).

There are 4 weeks required to move the system from tank to tank.

There are an additional 4 weeks of time required for the dismantling and removal of the retrieval system.

The total time required is:

Retrieve four tanks	58.5 weeks	
Move system 3 times	12 weeks	
Dismantle system	4 weeks	
TOTAL	74.5 weeks	
16 persons @$75/hr X 40 hr/wk for 74.5 weeks		$3,576,000
Per diem (12 persons @$80/day)		$501,000
	Sub-total	$4,077,000

PHMC labor costs are for a 6 man crew, four shifts, for the 74.5 weeks retrieval and dismantling time.

24 persons @ $95/hr for 74.5 weeks	$6,794,,000
TOTAL	$10,871,000

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APPENDIX D

COST AND WORKER-HOUR BREAKDOWN

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APPENDIX D

COST AND WORKER-HOUR BREAKDOWN

The summary of the breakdown of the costs and worker-hours for the three levels of residual waste volumes is shown below. The details of the breakdowns are show in the remainder of the appendix. The breakdowns are for the estimates contained in Appendix A. Refer to Appendix A for the estimate basis.

	102 m^3 (3,600 ft^3)	10.2 m^3 (360 ft^3)	1.0 m^3 (36 ft^3)
Capital Cost	$29,680,000	$31,157,000	$31,157,000
PHMC operating cost	$5,546,000	$9,590,000	$18,489,000
PHMC operating worker-hours	38,619	66,760	128,726
PHMC installation worker-hours	241,970	325,528	325,528
D&D cost	$1,008,000	$1,184,000	$1,184,000

D&D = Decontamination and decommissioning
PHMC = Project Hanford Management Contractor.

102 m^3 (3,600 ft^3) CAPITAL COSTS

The estimates in this appendix are a breakdown of the costs in Appendix A. Refer to Appendix A for the cost basis.

1. LLCE Removal

   From Manderbach (1997a), "Slurry Pump Removal" the cost of a flexible receiver is $212,000 and the cost of a metal burial box is $5,000. Applying an 8 percent sales tax, the cost of the first unit is $245,000. Subsequent units are estimated at 72 percent of the first unit or $176,000. Cost for 6 units is 245 + .72 x 5 x 245

   TOTAL = $1,075,000.

2. Sluicing Equipment Fabrication

   From FDNW Enhanced Sluicing Estimate E20144, page 2, WBS 15140, the vendor cost is $2,000,000 for each tank.

   TOTAL = $4,000,000. (for 2 tanks)

3. Sluicer Control Room

   Per Appendix A, the sluicer control room costs $204,000. Assume $95,000 for the purchase of a Mobile Office.

   TOTAL = $95,000.

4. Vehicle Retrieval System

   Per Appendix A, the vendor procurement cost is $5.5M. Assume 100 percent capital cost.

   TOTAL = $5,500,000.

5. HVAC System

   From Appendix A, the cost of the HVAC is $982k with $700k assumed capital costs.

   TOTAL = $700,000.

6. Waste Transfer Line

   Per Appendix A, the cost of the waste transfer line is $910k based on a vendor fabricate and install contract. Assume 50 percent is capital.

   TOTAL = $455,000.

7. New Valve Pit

   The new pit and cover block design, fabrication, and installation are assumed to be PHMC tasks. Of the total cost, $50k is assumed to be capital.

   TOTAL = $50,000.

8. Pit Decontamination

   Assume $2,000k for a vendor to design, fabricate, and deliver a pit decontamination system per PHMC specifications.

   TOTAL = $2,000,000.

9. Balance of Plant

   The Jumper fabrication costs are capital expenditures. Per Appendix A, 16 jumpers at $56K each.

   TOTAL = $896,000.

TOTAL CAPITAL COST = $14,871,000 + CONTINGENCY AND ESCALATION

= $29,680,000.

\3600CAP

10.2 m^3 (360 ft^3) CAPITAL COSTS

The estimates in this appendix are a breakdown of the costs in Appendix A. Refer to Appendix A for the cost basis.

1. LLCE Removal

   From Manderbach (1997a), "Slurry Pump Removal" the cost of a flexible receiver is $212,000 and the cost of a metal burial box is $5,000. Applying an 8 percent sales tax, the cost of the first unit is $245,000. Subsequent units are estimated at 72 percent of the first unit or $176,000. Cost for 9 units is 245 + .72 x 8 x 245

   TOTAL = $1,656,000.

2. Sluicing Equipment Fabrication

   From FDNW Enhanced Sluicing Estimate E20144, page 2, WBS 15140, the vendor cost is $2,000,000 for each tank.

   TOTAL = $4,000,000. (for 2 tanks)

3. Sluicer Control Room

   Per Appendix A, the sluicer control room costs $204,000. Assume $95,000 for the purchase of a Mobile Office.

   TOTAL = $95,000.

4. Vehicle Retrieval System

   Per Appendix A, the vendor procurement cost is $5.5M. Assume 100 percent capital cost.

   TOTAL = $5,500,000.

5. HVAC System

   From Appendix A, the cost of the HVAC is $982k with $700k assumed capital costs.

   TOTAL = $700,000.

6. Waste Transfer Line

   Per Appendix A, the cost of the waste transfer line is $980k based on a vendor fabricate and install contract. Assume 50 percent is capital.

   TOTAL = $490,000.

7. New Valve Pit

   The new pit and cover block design, fabrication, and installation are assumed to be PHMC tasks. Of the total cost, $50k is assumed to be capital.

   TOTAL = $50,000.

8. Pit Decontamination

   Assume $2,000k for a vendor to design, fabricate, and deliver a pit decontamination system per PHMC specifications.

   TOTAL = $2,000,000.

9. Balance of Plant

   The Jumper fabrication costs are capital expenditures. Per Appendix A, 20 jumpers at $56K each.

   TOTAL = $1,120,000.

TOTAL CAPITAL COST = $15,611,000 + CONTINGENCY AND ESCALATION

= $31,157,000.

\360CAP

1.0 m^3 (36 ft^3) CAPITAL COSTS

The estimates in this appendix are a breakdown of the costs in Appendix A. Refer to Appendix A for the cost basis.

1. LLCE Removal

   From Manderbach (1997a), "Slurry Pump Removal" the cost of a flexible receiver is $212,000 and the cost of a metal burial box is $5,000. Applying an 8 percent sales tax, the cost of the first unit is $245,000. Subsequent units are estimated at 72 percent of the first unit or $176,000. Cost for 9 units is 245 + .72 x 8 x 245

   TOTAL = $1,656,000.

2. Sluicing Equipment Fabrication

   From FDNW Enhanced Sluicing Estimate E20144, page 2, WBS 15140, the vendor cost is $2,000,000 for each tank.

   TOTAL = $4,000,000. (for 2 tanks)

3. Sluicer Control Room

   Per Appendix A, the sluicer control room costs $204,000. Assume $95,000 for the purchase of a Mobile Office.

   TOTAL = $95,000.

4. Vehicle Retrieval System

   Per Appendix A, the vendor procurement cost is $5.5M. Assume 100 percent capital cost.

   TOTAL = $5,500,000.

5. HVAC System

   From Appendix A, the cost of the HVAC is $982k with $700k assumed capital costs.

   TOTAL = $700,000.

6. Waste Transfer Line

   Per Appendix A, the cost of the waste transfer line is $980k based on a vendor fabricate and install contract. Assume 50 percent is capital.

   TOTAL = $490,000.

7. New Valve Pit

   The new pit and cover block design, fabrication, and installation are assumed to be PHMC tasks. Of the total cost, $50k is assumed to be capital.

   TOTAL = $50,000.

8. Pit Decontamination

   Assume $2,000k for a vendor to design, fabricate, and deliver a pit decontamination system per PHMC specifications.

   TOTAL = $2,000,000.

9. Balance of Plant

   The Jumper fabrication costs are capital expenditures. Per Appendix A, 20 jumpers at $56K each.

   TOTAL = $1,120,000.

TOTAL CAPITAL COST = $15,611,000 + CONTINGENCY AND ESCALATION

= $31,157,000.

\36CAP

PHMC OPERATING COSTS

Estimates in this appendix are a breakdown of the costs in Appendices A, B, and C. Refer to Appendix A for the cost basis.

102 m^3 (3,600 ft^3) Residual Waste

Sluicer - 5 person crew X 4 shifts X 31.7 weeks X 40 hr/wk X $95/hr = $2,409,000

Vehicle - 6 person crew X 4 shifts X 4.06 weeks X 40 hr/wk X $95/hr = $370,000

TOTAL = $2,779,000 + contingency (32 percent) and escalation (51.2 percent) =$5,546,000

10.2 m^3 (360 ft^3) Residual Waste

Sluicer - 5 person crew X 4 shifts X 32.5 weeks X 40 hr/wk X $95/hr = $2,470,000

Vehicle - 6 person crew X 4 shifts X 25.6 weeks X 40 hr/wk X $95/hr = $2,335,000

TOTAL = $4,805,000 + contingency and escalation = $9,540,000

1.0 m^3 (36 ft^3) Residual Waste

Sluicer - 5 person crew X 4 shifts X 32.5 weeks X 40 hr/wk X $95/hr = $2,470,000

Vehicle - 6 person crew X 4 shifts X 74.5 weeks X 40 hr/wk X $95/hr = $6,974,000

TOTAL = $9,264,000 + contingency and escalation =$18,489,000

PHMC-OPS

PHMC OPERATING WORKER-HOURS

The estimates in this appendix are a breakdown of the costs in Appendix A. Refer to Appendix A for the cost basis.

102 m^3 (3,600 ft^3) Residual Waste

Sluicer - 5 person crew X 4 shifts X 31.7 weeks X 40 hr/wk	= 25,360
Vehicle - 6 person crew X 4 shifts X 4.06 weeks X 40 hr/wk	= 3,897
TOTAL = 29,257 + contingency (32 percent)	= 38,619

10.2 m^3 (360 ft^3) Residual Waste

Sluicer - 5 person crew X 4 shifts X 32.5 weeks X 40 hr/wk	= 26,000
Vehicle - 6 person crew X 4 shifts X 25.6 weeks X 40 hr/wk	= 24,576
TOTAL = 50,576 + contingency (32 percent)	= 66,760

1.0 m^3 (36 ft^3) Residual Waste

Sluicer - 5 person crew X 4 shifts X 32.5 weeks X 40 hr/wk	= 26,000
Vehicle - 6 person crew X 4 shifts X 74.5 weeks X 40 hr/wk	= 71,520
TOTAL = 97,520 + contingency (32 percent)	= 128,726

PHMC-MH

102 m^3 (3,600 ft^3) PHMC INSTALLATION WORKER-HOURS

The estimates in this appendix are a breakdown of the costs in Appendix A. Refer to Appendix A for the basis.

1. LLCE Removal

   From Manderbach (1997a), "Slurry Pump Removal" the worker-hours are 3318 for the first unit. Assume subsequent units are 72 percent of the first unit. Worker-hours for 6 units are (3318 + .72 x 3318 x 5).

   TOTAL = 15,262

2. Sluicing Equipment Fabrication

   From FDNW Enhanced Sluicing Estimate E20144, page 2, WBS 152300, the installation cost is $1,162,000. Assume 75 percent labor and 25 percent material/other for each of the 2 tanks. Worker-hours are 2 x .75 x $1,162,000 ÷ $95/hr

   TOTAL = 18,347 worker-hours (for 2 tanks)

3. Sluicer Control Room

   Per Appendix A, the sluicer control room costs $204,000. Assume $90,000 for installation labor at $95/hr. Worker-hours are $90,000 ÷ $95/hr.

   TOTAL = 947 worker-hours

4. Vehicle Retrieval System

   Per Appendix A, the vehicle installation cost is $842,000. Assume $700,000 installation labor. Worker-hours are $700,000 ÷ $95/hr.

   TOTAL = 7,368 worker-hours

5. HVAC System

   From Appendix A, the cost of the HVAC is $982,000 with $125,000 assumed installation labor costs. Worker-hours are $125,000 ÷ $95/hr.

   TOTAL = 1,315 worker-hours.

6. Waste Transfer Line

   Per Appendix A, the fabrication and installation of the waste transfer line is a vendor cost based on a vendor fabricate and install contract.

   TOTAL = NA

7. New Valve Pit

   The new pit and cover block design, fabrication, and installation are assumed to be PHMC tasks. Of the total $334,000 cost, $220,000 is assumed to be installation labor cost. Worker-hours are $220,000 ÷ $95/hr.

   TOTAL = 2,316 worker-hours

8. Pit Decontamination

   Assume 80 percent of the $13,500,000 for the pit decontamination task is PHMC labor. Worker-hours are .8 x $13,500,000 ÷ $95/hr.

   TOTAL = 113,684 worker-hours

9. Balance of Plant

   Per Appendix A, assume 80 percent of the cover block removal, cover block fabrication, green house set-up, core drill, concrete pads, and CCTV installation are PHMC labor costs. Worker-hours are .8 x ($773,000 + $820,000 + $794,000 + $292,000 + $24,000 + $156,000) ÷ $95/hr.

   TOTAL = 24,073 worker-hours

TOTAL PHMC INSTALLATION WORKER-HOURS = 183,311 + CONTINGENCY (32 percent)

= 241,970

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10.2 m^3 (360 ft^3) PHMC INSTALLATION WORKER-HOURS

The estimates in this appendix are a breakdown of the costs in Appendix A. Refer to Appendix A for the basis.

1. LLCE Removal

   From Manderbach (1997a), "Slurry Pump Removal" the worker-hours are 3318 for the first unit. Assume subsequent units are 72 percent of the first unit. Worker-hours for 9 units are (3318 + .72 x 3318 x 8).

   TOTAL = 22,429

2. Sluicing Equipment Fabrication

   From FDNW Enhanced Sluicing Estimate E20144, page 2, WBS 152300, the installation cost is $1,162,000. Assume 75 percent labor and 25 percent material/other for each of the 2 tanks. Worker-hours are 2 x .75 x $1,162,000 ÷ $95/hr

   TOTAL = 18,347 worker-hours (for 2 tanks)

3. Sluicer Control Room

   Per Appendix A, the sluicer control room costs $204,000. Assume $90,000 for installation labor at $95/hr. Worker-hours are $90,000 ÷ $95/hr.

   TOTAL = 947 worker-hours

4. Vehicle Retrieval System

   Per Appendix A, the vehicle installation cost is $842,000. Assume $700,000 installation labor. The vehicle retrieval system is installed in all four AX farm tanks. Worker-hours are $700,000 x 4 ÷ $95/hr.

   TOTAL = 29,474 worker-hours

5. HVAC System

   From Appendix A, the cost of the HVAC is $982,000 with $125,000 assumed installation labor costs for three tanks. There is an additional $100,00 to connect the system to 241-AX-104. Worker-hours are $225,000 ÷ $95/hr.

   TOTAL = 2,368 worker-hours.

6. Waste Transfer Line

   Per Appendix A, the fabrication and installation of the waste transfer line is a vendor cost based on a vendor fabricate and install contract.

   TOTAL = NA

7. New Valve Pit

   The new pit and cover block design, fabrication, and installation are assumed to be PHMC tasks. Of the total $334,000 cost, $220,000 is assumed to be installation labor cost. Worker-hours are $220,000 ÷ $95/hr.

   TOTAL = 2,316 worker-hours

8. Pit Decontamination

   Assume 80 percent of the $16,500,000 for the pit decontamination task is PHMC labor. Worker-hours are .8 x $16,500,000 ÷ $95/hr.

   TOTAL = 138,947 worker-hours

9. Balance of Plant

   Per Appendix A, assume 80 percent of the cover block removal, cover block fabrication, green house set-up, core drill, concrete pads, and CCTV installation are PHMC labor costs. Worker-hours are .8 x ($928,000 + $1,025,000 + $953,000 + $350,000 + $32,000 + $208,000) ÷ $95/hr.

   TOTAL = 31,874 worker-hours

TOTAL PHMC INSTALLATION WORKER-HOURS = 246,612 +
CONTINGENCY (32 percent) = 325,528

\360INST

1.0 m^3 (36 ft^3) PHMC INSTALLATION WORKER-HOURS

The estimates in this appendix are a breakdown of the costs in Appendix A. Refer to Appendix A for the basis.

1. LLCE Removal

   From Manderbach (1997a), "Slurry Pump Removal" the worker-hours are 3318 for the first unit. Assume subsequent units are 72 percent of the first unit. Worker-hours for 9 units are (3318 + .72 x 3318 x 8).

   TOTAL = 22,429

2. Sluicing Equipment Fabrication

   From FDNW Enhanced Sluicing Estimate E20144, page 2, WBS 152300, the installation cost is $1,162,000. Assume 75 percent labor and 25 percent material/other for each of the 2 tanks. Worker-hours are 2 x .75 x $1,162,000 ÷ $95/hr

   TOTAL = 18,347 worker-hours (for 2 tanks)

3. Sluicer Control Room

   Per Appendix A, the sluicer control room costs $204,000. Assume $90,000 for installation labor at $95/hr. Worker-hours are $90,000 ÷ $95/hr.

   TOTAL = 947 worker-hours

4. Vehicle Retrieval System

   Per Appendix A, the vehicle installation cost is $842,000. Assume $700,000 installation labor. The vehicle retrieval system is installed in all four AX farm tanks. Worker-hours are $700,000 x 4 ÷ $95/hr.

   TOTAL = 29,474 worker-hours

5. HVAC System

   From Appendix A, the cost of the HVAC is $982,000 with $125,000 assumed installation labor costs for three tanks. There is an additional $100,00 to connect the system to 241-AX-104. Worker-hours are $225,000 ÷ $95/hr.

   TOTAL = 2,368 worker-hours.

6. Waste Transfer Line

   Per Appendix A, the fabrication and installation of the waste transfer line is a vendor cost based on a vendor fabricate and install contract.

   TOTAL = NA

7. New Valve Pit

   The new pit and cover block design, fabrication, and installation are assumed to be PHMC tasks. Of the total $334,000 cost, $220,000 is assumed to be installation labor cost. Worker-hours are $220,000 ÷ $95/hr.

   TOTAL = 2,316 worker-hours

8. Pit Decontamination

   Assume 80 percent of the $16,500,000 for the pit decontamination task is PHMC labor. Worker-hours are .8 x $16,500,000 ÷ $95/hr.

   TOTAL = 138,947 worker-hours

9. Balance of Plant

   Per Appendix A, assume 80 percent of the cover block removal, cover block fabrication, green house set-up, core drill, concrete pads, and CCTV installation are PHMC labor costs. Worker-hours are .8 x ($928,000 + $1,025,000 + $953,000 + $350,000 + $32,000 + $208,000) ÷ $95/hr.

   TOTAL = 31,874 worker-hours

TOTAL PHMC INSTALLATION WORKER-HOURS = 246,612
+ CONTINGENCY (32 PERCENT) = 325,528

\36INST

DECONTAMINATION AND DECOMMISSIONING COSTS

The estimates in this appendix are a breakdown of the costs in Appendix A. Refer to Appendix A for the cost basis.

102 m^3 (3,600 ft^3) Residual Waste

Vehicle Procurement - The $5.5M vendor cost for a vehicle retrieval system includes $100k for D&D.

BOP Mods And Installation - The pump disposal ($55K) and the cover block disposal ($350k) are D&D costs.

TOTAL = $100k + $55k + $350K

= $505,000. + contingency (32 percent) and escalation.

= $1,008,000.

360 Ft^3 Residual Waste

Vehicle Procurement - The $5.5M vendor cost for a vehicle retrieval system includes $100k for D&D.

BOP Mods And Installation - The pump disposal ($55K) and the cover block disposal ($438k) D&D costs.

TOTAL = $100k + $55k + $438K

= $593,000 + contingency and escalation

= $1,184,000.

36 Ft^3 Residual Waste

Vehicle Procurement - The $5.5M vendor cost for a vehicle retrieval system includes $100k for D&D.

BOP Mods And Installation - The pump disposal ($55K) and the cover block disposal ($438k) D&D costs.

TOTAL = $100k + $55k + $438K

= $593,000 + contingency and escalation

= $1,184,000.

\D&D

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APPENDIX E

MISCELLANEOUS INFORMATION

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APPENDIX E

MISCELLANEOUS AX TANK FARM INFORMATION

Tank	Current volume	Waste depth	Condition
241-AX-101	2,838,750 L (750,000 gal)	6.7 m (22 ft) deep	Sound
241-AX-102	124,905 L (33,000 gal)	30 cm (12 in.) deep	Leaker
241-AX-103	423,920 L (112,000 gal)	102 cm (40 in.) deep	Sound
241-AX-104	26,495 L (7,000 gal)	6 cm (2.5 in.) deep	Leaker

Tank	Sluicing heel	Years sluiced
241-AX-101	11,355 L (3,000 gal)	1975/76
241-AX-102	26,495 L (7,000 gal)	1976/77
241-AX-103	62,452 L (16,500 gal)	1976/77
241-AX-104	26,495 L (7,000 gal)	1976/78

(Becker [1997] used as source of sluicing heel volumes)

Note that the residual sluicing heel achieved in the 1970's (using 2 sluicers) exceeded 10.2 m^3 (360 ft^3) in all four tanks.

SHADOWS

There are 22 ALCs in the AX farm tanks. These are full length pipes 76 cm (30-in.) in diameter. These "shadow" a significant portion of the tank volume from the sluicing jet.

OTHER

Tank liner height 9.9 m (32 ft-6 in.)

Flat bottom tanks

There is no active ventilation system in AX farm.

TELECON MEMO

DATE: 4/30/98 TIME:

SUBJECT: Techniques for measuring waste in the SSTs

BETWEEN: S. A. Krieg/F. R. Reich

General discussion on the techniques and capabilities of the various systems for measuring the remaining waste in the SSTs are documented as follows:

- There are two technologies that are sufficiently developed to use for waste volume measurements, video and photogrammetry.
- The best waste volume measurement we can expect with video or photogrammetry is 360 $ft^3 \pm 180\ ft^3$.
- A third technology, Topographic Mapping System (TMS), aka structured light, has the potential to measure 180 $ft^3 \pm 90\ ft^3$ of residual waste but needs development.
- It is not feasible to measure 36 ft^3 of waste remaining in a SST with any of the current technologies.
- All three of the current waste measurement technologies (video, photogrammetry, TMS) are surface measurement tools - accuracies depend on locating the tank walls, floor, etc.
- Accuracies depend on the surface contour of the waste. Less accurate measurements are obtained on rough waste surfaces than smooth ones.
- None of the three systems are able to differentiate between waste and corrosion products i.e. waste looks like rust on the surface of the tank.
- In the AX farm tanks there is a problem with the air lift circulators (ALC). The systems are unable to "see" the back of the ALCs, inside the ALCs, or the wall area in the "shadow" of the ALCs.

Fred will send me a copy of the handouts from the "HTI Waste Volume Estimate Review" of April, 1997. These handouts have a considerable amount of information that was developed by the Waste Volume Estimate Team (Fred Reich, Mike Sumsion, Dennis Goodnough, and Don Daly).

S. A. KRIEG

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