RMIS View/Print Document Cover Sheet

This document was retrieved from the Documentation and Records Management (DRM) ISEARCH System. It is intended for Information only and may not be the most recent or updated version. Contact a Document Service Center (see Hanford Info for locations) if you need additional retrieval information.

Accession #: D196025236

Document #: SD-WM-TA-032

Title/Desc:

B PLANT PROCESS PIPING REPLACEMENT FEASIBILITY
STUDY

Pages: 360

Sta. 4
FEB 07 1996

ENGINEERING DATA TRANSMITTAL

Page 1 of 1
1. EDT 606363

2. To: (Receiving Organization) Distribution	3. From: (Originating Organization) IPM Project, W-236B	4. Related EDT No.: 150247
5. Proj./Prog./Dept./Div.: Projects	6. Cog. Engr.: G. F. Howden	7. Purchase Order No.: N/A
8. Originator Remarks: This EDT completes formal release of the results of a feasibility study performed in 1991 by the TRUEX Project, W-095 and is placed in the Central File for record and reference purposes.		9. Equip./Component No.: N/A
11. Receiver Remarks: Data presented was specific to the B Plant refurbishment. Concepts presented for remote modification of cells and hot pipe trench are applicable to any of the Hanford Site canyon facilities. The concepts also would support more efficient operational maintenance of the modified plants in any future processing mission.		10. System/Bldg./Facility: N/A
		12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: N/A

15. DATA TRANSMITTED					(F)	(G)	(H)	(I)
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	Approval Designator	Reason for Transmittal	Originator Disposition	Receiver Disposition
1	WHC-SD-WM-TA-032	-	0	B Plant Process Piping Replacement Feasibility Study	N/A	2	1	

16. KEY			
Approval Designator (F)	Reason for Transmittal (G)	Disposition (H) & (I)	
E, S, Q, D or N/A (see WHC-CM-3-5, Sec. 12.7)	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment	4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)										(G)	(H)
Reason	Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	Reason	Disp.
1	1	Cog. Eng. G. F. Howden	<i>G. F. Howden</i>	2/29/95							
1	1	Cog. Mgr. S. A. Barker	<i>S. A. Barker</i>	2/29/95							
		QA									
		Safety									
		Env.									

18. Signature of EDT Originator <i>G. F. Howden</i> 2/29/95	19. Authorized Representative for Receiving Organization Date	20. Cognizant Manager Date <i>S. A. Barker</i> 2/29/95	21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments
---	---	--	---

RELEASE AUTHORIZATION

Document Number: WHC-SD-WM-TA-032, REV 0

Document Title: B Plant Process Replacement Feasibility Study

Release Date: 2/7/96

**This document was reviewed following the
procedures described in WHC-CM-3-4 and is:**

APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

Kara Broz

TRADEMARK DISCLAIMER. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy. Available in paper copy. Printed in the United States of America. To obtain copies of this report, contact:

Westinghouse Hanford Company - Document Control Services
P.O. Box 1970, Mailstop H6-08, Richland, WA 99352
Telephone: (509) 372-2420; Fax: (509) 376-4989

Permission has been granted to publish the Copyrighted information in this document. Documentation of the permission has been archived at Central Files.

SUPPORTING DOCUMENT

1. Total Pages **357**

2. Title

B Plant Process Piping Replacement Feasibility Study

3. Number

WHC-SD-WM-TA-032

4. Rev No.

0

5. Key Words

Canyon Facility	Core Drill
Process	Manipulator
Piping	Electromechanical Manipulator
Cell	Refurbish
Robotics	Hot Pipe Trench

6. Author

Name: Gary F. Howden

Signature: *Gary F. Howden* 6/29/95

Organization/Charge Code 8K430/E44754

7. Abstract

Reports on the feasibility of replacing existing embedded process piping with new more corrosion resistant piping between cells and between cells and a hot pipe trench of a Hanford Site style canyon facility. Provides concepts for replacement piping installation, and use of robotics to replace the use of the canyon crane as the primary means of performing/supporting facility modifications (eg, cell lining, pipe replacement, equipment reinstallation) and operational maintenance.

8. RELEASE STAMP

DATE: STA: 4	<p>MANFORD RELEASE</p>	<div style="border: 1px solid black; border-radius: 50%; width: 40px; height: 40px; line-height: 40px; margin: 0 auto;">3</div> ID:
FEB 07 1996		

WHC-SD-WM-TA-032
Revision 0

**B PLANT PROCESS PIPING
REPLACEMENT FEASIBILITY STUDY**

September 6, 1991

Prepared By

Gary F. Howden
TRUEX/Retrieval Projects

WHC-SD-WM-TA-032
Revision 0

This page intentionally left blank.

ACKNOWLEDGMENTS

The author wishes to acknowledge with appreciation the contributions of the following persons in the preparation of this report:

H. G. Barrus, Equipment Engineering, for his research on the state of technology of concrete cutting and drilling and preparation of concepts for direct and remote cutting of penetrations between cells using diamond cable cutting technology (see Appendix D for letter report).

R. R. Buel, Manager of Mechanical Maintenance at PUREX, for historical background on embedded pipe repair at PUREX.

R. D. Campbell, Kaiser Engineers Hanford, for evaluation of concepts and suggestions on design of proposed equipment.

C. R. Cruz, B Plant Design Engineering, for his research on the structural details of the original B Plant construction.

J. W. Gehrke, B Plant Process Engineering, for insight on past projects that have modified the design of B Plant.

M. J. Gunderson, B Plant Design Engineering, for concepts on location of new pipe routings and review of draft assessments.

R. L. Hibbard, Manager of Fabrication Services, for historical background on PUREX embedded pipe repair experience.

S. E. Jones, Manager of Mechanical Maintenance at B Plant, for historical background at B Plant and assistance in making contacts at PUREX.

D. J. MacIsaac, Kaiser Engineers Hanford, for evaluation of concepts and suggestions on design of proposed equipment.

M. C. Perkins, Boeing Computer Services Richland, Graphics, for his contributions in preparing graphical illustrations of the concepts presented in this document.

R. C. Roal, Manager of Engineering at PUREX, for background on PUREX embedded pipe repair experience.

M. K. Sheeley, TRUEX/Retrieval Projects, for her editing and arranging of the draft of this report to produce a professional end product.

W. T. Susiene, Kaiser Engineers Hanford, for his dedicated work planning effort in preparing the cost estimate data for this study.

This page intentionally left blank.

CONTENTS

1.0	OBJECTIVE	1
1.1.	BACKGROUND	1
1.2.	SCOPE OF WORK	1
2.0	SUMMARY	2
3.0	RECOMMENDATIONS AND CONCLUSIONS	17
4.0	UNCERTAINTIES	17
5.0	DESCRIPTION OF ALTERNATIVES AND SOLUTIONS	18
5.1.	CRITERIA	18
5.2.	ASSUMPTIONS	18
5.3.	ALTERNATIVES	19
6.0	DISCUSSION OF PREFERRED SOLUTION	20
7.0	NO ACTION ALTERNATIVE	20
8.0	COST ASSESSMENT	21
8.1.	OPTION 1	21
8.2.	OPTION 2	21
8.3.	OPTION 2A (BASED ON FIGURE 3 HPT MODIFICATION)	21
8.4.	OPTION 2B (BASED ON FIGURE 4 HPT MODIFICATION)	22
8.5.	OPTION 2C (BASED ON FIGURE 5 HPT MODIFICATION)	22
9.0	REFERENCES	23
APPENDICES		
A -	EMBEDDED (PROCESS) PIPE LINING ASSESSMENT	A-1
B -	ARCHITECTURAL ASSESSMENT	B-1
C -	STRUCTURAL ASSESSMENT	C-1
D -	FACILITY MODIFICATION CONCEPTS AND METHODS REPORT	D-1
E -	COST DATA	E-1
F -	AUTHORIZATION TO USE COPYRIGHTED DATA	F-1

LIST OF FIGURES

Figure 1	221B Canyon Building.	3
Figure 2	B Plant Replaceable Piping Feedthrough, Remotely Installed. . .	4
Figure 3	B Plant Replaceable Hot Pipe Trench Piping Module With Lower. .	5
	Shielding Support Block	
Figure 4	B Plant Hot Pipe Trench Entombment With Hot Pipe Trench	6
	Piping Module	
Figure 5	B Plant Replaceable Hot Pipe Trench Piping Module	7
Figure 6	B Plant Piping Feedthrough Core Drilling Safe Zone	8
Figure 7	B Plant Piping Feedthrough Penetration Manually Operated. . . .	10
	Core Drilling Machine	
Figure 8	B Plant Piping Feedthrough Penetration Remotely Operated . . .	11
	Core Drilling Machine	
Figure 9	B Plant Piping Feedthrough Penetration Remotely Operated. . . .	12
	Core Tube Extractor	
Figure 10	B Plant Piping Feedthrough Penetration Core Drill Tube And. . .	13
	Concrete Slug Disposal System	
Figure 11	Portable Remote Manipulator Module.	14
Figure 12	Portable Remote Manipulator Module Arm/Shoulder Assembly. . . .	15
Figure 13	Portable Remote Manipulator Module Operator's Control	16
	Station	

B PLANT PROCESS PIPING REPLACEMENT FEASIBILITY STUDY

1.0 OBJECTIVE

This report documents findings of an assessment of the feasibility of lining existing embedded process piping in B Plant that interconnects the process cells, hot pipe trench (HPT) and the piping gallery with more corrosion resistant materials.

1.1 BACKGROUND

This study and assessment was undertaken in support of re-evaluation and redefinition of the defense waste remediation program. The issue of providing a more corrosion resistant piping system developed as a result of recent process chemistry studies which have indicated that hydrofluoric (HF) acid will be created when neutralized cladding removal waste is dissolved in nitric acid. Additional HF acid may also have to be added to the process in order to achieve maximum dissolution of solids. Other studies (Schwenk 1991) indicate that the HF acid will attack the embedded 18-8 and 300 series piping at unacceptable rates.

1.2 SCOPE OF WORK

This report consolidates the findings of a series of mini-studies that were performed and are included in the appendices as supporting information. The mini-studies assessed the following:

- The logic and feasibility of using existing embedded pipe routings as pathways for installing new, more corrosion resistant pipe or tubing
- The B Plant architectural design attributes from the standpoint of supporting the addition of new pipe routings
- The B Plant cell wall structure and embedments for impediments to making new pipe routing between cells, cells and hot pipe trench (HPT) or cells and cold side pipe gallery from which makeup chemicals, steam, water and air are supplied to the cells in controlled fashion
- The technology of making large penetrations in thick concrete walls such as core drilling, water jet cutting, diamond impregnated wire and cable cutting, etc.
- Construction methods and equipment for manually and remotely modifying the B Plant structure

- New piping installation concepts and a process hydraulics assessment of those concepts.

2.0 SUMMARY

Studies of the embedded piping to, and between the B Plant cells indicate that there are only four 2-in.-diameter lines between pairs of cells. Each pair of cells is separated from the adjacent pairs by a structural expansion joint. Pipe routings to the adjacent pairs of cells are via the HPT (Figure 1).

Of the four lines joining each pair, only three of the four have the possibility of being lined with smaller sized corrosion resistant pipe or tubing. Due to the design of the piping in the HPT, it is not feasible to install metallic liners from the cells to the HPT or within the HPT piping. The radiation levels of the solutions being handled, and the aggressive nature of the chemicals being handled make a "flood" coating of the pipes with an organic or inorganic coating material both impractical and unreliable from the verification standpoint.

It is feasible to install new full sized encased lines between pairs of cells, and through the walls containing expansion joints to adjacent pairs of cells. This will require cutting new penetrations through the walls and installing shop fabricated feedthrough assemblies (Figure 2), each of which provides five or more new lines. The outer shell of the feedthrough provides secondary containment, draining any leakage back to a lined cell sump.

With the application of the feedthrough concept to providing new pipe between adjacent cells, it is possible by using jumpers to bridge across a cell and from feedthrough to feedthrough and provide a continuous pipe run within cell space for the length of the plant. This would enable complete abandonment of the present unlined HPT. To do so however will add significantly to the congestion in the upper cell space which is needed for maintenance and repair access.

Figures 3, 4, and 5 show three concepts for refurbishing the HPT with new corrosion resistant pipe and a secondary containment liner. All three approaches are discussed in Section 6.0 (and Appendix D) and are considered technically feasible. Each will require further study to determine the optimum approach. The benefit of refurbishing the HPT is that it will provide the routing for long transfers of process solutions within the plant with less upper cell congestion while the cell-to-cell feedthroughs will handle the process flow between adjacent cells, eliminating the need for most of the pipe now in the HPT.

Of paramount concern is how these modifications can be made in an existing plant where high dose rates in at least some cells will preclude manned entry to do core drilling and feedthrough installation in the upper cell region shown on Figure 6. It is probable that some or many of the cells can be accessed manually

Figure 1. 221B Canyon Building

Figure 2. B Plant Replaceable Piping Feedthrough Remotely Installed

79105126.23

Figure 3. B Plant Replaceable Hot Pipe Trench Piping Module with Lower Shielding Support Block

WHC-SD-WM-TA-032
Revision 0

79105126.51

5

Figure 5. B Plant Replaceable Hot Pipe Trench Piping Module

Figure 6. B Plant Piping Feedthrough Core Drilling Safe Zone

B Plant Cross Section Looking East

after removal of existing equipment and decontamination. A shielded platform such as shown on Figure 7 would allow the work to be accomplished at least cost.

Those cells which cannot be manually accessed can be modified remotely using a core drilling machine as shown on Figure 8 and a core extraction system as shown on Figures 9 and 10. A remotely operated manipulator module (Figures 11, 12, and 13) which can be moved from cell to cell by the canyon crane will be used to assist in cell and HPT clean out, service the core drill machine, and assist in new equipment installation. Both of these machines are discussed in more detail in Appendix D and are well within current technology applications at Hanford. For example, over 400 large penetrations (14 in. diameter) were drilled through the eight foot thick wall between B Plant cells and the air exhaust tunnel (Figure 6) during the last major plant modification in the late 1960's. The first electromechanical manipulator (EMM) was used at Hanford in the early 1960's for hot fuel recovery at the old reactors. Subsequent EMM procurements and installations were made in the 1970's at the Fast Flux Test Facility and 1980's for the Fuels and Materials Examination Facility and the 305 Laboratory.

Application of several of the portable, remotely operated manipulator systems shown on Figures 11, 12 and 13 during facility modification and subsequent operation will significantly alter the way remote work is performed in a Hanford type canyon facility and the way cell process and control equipment is designed. For example:

- The systems will enable several cells to be worked on simultaneously rather than one at a time as with the single canyon crane. The result should be significantly reduced plant maintenance down time.
- The systems will greatly reduce or eliminate reliance on the existing canyon crane for performing precision placement of new process components in the cells during facility modification or subsequent operational maintenance.
- The manipulative capability of the systems will offer the cell equipment designer much more flexibility in design of lower cost process or control equipment such as flexible wiring harnesses and piping jumpers instead of more costly precision built rigid jumpers.
- The systems will enable more extensive in situ maintenance of in-cell equipment components instead of more costly major assembly replacement.

Figure 7. B Plant Piping Feedthrough Penetration Manually Operated Core Drilling Machine

79105126.22

Figure 8. B Plant Piping Feedthrough Penetration Remotely Operated Core Drilling Machine

79105126.12

Figure 9. B Plant Piping Feedthrough Penetration Remotely Operated Core Drill Tube Extractor

WHC-SD-MM-TA-032
Revision 0

79105126.27

Figure 10. B Plant Piping Feedthrough Penetration Core Drill Tube and Concrete Slug Disposal System

Figure 11. Portable Remote Manipulator Module

Figure 12. Portable Remote Manipulator Module Arm/Shoulder Assembly

Figure 13. Portable Remote Manipulator Module Operator's Control Station

3.0 RECOMMENDATIONS AND CONCLUSIONS

Modification of B Plant for the production TRUEX mission should be baselined on adding new corrosion resistant piping between cells via the use of replaceable self encasing feedthrough assemblies (Figure 2) that can be shop fabricated for rapid, direct or remote installation. Techniques for lining or coating existing process piping to make it more corrosion resistant do not appear feasible or verifiable.

Figure 6 shows the recommended zone for drilling new penetrations for new piping feedthroughs (Figure 2). This zone will have least structural effect and is also more easily accessed by direct means and with remotely operated equipment.

A block of cells should be selected for the process that are all adjacent to one another. This will maximize the benefit from the use of the cell-to-cell feedthrough (Figure 2) and will minimize the need for inter-cell transfers via the HPT.

Modification of the HPT (using one of the options shown on Figures 3, 4, and 5) is recommended to enable the maximum use of the plant structure for waste pretreatment missions by providing the capability to move untreated and treated wastes throughout the plant. Providing a metallic lining in the HPT as well as all of the cells that will be used for any liquid handling will eliminate much of the basis for opposition to the cost effective use of B Plant for waste pretreatment functions.

Four to five remotely operated manipulator modules (Figure 11) should be built to support modification of the B Plant and eliminate the single canyon crane as the bottle neck to a reasonable construction schedule. The canyon crane will still be required to handle cell and HPT cover blocks, for positioning the EMM modules, for moving new materials to the modules for installation in the cells or HPT and for removing waste. Availability of this type hardware will significantly effect the way new process equipment is designed, installed and maintained. Its use as an operating and maintenance tool will significantly enhance the flexibility of the process equipment designers and the plant operators.

A full-scale Conceptual Design Report and cost estimate should be developed for application of B Plant for the waste pretreatment mission based on the above recommendations and upgrading the Plant's existing services and structure to meet current Federal facility design criteria.

4.0 UNCERTAINTIES

The following will require further engineering work to finalize an appropriate solution but are not considered to represent a "show stopper" condition.

- A means to flush the HPT transfer lines shown on Figure 5 while minimizing the liquid waste generated.
- The technique of anchoring the HPT trays shown on Figure 5 for seismic purposes. Contacts with suppliers of expanding anchor bolts indicate that some work has been done on self drilling bolts. Further investigation and development will be required.
- Techniques for remotely verifying the leak tightness of the HPT trays (Figure 5) after installation, and the correct torque values on anchor bolts.
- The condition of the concrete floors in the HPT will drive the method of anchoring the HPT trays. Recent color photographs and video tapes of the HPT do not indicate serious degradation of the concrete. Further inspection is needed, however.
- Air flow into the cells may be a limiting factor on the number of cells that can be worked on at one time without an increase in the canyon ventilation air throughput. It will be necessary to have three to six cells open at a time to effectively conduct construction work. Present operating practice limits to two, the number of cells open at a time. Strategies for adding air flow and effectively using that available must be developed.

5.0 DESCRIPTION OF ALTERNATIVES AND SOLUTIONS

5.1. CRITERIA

Since this study is an assessment, it is somewhat subjective in nature. However, the following broad criteria were considered in arriving at conclusions and recommendations:

- The means of providing enhanced corrosion resistance in embedded process piping should not excessively impair the present plant process throughput capability
- Means of providing corrosion resistance must be verifiable
- Secondary containment must be provided at all points
- Remotely performed modifications must be accomplished within a reasonable project time frame, i.e., remotely performed in-cell work must generally keep up with non-remote work.

5.2. ASSUMPTIONS

The following assumptions were the basis of this study and the recommendations and conclusion:

- All process chemical lines and process solution lines will require secondary containment
- The B Plant structure may or may not be accepted as the secondary containment envelope
- After cell clean out and decontamination to reasonable economic limitations, many of the cells will not be directly accessible.

5.3. ALTERNATIVES

The following were considered as possible alternatives for providing a more corrosion resistant process piping system in B Plant:

- Organic and inorganic flood coatings in existing embedded pipes
- Nonmetallic liners in existing embedded pipes
- Metallic liners in existing embedded pipes
- Directly installed new piping to replace existing piping
- Remotely installed new piping to replace existing piping
- Alternatives for providing secondary containment for new piping in the HPT.

The concepts of flood coating, expandable and nonexpandable nonmetallic liners were discarded on the basis of the aggressiveness of the process solutions and in consideration of the difficulty of verifying the uniformity of coatings and thicknesses. A further consideration in discarding these concepts was the difficulty in obtaining and maintaining an acceptable covering at piping interfaces such as flanges and nozzles. Appendix A is a letter report describing the Hanford experience with metallic and nonmetallic liners. Both approaches have been labor intensive. The nonmetallic pull-in liners have had limited application and success. The metallic liners have been limited to straighter embedded pipes and have generally reduced the available flow area to less than one third of the original pipe size.

A further consideration with using existing embedded pipe as a routing for more corrosion resistant pipe is that there are only three to four possible inter-cell routings between pairs of cells in a section, and none between adjacent cells in adjacent sections of the building. The existing pipe when used as a conduit and encasement for a new line is still subject to corrosion failure as an encasement if the new line fails.

The recommended approach to providing corrosion resistant piping between the cells and between the cells and HPT is the installation of new, prefabricated feedthroughs and HPT modules that also provide encasement or secondary containment as discussed in Section 3.0.

6.0 DISCUSSION OF RECOMMENDED SOLUTION

As the conclusion was reached during this study that the concept of coating or relining the existing piping was not feasible, and that the use of new piping feedthroughs would be necessary, the question of whether B Plant had the architectural attributes for such a modification and whether the work would be prohibited or restricted by embedded structural features became foremost. These issues were dealt with in two mini-studies which are included in Appendices B and C. The results of these mini-studies is summarized on Figure 6 which shows a recommended drilling or cutting zone which will have minimum impact on the structure and other embedded piping.

It will be advantageous to cut or drill in the lowest 15 in. of the zone shown on Figure 6 since the cover blocks in the HPT probably would not have to be replaced, with savings in old block disposal and new high density replacement blocks. Furthermore, although the cell cover blocks will have to be replaced (or raised by installing a cast iron riser in the cell opening to raise the blocks one 24-in. step) the use of standard density concrete may be feasible and less costly.

Appendix D reports on the effort to identify alternative concepts for B Plant modification that would provide suitable process flow rates (suitable pipe sizes), secondary containment, and methods of performing the work. In summary, the cell-to-cell feedthrough concept and HPT modularized pipe and liner concepts shown on Figures 2 through 5 illustrate what are believed to be feasible approaches to the primary problems of new pipe installation and secondary containment. Figures 7 through 13 summarize the recommended approach for performing work in both situations that can be expected; cells where direct access is feasible and cells where the work must be performed remotely but with greater flexibility and speed than is available using only the canyon crane.

The reader is directed to the appendices for a more detailed discussion of each of these topics.

7.0 NO ACTION ALTERNATIVE

As work continues on the TRUEX Pilot Plant (Project W-153) design it may become apparent that with the use of suitable additives, the corrosion problem may become less of an issue, or no issue. In that case, the use of B Plant as a site for the TRUEX process may revert back to the secondary containment issue and some lesser issues, including the uncertainty about residual wall thickness in embedded pipe. Some cursory investigation of technology for measurement of piping wall thickness indicates that there are devices available that are routinely used for tubing wall thickness measurement in nuclear steam generators that may be adaptable to measuring the wall thickness of B Plant's embedded process lines (see Jones 1987, Lloyd et al. 1991, and Sigma 1988). Assuming the pipe wall thickness issue also proves not to be significant, the remaining containment issue could be encasement of process lines. With no corrective action such as described above, B Plant could be considered unusable for the

TRUEX mission.

8.0 COST ASSESSMENT

A cost assessment of the cost of replacing the embedded piping as discussed above was prepared with the support of Kaiser Engineers Hanford's estimating group. The estimate was structured to provide incremental costs to the existing estimated cost for the B Plant TRUEX Upgrade, Project W-095. That project included clean out of 20 to 25 cells, installation of metallic floor and wall liners and new equipment for the production waste treatment mission at a total estimated cost of \$320 million.

The incremental cost additions to the \$320 million estimate for Project W-095 are as follows:

8.1 OPTION 1

Option 1 is the minimum cost case. It assumes that all existing embedded pipe and pipe in the HPT is usable in some limited form, and that the B Plant structure is acceptable as the secondary containment. It assumes that highly corrosion resistant pipe is needed only between a few selected adjacent cells, and that those cells will be cleaned out and shielded by Project W-095 to allow personnel entry to the upper 10 ft of the cells for manual operation of core drilling equipment and installation of new feedthroughs. (See Appendix E, Cost Estimate Work Scope for details of the Option 1 estimate.)

Estimated incremental cost addition \$8,780,000.

8.2 OPTION 2

Option 2 is the maximum cost case. It assumes that the existing embedded piping to the HPT, between adjacent cells, and the HPT piping is unusable, that the embedded piping to the cold side piping gallery is usable, that the B Plant structure is not acceptable as the means of secondary containment, that secondary containment is needed for all process piping, and that all work in the cells and HPT will be done remotely. (See Appendix E, Cost Estimate Work Scope for details of the Option 2 estimate.) Option 2 is further broken into three alternatives that are based on the treatment of the HPT as shown on Figures 3, 4, and 5.

8.3 OPTION 2A (BASED ON FIGURE 3 HPT MODIFICATION)

Option 2a is based on using new high density cover blocks on all cells and the HPT. High density shielding blocks will be installed in the neck of the HPT to seal off the existing piping and a new, lined HPT constructed on top of the shielding blocks.

The cover blocks would be supported 16 in. below the top of the opening and

would stand an estimated 8 in. above the canyon floor. Costs include disposal of the existing cover blocks.

Estimated incremental cost addition \$135,900,000.

8.4 OPTION 2B (BASED ON FIGURE 4 HPT MODIFICATION)

Option 2b is based on using new high density concrete cover blocks on all cells and the HPT. The top of the cell cover blocks would be flush with the canyon floor and the top of the HPT cover blocks would probably be flush or raised about 8 in. above the canyon floor. Costs include disposal of the existing cover blocks and pouring the lower 24 to 30 in. of the HPT full of concrete to entomb the existing HPT piping.

Estimated incremental cost addition \$134,200,000.

8.5 OPTION 2C (BASED ON FIGURE 5 HPT MODIFICATION)

Option 2c is based on using new high density cell cover blocks and reusing the existing HPT cover blocks. All cover blocks would be flush with the canyon floor. Costs include disposal of the cell cover blocks and removal and disposal of all existing HPT piping.

Estimated incremental cost addition \$163,400,000.

The cost of the recommended case is bounded by cost alternatives 2A, 2B and 2C and must be finalized during conceptual design by trade studies of those cases. Based on the above, the replacement of cell-to-cell, and cell-to-HPT piping with new encased or enclosed piping would add between \$134 M and \$163 M to the base \$320 M estimated cost to clean out and line twenty to twenty five cells and outfit them with new process equipment.

The above estimated incremental costs include escalation based on start up of Project W-095 by March 2002, contingency factors based on current level of uncertainties, operating costs for B Plant personnel to support remote installations, and costs for solid and liquid waste disposal.

9.0 REFERENCES

- Jones, J. A. Applied Research Company, 1987, *Nondestructive Evaluation of Ferritic Piping for Erosion-Corrosion*, EPRI NP-5410, Electric Power Research Institute.
- Lloyd, E. A. and J. B. Spooner, 1991, "Single Pass Inspection For Steam Generator Tubes," *Nuclear Engineering International*, Vol. 36, No. 444.
- Sigma Research, Inc., 1988, *Adaptation of the PARIS Technology for Measuring Wall Thinning in Ferritic Steel Components*, EPRI NP-5961, Electric Power Research Institute.

This page intentionally left blank.

APPENDIX A
EMBEDDED (PROCESS) PIPE LINING ASSESSMENT

This page intentionally left blank.

Westinghouse
Hanford Company

Internal
Memo

From: TRUEX Projects 85330-91-020
Phone: 3-2365 S4-68
Date: June 17, 1991
Subject: B PLANT PROCESS PIPING REPLACEMENT FEASIBILITY STUDY--
EMBEDDED PIPE LINING ASSESSMENT REPORT

To: M. L. Grygiel S6-65

cc: P. A. Baynes S6-70
M. A. Cahill R3-46
J. W. Gehrke S6-70
M. J. Gunderson S6-81
B. K. Horsager S4-68
M. E. Johnson S4-58
S. E. Jones S6-61
D. F. Salsman S6-81
S. J. Street* S4-58
GFH File/LB
*w/o attachment

Attached for your review is the Embedded Pipe Lining Assessment Report in satisfaction of Task 2 of the B Plant Process Piping Replacement Feasibility Study. The report was originally due on June 7, 1991.

Please call me if you have any questions about this report.

G. F. Howden
Principal Engineer

mks

Attachment

This page intentionally left blank.

**B PLANT PROCESS PIPING
REPLACEMENT FEASIBILITY STUDY
EMBEDDED PIPE LINING ASSESSMENT**

June 14, 1991

Prepared By

Gary F. Howden
TRUEX Projects

This page intentionally left blank.

ACKNOWLEDGMENTS

The author wishes to acknowledge with appreciation the contributions of the following persons to the preparation of this work:

R. R. Buel, Manager of Mechanical Maintenance at PUREX for historical background on embedded pipe repair at PUREX.

R. D. Campbell, Kaiser Engineers Hanford, for evaluation of concepts and suggestions on design of proposed equipment.

J. W. Gehrke, B Plant Process Engineering, for insight on past projects that have modified the design of B Plant.

M. J. Gunderson, B Plant Design Engineering, for concepts on location of new pipe routings.

R. L. Hibbard, Manager of Fabrication Services for historical background on PUREX embedded pipe repair experience.

S. E. Jones, Manager of Mechanical Maintenance at B Plant for historical background at B Plant and assistance in making contacts at PUREX.

R. C. Roal, Manager of Engineering at PUREX for background on PUREX embedded pipe repair experience.

This page intentionally left blank.

CONTENTS

PURPOSE	A-11
SCOPE OF WORK	A-11
GENERAL ARRANGEMENT	A-11
HISTORICAL EXPERIENCE	A-12
ASSESSMENT	A-13
ASSESSMENT CASE 1	A-13
CONCLUSION CASE 1	A-14
ASSESSMENT CASE 2	A-14
CONCLUSION CASE 2	A-15
REFERENCES AND FOOT NOTES	A-16

LIST OF FIGURES

Figure 1	221B Canyon Building	A-17
Figure 2	Drawing D-61259, Embedded Piping Details	A-18
Figure 3	Drawing HW-69882, Piping Through Concrete Standard Section .	A-19
Figure 4	Drawing H-2-60876, Cell 17 In-Cell Piping Arrangement. . . .	A-20
Figure 5	Drawing H-2-60888, Cell 27 In-Cell Piping Arrangement. . . .	A-21
Figure 6	Insert For Routing New Process Lines Between Cells	A-22
Figure 7	B Plant New Process Piping Manual Installation	A-23
Figure 8	Feedthrough To Be Installed In Core Drilled Holes Between . .	A-24
Figure 9	Cells B Plant Replaceable Hot Trench Module	A-25

This page intentionally left blank.

**B PLANT PROCESS PIPING
REPLACEMENT FEASIBILITY STUDY
EMBEDDED PIPE LINING ASSESSMENT**

PURPOSE

A number of feasibility studies and assessments have been initiated in support of redefining the double shell tank waste disposal strategy. The B Plant Process Piping Replacement Feasibility Study, which is one element of that work, addresses the feasibility of partial or extensive process piping replacement if corrosion or other conditions preclude use of some or all of the existing process piping. The study includes:

- o An architectural assessment.
- o A review of the existing embedded piping arrangement, location, and characteristics that might support routing new piping through existing embedded piping.
- o A structural design assessment to determine if insurmountable impediments exist to making new piping penetrations.
- o An assessment of new technology for cutting large diameter (38.1 cm to 50.8 cm [15-in. to 20-in.]) and long (2.2 m [7-ft]) penetrations and equipment concepts for manually and remotely performing this work.
- o Concepts for new piping installation.

This interim report describes the findings of the embedded pipe lining assessment.

SCOPE OF WORK

This assessment will review the geometric characteristics of the existing embedded 25-12 CB process pipe and assess both the logic and feasibility of using these pipe routings as pathways for installation of new, more corrosion resistant material or pipe.

GENERAL ARRANGEMENT

The B Plant was constructed as a series of twenty essentially identical 12.2 m (40-ft) long modules whose cross section is generally shown on Figure 1 (All Figures referenced in Appendix A start on Page A-17). Adjacent modules were structurally keyed together but separated by an expansion joint. Each module typically contains two process cells separated by a 2.2 m (7-ft) thick concrete

wall, and a section of hot pipe trench (HPT) through which process piping was routed to interconnect to cells in adjacent 12.2 m (40-ft) sections.

Typically there are four 5.1 cm (2-in.) embedded process lines of 25-12 CB steel running between the two cells in a section. There are no embedded lines crossing between adjacent cells in adjoining sections separated by an expansion joint. To get process solutions between cells in adjoining 12.2 m (40-ft) sections (separated by an expansion joint) presently requires routing via the HPT.

The four 5.1 cm (2-in.) embedded process lines have the offsets as shown on Drawing D-61259, (see Figure 2). Of these, the two crossover lines shown as D-61259-C, which have a 15.2 cm (6-in.) offset with long, 1.8 m (6-ft) radius bends. The single line shown as D-61259-B has a long 1.7 m (5-ft, 6-in.) radius bend and a shorter 0.61 m (2-ft) radius bend with a point of inflection between. The single line shown as D-61259-A is generally "S" shaped with two long 1.7 m (5-ft, 6-in.) radius bends. It is complicated however by a sharp 8.9 cm (3.5-in.) offset with 30 cm (12-in.) radius bends near it's midpoint.

The embedded piping routed from the cell nozzles to the HPT is generally shown on Drawing HW-69882 (see Figure 3). Those lines exiting the cells to the HPT have an immediate 90 degree bend whose radii varies from 0.3 m to 0.9 m (12- to 37-in.) and two additional bends per line of varying severity before entering the HPT.

During the late 1960's and early 1970's, modifications were made to a number of B Plant cells to refit them for processing tank wastes to recover strontium and cesium. Those changes used 304 stainless steel and forged 90 degree elbows and fittings. Drawings H-2-60876 and H-2-60888, (see Figures 4 and 5) show typical arrangements which include; core drilling between the HPT and cells to route new lines between the cells and HPT; surface routing new process piping on the cell walls.

As part of these plant modifications the HPT was completely stripped out and cleaned for personnel entry. All new piping with short radius forged stainless steel elbows was installed.

HISTORICAL EXPERIENCE

There has not been an occasion to attempt to repair any of the process lines by "relining" at B Plant. A number of investigations of the feasibility of remotely relining the 0.6 m (24-in.) diameter cell drain header have been made. That problem is significantly different from the process pipe line relining issue due to the difference in relative sizes of the lines, and the different operating conditions.

There were occasions at PUREX where relining was employed. During construction of PUREX, some embedded stainless steel lines were wrapped with an insulation material containing a chloride compound. Heat from steam in steam feeder lines to the cells caused a break down of the insulation and liberation of chloride ions which attacked the stainless steel pipes causing failure.

An early repair approach was to pull in a (Teflon¹) liner and field form the material into a flange on each end to provide a seal. A fairly high failure rate of the field formed flanges lead to a search for other repair solutions.

Another approach to repair the steam lines between a cell and the cold side pipe gallery was by pulling in a metal hose. That technique involved pulling a corrugated stainless steel thin walled tube (similar to those used for residential water heater hookup) with a protective woven wire covering through an embedded line from the cell side to the corridor side using heavy duty pulling equipment located in the pipe gallery.

In both situations, personnel were able to enter the upper region of the cell to handle and feed the new liner and subsequently to install new in-cell connection hardware.

There was a pipe repair at PUREX that involved repairing a larger (believed to be 5 cm [2-in.] pipe) line to the cask loading station at PUREX. In that case, a smaller (1.3 cm to 1.9 cm [0.5-in. or 0.75-in.]) stainless steel pipe was pulled through the larger failed line. This work was done sometime in the 1960's and as a result of extensive retirement of personnel of that period, efforts to identify the full details of the repair have not succeeded.

ASSESSMENT

In considering the issue of relining existing embedded process pipes to attain higher corrosion resistance, a number of questions arise.

1. Is double containment of the solution required within the B Plant structure?
2. If back up containment is required, is the same level of higher corrosion resistance required of the back up containment?
3. Must the highly corrosive solution be transferred across an expansion joint to an adjacent section of the building? (If so, it must now be routed via the HPT.)
4. Are the available (four maximum) lines between adjacent cells within a section sufficient, assuming that all four could be relined?

ASSESSMENT CASE I

In considering the above questions, if it is determined that the B Plant structure is acceptable as a secondary form of containment for the contained process equipment and piping, then:

- Schedule 40- pipe in 1.9 cm (0.75-in.) and possibly 2.5 cm (1-in.) pipe sizes could be pulled through the two 5 cm (2-in.) diameter lines on Figures 2 and 3 identified as D-61259-C.
- Flexible metal hoses in the 2.5 cm to 3.2 cm (1- to 1.25-in.) size range could be pulled through at least three of the four 5 cm (2-in.) lines that join the pair of cells within a 12.2 m (40-ft) section of

the plant.

- A technique would have to be developed to field attach the nozzle on at least one end, and to fix the nozzle to the cell walls on both ends. If the cell can be cleaned to allow personnel access, the nozzle installation could be readily accomplished under Special Work Permit conditions. If the cell cannot be cleaned to allow personnel entry, the task would be more difficult and costly to do remotely, requiring a significant tooling and equipment development effort.
- There is not a way to pull a liner from a cell to the HPT without major cleanup and at least partial removal of installed piping in the HPT to allow manual connection of the new line to new pipe runs in the HPT.
- The liner will reduce the flow capacity of the line.
- The thinner walls of flexible metal hoses would be subject to earlier corrosion failure than heavier pipe.
- A liner leak within a wall would destroy the existing embed and could cause serious structural concrete damage.
- Four lines between a pair of cells may be insufficient for the needed process.

CONCLUSION CASE 1

If the B Plant envelope is acceptable as the secondary containment of process lines routed within it, it is believed feasible to route highly corrosion resistant lines through at least three of the four existing lines between cells within a section, but not through existing lines to cells in adjacent 12.2 m (40-ft) sections of the building where routings would be via the HPT.

A more cost effective method of routing lines between cells within a 12.2 m (40-ft) section as well as across the expansion joint between cells in adjacent sections is shown on Figures 6 and 7. The method would involve manually core drilling one or more 35-38 cm (14- to 15-in.) diameter holes through the wall between adjacent cells and inserting a shop fabricated insert like that shown on Figure 6, then field attaching the rest of the lines as shown on Figure 7 to the stub pipes on the opposite end of the insert in the adjacent cell.

The outer shell of the insert would provide containment to the process lines within, even while crossing the expansion joints. The insert would be bolted to the cell wall at one end only to maintain alignment of the nozzle bar and to allow the insert to "float" within the hole to accommodate any building movement at the expansion joints.

Use of a feedthrough as shown on Figure 6 would enable installation of full sized process lines with heavier walled, corrosion resistant pipe and would not limit process design to three or four lines between cells within a building section.

ASSESSMENT CASE 2

In considering the above four questions, if it is determined that the B Plant structure IS NOT acceptable as a secondary form of containment for the contained process equipment and piping, then:

- Pipe relining should not be undertaken, since a fault in the new line or liner would expose the existing embed and surrounding concrete to highly corrosive solutions.
- A means of routing doubly contained lines between the cells and possibly the cells and HPT will be required.
- A means of routing doubly contained lines across expansion joints to other sections of the building will be needed.
- The piping in the HPT may need replacement, including provision of a means of secondary containment.
- Discussions with J. F. Williams, Jr. (Environmental Engineering/ RCRA Permits) indicate that the secondary containment will have to meet the requirements of WAC 173-303.

CONCLUSION CASE 2

If the outcome of the current effort to qualify the B Plant as the secondary containment barrier to all contained process equipment and piping is not successful, use of the B Plant will require not only lining of the cells, but the routings for piping between cells. Figure 8 shows a shop fabricated feedthrough that could be either manually or remotely installed in 35-38 cm (14- to 15-in.) diameter core drilled holes between the cells, or cells and HPT. As with Figure 6, the outer shell would serve as secondary containment for the lines passing through it. The outer shell would be anchored by a bolt at one end to maintain nozzle bar alignment while allowing the assembly to "float" within the wall penetration to accommodate expansion of the assembly or building movements at expansion joints between building sections. Any internal leakage would drain to the lined cells.

Figure 9 shows a proposed shop fabricated HPT module that could be used to replace the existing stainless steel HPT piping with more corrosion resistant materials while providing secondary containment. As shown on Figure 9, the module would:

- ~ Be fabricated in 6 m (20-ft) long sections joined by tie plates on the top corners
- ~ Have a corrosion resistant liner inside of a structural frame
- ~ Have 1.2 m (4- ft) high sides and 0.6 m (2-ft) high ends, providing a containment capacity of 1,800 gallons per module
- ~ Be equipped with a level sensor and an air jet sump pump
- ~ Carry 12 pipe lines and one instrument and control conduit. Of the 12 pipe lines, one would be a drain line for the sumps, one an air supply line, one a water supply line for water flushing, leaving 9 process lines for longer transfers between cells. (Cell to cell

transfers would be direct via inter-cell feedthroughs as shown on Figure 8.)

- Connect to adjacent modules via a splash shroud over the end panels and pipe jumpers to connect the pipe and conduit to provide a full plant length set of transfer lines
- Be capable of being either manually installed if the HPT can be cleaned up, or remotely installed
- Eliminate all existing cell to HPT process lines.

In summary, if the present B Plant structure is accepted as the means of secondary containment for contained systems, Gardner et al. 1990 recommends against pipe lining with non-metallic materials and there is a better and cost competitive way to provide cell-to-cell transfers of process solutions, including across expansion joints. If the plant is not accepted as a secondary containment and doubly contained lines must be provided, that is an even greater reason to avoid trying to reline the few existing inter-cell transfer lines and to pursue a new approach such as illustrated in Figures 8 and 9.

REFERENCES

Drawing D-61259, Embedded Piping Details.

Drawing HW-69882, Piping Through Concrete, Standard Section.

Drawing H-2-60876, Cell 17 In-Cell Piping Arrangement.

Drawing H-2-60888, Cell 27 In-Cell Piping Arrangement.

Gardner, H. R., E. B. Schwenk, and P. C. Ohl, 1990, *Evaluation of B Plant Secondary Containment Upgrade Alternatives*, WHC-SD-WM-TI-417, Rev. 0, transmitted by EDT 115164, Westinghouse Hanford Company, Richland, Washington.

WAC 173-303, Dangerous Waste Regulations, Washington State Department of Ecology, Amended December, 1993.

FOOT NOTES

1. Teflon is a trademark of the E. I. du Pont de Nemours and Company

Figure 1. 221B Canyon Building.

Figure 2. Drawing D-61259, Embedded Piping Details.

Figure 3. Drawing HW-69882, Piping Through Concrete, Standard Section.

BEST AVAILABLE

A-20

Figure 5. Drawing H-2-60888, Cell 27 In-Cell Piping Arrangement.

MHC-SD-WM-TA-032
Revision 0

A-21

BEST AVAILABLE COPY

Figure 6. Inserts for Routing New Process Lines Between Cells.

Figure 7. B Plant New Process Piping Manual Installation.

A-23

WHC-SD-MM-TA-032
Revision 0

Figure 8. Feedthrough to be Installed in Core Drilled Holes Between Cells.

79105126.17

Figure 9. B Plant Replaceable Hot Trench Module.

This page intentionally left blank.

APPENDIX B
ARCHITECTURAL ASSESSMENT

This page intentionally left blank.

Westinghouse
Hanford Company

Internal
Memo

From: TRUEX Projects 85330-91-018
Phone: 3-2365 S4-68
Date: May 31, 1991
Subject: B PLANT PROCESS PIPING REPLACEMENT FEASIBILITY STUDY--
ARCHITECTURAL ASSESSMENT REPORT

To: M. L. Grygiel S6-65

cc: J. W. Gehrke S6-70
M. J. Gunderson S6-81
B. K. Horsager S4-68
M. E. Johnson S4-58
D. F. Salsman S6-81
S. J. Street* S4-58
GFH File/LB
*w/o attachment

Attached for your review is the Architectural Assessment Report in satisfaction of Task 1 of the B Plant Process Piping Replacement Feasibility Study. The report was due on this date.

Please call me if you have any questions about this report.

G. F. Howden
Principal Engineer

mks

Attachment

This page intentionally left blank.

**B PLANT PROCESS PIPING
REPLACEMENT FEASIBILITY STUDY
ARCHITECTURAL ASSESSMENT**

May 31, 1991

Prepared By

**Gary F. Howden
TRUEX Projects**

This page intentionally left blank.

ACKNOWLEDGEMENTS

The author wishes to acknowledge with appreciation the contributions of the following persons to the preparation of this work:

M. J. Gunderson, B Plant Design Engineering, for concepts in location of new pipe routings.

J. W. Gehrke, B Plant Process Engineering, for insight on past projects that have modified the design of B Plant.

This page intentionally left blank.

CONTENTS

PURPOSE	B-10
SCOPE OF WORK	B-10
GENERAL ARRANGEMENT	B-10
ASSESSMENT	B-11
HISTORICAL EXPERIENCE	B-12
CONCLUSIONS	B-12
REFERENCES	B-13

LIST OF FIGURES

Figure 1	221B Canyon Building	B-14
Figure 2	Chemical Sewer - B Plant Area Map.	B-15
Figure 3	Drawing HW-69882, Piping Through Concrete, Standard Section.	B-16
Figure 4	B Plant Piping Feedthrough Core Drilling Safe Zone	B-17
Figure 5	Sketch - Penetrations Through Cell, Typical Section.	B-18
Figure 6	B Plant New Process Piping Manual Installation	B-19

**B PLANT PROCESS PIPING
REPLACEMENT FEASIBILITY STUDY
ARCHITECTURAL ASSESSMENT
MAY 30, 1991**

PURPOSE

A number of feasibility studies and assessments have been initiated in support of redefining the DST waste disposal strategy. The B Plant Process Piping Replacement Feasibility Study, which is one element of that work addresses the feasibility of partial or extensive process piping replacement if corrosion or other conditions preclude use of some or all of the existing process piping. The study includes:

- An architectural assessment of the inter-relationships of the cells, hot pipe trench and canyon gallery.
- A review of the existing embedded piping arrangement, location, and characteristics that might support routing new piping through existing embedded piping.
- A structural design assessment to determine if insurmountable structural impediments exist to making new piping penetrations.
- An assessment of new technology for cutting large diameter (38.1 cm to 50.8 cm [15 in.-20 in.]) and long (2.2 m [7 ft]) penetrations, and equipment concepts for manually and remotely performing such work.
- Concepts for new piping installations.

This interim report describes the findings of the architectural assessment.

SCOPE OF WORK

This assessment will review the major design attributes of the B Plant, and assess those attributes from the standpoint of supporting the addition of new pipe routings.

GENERAL ARRANGEMENT

The B Plant was designed and constructed as a series of very similar or identical modules. Figure 1 (see Pg B-14) shows the general cross section of the plant. Figure 2 is a plan view of the plant and site. It will be noticed on Figure 2 that twenty sections are identified. Those sections represent the 12.2 m (40-ft) long segments that make up the B Plant. While the first, second, fifth and twentieth sections have some unique features, each of the other sixteen sections were constructed essentially as replicas of each other. Each 12.2 m (40-ft) long section contains two process cells that are 8.53 m (28-ft) deep (measured from the canyon floor), 5.4 m (17-ft, 8-in.) long (N-S)

and 3.96 m (13-ft) wide (E-W). As designed, the cells are covered with three 1.8 m (6-ft) thick concrete cover blocks leaving a cell clear height of 6.7 m (22-ft).

The walls between the two cells are 2.2 m (7-ft) thick concrete. The cells outer side walls (the walls adjacent to the joints between sections) are 1.1 m (3-ft, 6-in.) thick (which with the 1.1 m (3-ft, 6-in.) wall of the adjacent cell in the next section provides 2.2 m (7-ft) separation between all cells). Figure 3 (Reference 1) shows a massive male/female joint coupling each successive section and providing for expansion-contraction of the sections.

Process piping as originally installed enters the typical cell on the west, north and east walls, 2.74 m (9-ft) below the canyon floor. In some 12.2 m (40-ft) sections of the plant, a few embedded process pipe lines pass through the wall between the two cells in a section, but no embedded process pipes pass between cells separated by an expansion joint between adjacent sections. Most cell to cell pipe routings are through the hot pipe trench.

The south wall of the typical cell is separated from the adjacent hot pipe trench by a 1.83 m (6-ft) thick concrete wall, and from the air tunnel by a 2.2 m (7-ft) thick concrete wall. (References 2 & 3)

The hot pipe trench is 2.44 m (8-ft) wide and 3.2 m (10-ft, 6-in.) deep (from the canyon floor). As designed, the trench is covered by stepped concrete shielding blocks that are 1.37 m (4-ft, 6-in.) thick leaving a 1.83 m (6-ft) clear height with the covers in place. The floor of the pipe trench in a typical 12.2 m (40-ft) section slopes 7.6 cm (3-in.) toward a drain located near the center of the section.

ASSESSMENT

A review of the B Plant construction drawings (References 1, and 3 through 8) indicates a number of prominent embeds in the cells east walls (cell wall face to a depth of 1.1 m (3-ft, 6-in.) which are summarized on Figure 4.

The presence of the 6-in. cast iron process sewer drain line in the area below the row of process pipe line nozzles precludes new wall penetrations between cells immediately below the original nozzles (In many cells that wall area is now occupied by surface run piping to newer nozzles installed in the 1960 period) without a direct decision to stop use of the process sewer in some cells.

Also as noted on Figure 4, a cell spray header is embedded in the cell walls at elevations (-)2.2 m (7-ft), (-)3.35 m (11-ft, 6-in.), and (-)5.95 M (19-ft, 6-in.). The spray headers loop the cell providing water to one or two spray heads on each wall. Drilling between the cells, or cells and hot pipe trench in the area immediately above the original nozzles would jeopardize cutting the spray header at (-)2.2 m (7-ft), which would disable all of the spray headers since they are fed by a common embedded supply line from the cold side piping gallery. The lower edge of any holes drilled between cells or the pipe trench need to be above the (-)2.2 m (7- ft) elevation.

Figure 4 also notes two 15 cm (6-in.) diameter instrument wells located 68.6 cm (27-in.) into the concrete from the cell east wall face. The wells are 3.66 m (12-ft) apart, but provide space between them and on either side for drilling new cell-to-cell penetrations. Recesses in the cell walls to the instrument wells as noted on Figure 4 serve as windows into the cells for instrumentation.

Gunderson (Reference 9) has suggested the concept of employing high density concrete cell and trench cover blocks which would reduce the thickness and allow drilling in the area noted on Figure 4. Figure 5 graphically shows penetrations in the area of the lower step of the existing 1.85 m (6-ft) thick cover blocks by using the thinner and/or raised cover blocks. Reference 9 also suggests the possibility of installing a shielded construction deck, Figure 5 in the area above the nozzles, allowing the manual operation of drilling equipment and manual installation of new piping as shown on Figure 6. If the cells can be sufficiently decontaminated this concept has much to offer since it would require the least number of new wall penetrations.

In the event that some or most cells cannot be decontaminated and/or shielded to allow direct work in the upper cell area, concepts for application of well tested robotics technology are being developed to enable remote drilling of cell-to-cell penetrations and pipe replacement. (Those concepts will be presented and discussed in another interim report of the pipe replacement studies).

The south wall of the cells had no process pipe line nozzles as originally installed lines. Some new surface run process lines and nozzles were installed on the south wall in the late 1960 period. The area above the (-)2.2 m (7-ft) line is clear for new cell-to-pipe trench penetrations.

The minimum 3.96 m (13-ft) width dimension of the cells compared to the 2.2 m (7-ft) thickness of the cell walls that would have to be drilled for new pipe routings is favorable for either manually or remotely operated drilling equipment. The 3.96 m (13-ft) minimum width will allow adequate room for use of one piece core drilling drill tubes which, with drives and feed mechanism would require 3 m to 3.7 m (10-ft to 12-ft) of the cells width for operation.

HISTORICAL EXPERIENCE

There is significant historical experience in B Plant for provision of new penetrations between cells, cells and the hot pipe trench, and cells to the air exhaust tunnel shown on Figure 4. During the mid-1960's, a major modification of the plant was made to change it's processing mission. References 10 and 11 describe typical cell modifications for a number of plant cells which involved cutting new cell-to-cell and cell-to-hot pipe trench penetrations, and installation of new process piping. Reference 12 describes the cutting of six to twelve 35.6 cm (14-in.) diameter vent holes through the 2.2 m (7-ft) thick concrete wall between each cell and the exhaust tunnel. The combination of new pipe penetrations and vent holes required over 400 new large diameter penetrations for that project.

CONCLUSIONS

The actual number of new highly corrosion pipe routings that would be required for a production TRUEX process in B Plant has not been determined at this time. For a very limited number, new routings cell-to-cell would be a minimum cost approach, particularly if many or all can be done manually. If new code requirements and environmental concerns require large scale pipe replacement, a major replacement of pipe in the hot pipe trench would be required. That issue is outside the scope of this assessment and will be discussed in a future interim report. The conclusion of this assessment is that there are no architectural impediments to installing limited or large scale new pipe penetrations in the zone identified on Figure 4.

REFERENCES

1. Dwg HW-70102, Piping Through Sections 3 & 4, Plan, Building 221.
2. Dwg W-69565, Standard Sections, Concrete Plans, Building 221.
3. Dwg W-69566, Standard Sections, Concrete Sections and Details, Building 221.
4. Dwg HW-69880, Standard Sections, Support and Guide Arrangement, Plan and Sections, Building 221.
5. Dwg HW-70101, Piping Through Concrete, Building 221.
6. Dwg HW-70103, Piping Through Concrete, Section 15 Sections, Building 221.
7. Dwg HW-70104, Piping Through Concrete, Section 15 Plans, Building 221.
8. Dwg HW-70144, Piping Through Concrete, Section 5 Plans, Building 221.
9. Memo 91-154-DSI, M. J. Gunderson to G. F. Howden/B. K. Horsager, Interim Report On The Feasibility Study of Replacing Existing Embedded Piping In B Plant, dated May 6, 1991.
10. Dwg H-2-60876, Cell 17 In Cell Piping Arrangement.
11. Dwg H-2-60877, Cell 18 In Cell Piping Arrangement.
12. Dwg H-2-32582, Structural Demolition Plan-Cell 15, & Vent Hole Arrangement-All Cells.

Figure 1. 221B Canyon Building.

Figure 2. Chemical Sewer - B Plant Area Map.

Figure 3. Drawing HW-69882, Piping Through Concrete, Standard Section.

BEST AVAILABLE COPY

Figure 4. B Plant Piping Feedthrough Core Drilling Safe Zone.

79105126.13

Typical Embedments in Cell East Wall

B Plant Cross Section Looking East

Figure 5. Sketch - Penetrations Through Cell Typical Section.

Figure 6. B Plant New Process Piping Manual Installation.

This page intentionally left blank.

APPENDIX C
STRUCTURAL ASSESSMENT

This page intentionally left blank.

Westinghouse
Hanford Company

Internal
Memo

From: TRUEX Projects 85330-91-019
Phone: 3-2365 S4-68
Date: June 6, 1991
Subject: B PLANT PROCESS PIPING REPLACEMENT FEASIBILITY STUDY-STRUCTURAL
ASSESSMENT REPORT

To: M. L. Grygiel S6-65

cc: C. R. Cruz S6-81
J. W. Gehrke S6-70
M. J. Gunderson S6-81
B. K. Horsager S4-68
M. E. Johnson S4-58
D. F. Salsman S6-81
S. J. Street* S4-58
GFH File/LB
*w/o attachment

Attached for your review is the Structural Assessment Report in satisfaction of Task 3 of the B Plant Process Piping Replacement Feasibility Study. The report was due on June 7, 1991.

Please call me if you have any questions about this report.

G. F. Howden
Principal Engineer

mks

Attachment

This page intentionally left blank.

**B PLANT PROCESS PIPING
REPLACEMENT FEASIBILITY STUDY
STRUCTURAL ASSESSMENT**

June 6, 1991

Prepared by

Gary F. Howden
TRUEX Projects

This page intentionally left blank.

ACKNOWLEDGEMENTS

The author wishes to acknowledge with appreciation the contributions of the following persons to the preparation of this work:

C. R. Cruz, B Plant Design Engineering, for structural review.

J. W. Gehrke, B Plant Process Engineering, for insight on past projects that have modified the design of B Plant.

This page intentionally left blank.

CONTENTS

PURPOSE	C-11
SCOPE OF WORK	C-11
GENERAL ARRANGEMENT	C-11
ASSESSMENT	C-12
HISTORICAL EXPERIENCE	C-13
CONCLUSIONS	C-13
REFERENCES	C-13
CORRESPONDENCE	C-14

LIST OF FIGURES

Figure 1	Drawing W 70102, Piping Through Sections 3 & 4,	C-18
	Plan, Building 221	
Figure 2	Drawing W 70102, Plan of Electrical and Instrument	C-19
	Conduit Lines	
Figure 3	B Plant Piping Feedthrough Core Drilling Safe Zone	C-20
Figure 4	Drawing W 79103, Piping Through Section 15, Sections,	C-21
	Building 221	
Figure 5	Sketch - Penetrations Through Cell Typical Section	C-22
Figure 6	Building 221B, 20 Inch Plug with Four 4 Inch Nozzles	C-23

This page intentionally left blank.

**B PLANT PROCESS PIPING
REPLACEMENT FEASIBILITY STUDY
STRUCTURAL ASSESSMENT**

PURPOSE

A number of feasibility studies and assessments have been initiated in support of redefining the double shell tank waste disposal strategy. The B Plant Process Piping Replacement Feasibility Study, which is one element of that work, addresses the feasibility of partial or extensive process piping replacement if corrosion or other conditions preclude the use of some or all of the existing process piping. The study includes the following:

- ~ An architectural assessment
- ~ An assessment of the feasibility of relining existing embedded piping
- ~ A structural assessment
- ~ A review of new large hole drilling technology and development of concepts for manual and remotely operated drilling machines
- ~ Concepts for new piping installations.

This is the third of the series of assessments. It deals with structural features and other embedments that would be impediments to drilling new piping penetrations between the adjacent cells, cells and hot pipe trench, and cells and cold side pipe gallery.

SCOPE OF WORK

This assessment will review the major structural design features of B Plant, the presence of other embedments in the concrete walls, and identify cell areas that may be available for drilling new pipe penetrations.

GENERAL ARRANGEMENT

Howden 1991 provides a description of the B Plant construction, using the technique of linking a series of essentially identical 12.2 m (40-ft) sections to develop the full plant length.

In constructing a typical 12.2 m (40-ft) section, the drawings (Drawings W 69565 and W 69566) indicate that a 1.8 m (6-ft) thick base mat of concrete was poured (top of base mat elevation -8.5 m [28-ft], where the canyon floor is elevation "0") upon which the lower level walls were

constructed to an elevation of -3.3 m (10-ft, 11-in.) Extending approximately 0.8 m (2-ft, 9-in.) above this major construction joint were 1.9 cm (0.75-in.) diameter rebar pins. The pins were set 0.6 m (2-ft) on center, near each cell wall surface. As a result, the drawings show no rebar in the east, south or west cell walls above the rebar pins whose top elevation is about -2.5 m (8-ft, 2-in.).

The drawings (Drawings W 69565 and W 69566) indicate that embedded in the center of the north wall of each cell starting at the construction joint (elevation -3.3 m [10-ft, 11-in.]) is a 0.9 m (3-ft) wide by 2.1 m (7-ft) deep (north-south) reinforced concrete column. This column rises to an elevation of +3.8 m (12-ft, 6-in.) above the canyon floor and is fully embedded in the canyon north wall above the (elevation "0") floor level. Drawings W 70102 and W 70103 indicate that the embedded process piping and conduit from the cells to the cold side pipe and electrical galleries is routed around these embedded columns as shown on Figures 1 and 2, Appendix C.

ASSESSMENT

The Architectural Assessment, (Howden 1991) identified a number of B Plant design characteristics that favor a core drilling zone as shown on Figure 3. Continuing with that assessment, the structural considerations would add the following:

- ~ As noted in the above General Arrangement section, there is no rebar in the east, west or south walls of the cells in the penetration zone shown on Figure 3.
- ~ As noted on Figures 1, 2, and 4, the north wall of the typical cell is heavily occupied with the 0.9 m x 2.1 m (3-ft by 7-ft) structural column and embedded process pipe and conduit except in a narrow 38 cm to 51 cm (15- to 20-in.) wide vertical strip near the northeast and northwest corners of the cell. Those zones could be used for drilling new penetrations between the operating gallery and cell for new chemical make-up lines and new instrumentation and control lines.
- ~ Cruz (Cruz 1991, copy attached) recommends the use of up to three 38 cm (15-in.) diameter penetrations in the south cell wall to the hot pipe trench as shown on Figure 5. With a feedthrough such as shown on Figure 5, two to three larger sized process lines could be handled in each penetration, which would be combined with new direct feedthroughs between cells.
- ~ Referring to Figure 3 the east and west walls could probably accommodate three 38 cm (15-in.) diameter penetrations between the two instrument wells and one on each outer side of the instrument wells for a total of five penetrations. That would provide routings for 10 to 15 larger sized 3.8 cm to 5.1 cm (1.5- to 2 in.) process lines between two adjacent cells. A feedthrough such as shown on Figure 6, where passing through walls between cells that have expansion joints in the wall, would provide shared secondary containment for the process pipes.

- Using a feedthrough such as shown on Figure 6 when passing through a cell wall containing an expansion joint should be technically acceptable because:
 - The outer shell provides secondary containment for lines crossing the expansion joint. The outer shell can drain to the secondary containment of either cell.
 - The keying between building sections will prevent the outer shell or the process lines being placed in shear at the expansion joint.
 - The feedthrough outer shell can be anchored at one cell face for alignment and otherwise allowed to float in the hole between cells to accommodate building expansion or contraction (which is expected to be well under a 0.6 cm (0.25-in.) per 12.2 m (40-ft) section over long time periods).

HISTORICAL EXPERIENCE

See Howden 1991.

CONCLUSIONS

From the standpoint of impediments to drilling new process piping penetrations between cells, cell and hot pipe trench, or cell and cold side pipe gallery, the drilling zone shown on Figure 3 offers the least likelihood of cutting embedded piping, conduit and rebar.

REFERENCES

- Cruz, C. R., to G. F. Howden, 1991, "Pipe Repair Feasibility Study--Structural Design Assessment," Internal memo 85154-91-CRC-169, dated May 24, 1991.
- Drawing W 69565, Standard Sections, Concrete Plans, Building 221.
- Drawing W 69566, Standard Sections, Concrete Sections and Details, Building 221.
- Drawing W 70102, Piping Through Sections 3 & 4, Plan, Building 221.
- Drawing W 70103, Piping Through Section 15, Sections, Building 221.
- Howden, G. F., to M. L. Grygiel, 1991, "B Plant Process Piping Replacement Feasibility Study--Architectural Assessment," Internal memo 85330-91-018, dated May 31, 1991.

CORRESPONDENCE

This page intentionally left blank

Westinghouse
Hanford Company

Internal
Memo

From: B Plant Design Engineering 85154-91-CRC-169
Phone: 3-3221 S6-81
Date: May 24, 1991
Subject: PIPE REPAIR FEASIBILITY STUDY - STRUCTURAL DESIGN ASSESSMENT

To: G. F. Howden S4-68

cc: D. F. Salsman S6-81
CRC File/LB

References: WHC-SD-WM-SA-005, Rev. 0, B Plant Canyon Structure Seismic
Evaluation, by B. V. Winkel.

SCOPE OF WORK:

1. Collecting the sources of information

Two avenues for the sources of information were followed, one was the search for concrete thickness and rebar size/spacing in the B Plant original drawings, and the other was a private consultation with Bob Winkel, author of the seismic modeling for B Plant, Reference 1. DWGS., W-69333, "SECTIONS 1 & 2, CONCRETE SECTIONS AND DETAILS," W-69565, "STD. SECTIONS CONCRETE PLANS", and W-69566, "STD. SECTIONS - SECTIONS AND DETAILS", for T-U-B Plants, show that the process cells walls were constructed with plain concrete (non-reinforced) and their slenderness ratio $22 \text{ ft} / 0.3 \times 7 \text{ ft} = 513$, indicates a massive section.

2. Structural Design Assessment

The structural section is primarily under compression for operating conditions and under shear for a seismic event. The structural design assessment is based on the information obtained from above conversation with Bob Winkel and with the assigned requirements as shown in attached sketch. The number and the size of penetrations have not reached a definitive design at the present time, however, the limitations on either their size or their number depend primarily on the geometry of the process cell wall available area.

In the 2'-0" wide band, see attached sketch, the maximum hole diameter for a penetration should be 1'3", and the number of penetrations to be limited to no more than 3 in a row.

G. F. Howden
Page 2
May 24, 1991

3. Summary

Even though, 3-15-in.-diameter penetrations in a row amount to about 51% of the original bearing area, the bearing safety factor is over 3 for operating conditions. The lateral motion under seismic conditions will be resisted by shear stress in the wall, however, because of the location of the penetrations the development of shear stresses, by inspection, would be insignificant.

In summary, the attached sketch gives the maximum number and size of penetrations in the process cell walls.

NOTE: Concrete block configuration can also be used as shown on
DWG H-2-41253.

C. R. Cruz, Cognizant Engineer
Plant Design Engineering

cjp

Attachment

Figure 1. Drawing W 70102, Piping Through Sections 3 & 4, Plan, Building 221

BEST AVAILABLE COPY

Figure 2. Drawing W 70102, Plan of Electric and Instrument Conduit Lines

WMC-SD-WM-TA-032
Revision 0

Figure 3. B Plant Piping Feedthrough Core Drilling Safe Zone

79105126.13

Typical Embedments in Cell East Wall

B Plant Cross Section Looking East

Figure 4. Drawing W 70103, Piping Through Section 15, Sections, Building 221

Figure 6. Building 221B, 20 Inch Plug with Four 4 Inch Nozzles

This page intentionally left blank.

APPENDIX D
FACILITY MODIFICATION CONCEPTS AND METHODS REPORT

This page intentionally left blank.

CONTENTS

PURPOSE	D-7
SCOPE	D-7
FACILITY MODIFICATION CONCEPTS AND ASSESSMENT	D-7
CASE 1. EMBEDDED PIPE RELINING	D-7
CASE 2. CELL-TO-CELL NEW PIPE INSTALLATION OPTIONS	D-8
CASE 3. PIPE GALLERY-TO-CELL PENETRATION OPTIONS	D-22
CASE 4. HOT PIPE TRENCH NEW PIPE INSTALLATION OPTIONS	D-24
CASE 5. CELL-TO-CELL WALL PENETRATION OPTIONS	D-32
CASE 6. AIRBORNE CONTAMINATION CONTROL OPTIONS	D-33
SUMMARY AND CONCLUSIONS	D-40
REFERENCES	D-41
APPENDICES	
D-1 CONCRETE CUTTING (DRILLING) TECHNOLOGY ASSESSMENT	D1-1
D-2 DIAMOND CABLE CUTTING SEQUENCE	D2-1
D-3 REMOTELY OPERATED CORE DRILLING SEQUENCE	D3-1
D-4 B PLANT CANYON/CELL VENTILATION	D4-1

TABLE

Table 1	Hot Pipe Trench Options	D-32
---------	-----------------------------------	------

LIST OF FIGURES

Figure 1	B Plant Cell Shielded Work Platform	D-9
Figure 2	B Plant Piping Feedthrough Penetration, Manually Installed	D-10
Figure 3	B Plant New Process Piping, Manual Installation	D-11
Figure 4	B Plant Piping Feedthrough Penetration, Manually Operated Core Drilling Machine	D-12
Figure 5	B Plant Replaceable Piping Feedthrough Remotely Installed	D-14
Figure 6	B Plant Piping Feedthrough Penetration, Remotely Operated	D-15
Figure 7	B Plant Piping Feedthrough Penetration, Remotely Operated	D-16
Figure 8	Portable Remote Manipulator Module	D-17

LIST OF FIGURES (cont'd)

Figure 9	Portable Remote Manipulator Module Arm/Shoulder Assembly . . .	D-18
Figure 10	Portable Remote Manipulator Module (Fixed) Operator's Control Station . . .	D-19
Figure 11	B Plant Piping Feedthrough Penetration, Remotely Operated Core Drill Tube (And Slug) Extractor . . .	D-20
Figure 12	B Plant Piping Feedthrough Penetration Core Drill Tube And Concrete Slug Disposal System . .	D-21
Figure 13	Removable Electrical (And Instrumentation) Feedthrough . . .	D-23
Figure 14	Spiral Type Electrical or Fluid Feedthrough	D-25
Figure 15	Remote Swing Arm Connector For Small Pipe And Tubing	D-26
Figure 16	B Plant Hot Pipe Trench Entombment With Hot Pipe Trench Piping Module . . .	D-28
Figure 17	B Plant Replaceable Hot Pipe Trench Piping Module With Lower Shielding Support Block .	D-29
Figure 18	B Plant Replaceable Hot Pipe Trench Piping Module	D-31
Figure 19	Manually Operated Diamond Impregnated Wire Cutting Machine . .	D-34
Figure 20	B Plant Process Piping Installation, Remotely Operated Diamond Cable Cutting System	D-35
Figure 21	B Plant Process Piping Installation, Remotely Operated Diamond Cable Cutting System, Plan and Elevation Views	D-36
Figure 22	B Plant Process Piping Installation, Diamond Cable Cutting Water/Vacuum System . .	D-37
Figure 23	B Plant Process Piping Installation After Remote Diamond Cable Cutting . . .	D-38

**B PLANT PROCESS PIPING
REPLACEMENT FEASIBILITY STUDY
FACILITY MODIFICATION CONCEPTS**

PURPOSE

A number of feasibility studies and assessments have been initiated in support of redefining the double shell tank waste disposal strategy. The B Plant Process Piping Replacement Feasibility Study, which is one element of that work, addresses the feasibility of partial or extensive process piping replacement if corrosion or other conditions preclude the use of some or all of the existing process piping. The study includes the following:

- An architectural assessment
- An assessment of the feasibility of relining existing embedded piping
- A structural assessment of impediments to making new cell wall piping penetrations
- Concepts for new piping installations
- A review of new large hole drilling or cutting technology.

This is the fourth in the series of assessments. This deals with concepts for new piping installations and is supplemented with some concepts for installing new control and instrumentation sensor lines and wiring to the cells.

SCOPE

This report will review and assess two new pipe installation concepts that are considered to be bounding options and some intermediate concepts. Additionally, concepts for installing new pipe, tubing, and electrical lines from the Pipe Gallery to the cells will be addressed.

FACILITY MODIFICATION CONCEPTS AND ASSESSMENT

CASE 1. EMBEDDED PIPE RELINING

The issue of relining existing embedded process pipes between adjacent cells was discussed in Howden 1991a. In summary, Howden 1991a documented that there are only four cell-to-cell lines between the two cells within a 12.2 m (40 ft) modular section of the plant and none between adjacent cells in adjacent sections which are separated by an expansion joint.

Case 1. Assessment

Howden 1991a concluded that relining the existing pipes between cells was a limiting factor in future process layout in the plant and that there is a better, cost competitive way to provide full sized new process lines between all cells, not just between pairs within a section. The options for pipe replacement will be discussed in the following paragraphs.

CASE 2. CELL-TO-CELL NEW PIPE INSTALLATION OPTIONS

Case 2a. Manual Installation

New process piping installations were accomplished in B Plant in the late 1960's by cleaning out the cells and where necessary, providing spot shielding to allow construction personnel entry to the process cells and hot pipe trench. A review of the modification drawings (WHC 1967 as typical) indicates that the new piping was installed between adjacent cells (within a 12.2 m [40-ft] section, or between a cell and the hot pipe trench [HPT]) by core drilling 35.6 cm (14-in.) diameter holes, inserting one or more new individual lines and filling the hole around the pipes with grout. It is likely that some prefabrication of the piping was done to minimize in-cell construction activity under Special Work Permit conditions. Some in-cell pipe welding and inspection was required.

Case 2a. Assessment

The feasibility of personnel entry to the cells for construction work is very uncertain. Until the cell equipment is removed and the cells cleaned, it is uncertain what background dose rates may be encountered. It is known that Strontium and Cesium solutions were spilled and/or dripped on the walls and floors of several cells during tank waste processing to recover those isotopes. The use of spot shielding and a shielded platform (see Figure 1) that would keep workers about 5.5 m (18-ft) above contaminated floor areas could enable manual piping installation. Safer, cost competitive approaches will be described below.

Case 2b. Prefabricated Assemblies--Manual Installation

A manually installed, shop fabricated piping feedthrough such as shown on Figure 2 can be installed between those cells with a low background dose rate or where the cell can be shielded to allow personnel access on a shielded work platform (Figure 1). By shop fabricating the distribution piping (Figure 3) for the pipe stub end of the feedthrough, a minimum of in-cell time will be required for welding and weld inspection.

Figure 4 shows a setup for manually core drilling new wall penetrations for installation of the feedthroughs.

The feedthrough is installed by sliding the whole assembly as shown on Figure 2 into a core drilled hole, leveling the kick plate end and fixing the orientation by installing a concrete anchor bolt through the hole in the tab. The remaining pipe connections (Figure 3) are then welded to the feedthrough's pipe stubs in the adjacent cell.

Figure 1. B Plant Cell Shielded Work Platform.

Figure 2. B Plant Piping Feedthrough Penetration Manually Installed.

79105126.24

Figure 3. B Plant New Process Piping Manual Installation.

Figure 4. B Plant Piping Feedthrough Penetration Manually
Operated Core Drilling Machine.

Case 2b. Assessment

The feedthrough concept as shown on Figure 2 provides the following advantages over grout-in-place piping as was done in the 1960's.

- The outer shell of the feedthrough provides secondary containment for the process pipe lines passing through it. The outer shell will drain to the cells for containment.
- The design allows process lines to pass directly through a wall between adjacent cells separated by a building expansion joint within the wall instead of routing the lines to the HPT then back to the adjacent cell. Anchoring the outer shell of the feedthrough at one end only will allow it to "float" in the wall penetration to accommodate the small amounts of building movement that may occur. The feedthrough would not be grouted in place.
- Shop fabricating the assembly and its method of installation as described above will minimize personnel exposure during installation.

Case 2c. Prefabricated Assemblies--Remote Installation

A remotely installed, shop fabricated piping feedthrough such as shown on Figure 5 can be installed in those cells where the background dose rate is too high to permit personnel access to the cells. This feedthrough will require a remotely cut penetration for each group of about five new 5 cm (2-in.) diameter process lines. Figures 6 and 7 show a remotely operated core drilling machine that can be moved from cell to cell by the canyon crane. A remotely operated manipulator module such as shown on Figures 8 to 10 that can be moved from cell to cell, or positioned along the HPT by the canyon crane is proposed for general use in cell clean out, supporting cell lining, servicing the core drilling machine shown on Figure 6, and handling the spent core drill tubes containing the concrete core slug as shown on Figures 11 and 12.

Case 2c. Assessment

The feedthrough concept shown on Figure 5 provides the same advantages described in the Assessment for 2b above. The concept of removable, replaceable utility feedthroughs has been employed for years in hot cell design.

The remotely operated core drilling and core handling equipment described above is well within the bounds of core drilling and machinery building technology and does not require any major development before preparation of specifications for procurement of core drilling, or core handling systems as depicted in the figures.

The remotely operated electromechanical manipulator (EMM) module (Figures 8 to 10) employ technology that was developed in the U.S. over 35 years ago and that was first applied at Hanford in the early 1960's and subsequently in the Fast Flux Test Facility (FFTF) and Fuels and Materials

Figure 5. B Plant Replaceable Piping Feedthrough Remotely Installed.

WHC-SD-WM-TA-032
Revision 0

79105126.23

Figure 6. B Plant Piping Feedthrough Penetration Remotely
Operated Core Drilling Machine.

79105126.12

Figure 7. B Plant Piping Feedthrough Penetration Remotely
Operated Core Drilling Machine and Support Equipment.

Figure 8. Portable Remote Manipulator Module.

Figure 9. Portable Remote Manipulator Module Arm/Shoulder Assembly.

Figure 10. Portable Remote Manipulator Module Operator's Control Station.

Figure 11. B Plant Piping Feedthrough Penetration Remotely Operated Core Drill Tube Extractor.

79105126.27

Figure 12. B Plant Piping Feedthrough Penetration Core Drill
Tube and Concrete Slug Disposal System.

79105126.30

Examination Facility (FMEF) in the mid-1970's and early 1980's. The systems shown on the figures apply well established and extensively used open loop control electromechanical manipulators.

This type of manipulator does not provide tactile feedback to the operator. It does provide high capacity lifting capability (54.5 kg [120-lb] with arm fully extended 1.5 m [5-ft] horizontally) and with well trained operators, is a tool suitable for heavy construction support that would be required to upgrade the B Plant cells.

Much work is being done by private industry, the universities and government laboratories to develop closed loop manipulator arms that do provide tactile feedback to the operator. These arms have a low lifting capacity (approximately 11- to 22 kg [25- to 50-lb]), and are not at a state of development that they should be considered as the basis for a major project.

CASE 3. PIPE GALLERY-TO-CELL PENETRATION OPTIONS

Embedded Pipe As Feedthroughs

The existing 18-8 embedded piping routed during original construction from the cold side pipe gallery into the process cells provides a potential routing path for both smaller bore pipe or tubing and for electrical wiring. Historically, in a small number of cases some existing embedded lines have been used for such routings at B Plant and/or PUREX (see Howden 1991a).

Core Drilled Penetrations

A study of the B Plant building structure (Howden 1991b) indicated that it is feasible to core drill new utility penetrations between the Pipe Gallery and a typical cell without cutting through any existing pipe/conduit embeds to the cell.

Location

The area that appears free of pipe and conduit embeds is near the northeast corner of each cell as discussed in (Howden 1991b). In this area is a vertical strip about 0.6 m (24-in.) wide that could be core drilled to provide two or three 35.6 cm (14-in.) diameter core drilled penetrations.

Interferences

Two widely spaced embedded 5 cm (2-in.) Schedule 40 cell spray headers cross horizontally through the core drilling zone (The large vertical space between the headers provides clearance for core drilling).

Feedthrough Concepts

The core drilled penetrations would be lined with a stainless steel stepped liner that would be grouted into place. Into the liner would be inserted a 30 cm (12-in.) diameter stepped shield plug similar to the 15 cm (6-in.) plug shown on Figure 13. Figure 13 is typical of a large number of

Figure 13. Removable Electrical Feedthrough.

79105126.28

15 cm (6-in.) feedthroughs that were built for the FMEF at Hanford. The 15 cm (6-in.) unit could handle up to 45 circuits including power and instrumentation.

Figure 14 is typical of a second type of feedthrough that was also built for the FMEF that could handle either electrical cables or hoses.

A third type feedthrough that was built for the FMEF is similar in profile to Figure 13 but contained approximately twenty, one centimeter (3/8-in.) diameter stainless steel tubes for pneumatic or hydraulic transfers to/from the cell.

Case 3. Assessment

Additional electrical and small bore flexible metal hose lines can be installed between the pipe gallery and a cell using existing embedded 5 cm (2-in.) process pipes as a conduit and secondary containment. If the concept for in-cell electrical connections that has traditionally be used were retained, a typical in-cell connector would have six circuits. A single small bore pipe or flexible metal hose would be installed in one embedded process line with a Hanford or PUREX type connector on the end.

If the proposal to employ the EMM module (Figure 8) as a future basis for process equipment design, operating and in situ maintenance of cell equipment is accepted, then the use of feedthroughs as shown on Figure 13 would provide much more flexibility in process equipment instrumentation and control design (40 to 50 circuits per feedthrough) as well as lower equipment cost. Lower cost is achievable for example, by use of standard high temperature electrical connectors (ceramic insulators not plastic) with stainless steel shells and flexible cable. Electrical jumpers of this type are typically used in hot cells equipped with EMM systems such as the interim examination and maintenance cell in the FFTF or the Hot Fuel Examination Facility-North hot cell at Idaho National Engineering Laboratory. EMMs have demonstrated the ability to connect and disconnect this type of jumper on a routine maintenance basis.

The use of the EMM as an in-cell tool handler also opens the options for use of small tubing size connectors such as shown on Figure 15 for instrument sensor lines, pneumatic supply lines to valves operators, and for smaller sized (under 1.9 cm [3/4 in.]) chemical feed lines. The smaller line and connector sizes together with the opportunities to use more flexible metal hoses reduce material costs and design and fabrication costs of traditional rigid jumpers that must meet exacting dimensional requirements.

In conclusion, significant process design options and lower equipment, operating and maintenance costs should be realized by applying manned hot cell utility feedthrough concepts and remote manipulation experience to future programs in the B Plant (or other canyon facilities).

CASE 4. HOT PIPE TRENCH NEW PIPE INSTALLATION OPTIONS

The HPT was used for process solution transfers between cells, for bringing tank wastes into the plant for recovery of Strontium and Cesium, and for return of qualified wastes to the tank farms. With the cell-to-cell

Figure 14. Spiral Type Electrical or Fluid Feedthrough.

Figure 15. Remote Swing Arm Connector for Small Pipe and Tubing.

feedthrough concept applied as discussed previously, the process solution transfers via the HPT are expected to be significantly reduced and focused on long distance transfers within the plant. In the event that secondary containment requirements dictate lining of the trench to provide new secondary containment of the trench piping, the HPT options available are:

- Abandonment
- Partial entombment
- Partial capping
- Modular pipe replacement.

Each of the options will be discussed below.

Abandonment

Since the number of long distance transfers should be significantly reduced by the use of cell-to-cell feedthroughs, total abandonment of the HPT is one consideration. With this option, the lines in the HPT would be thoroughly flushed and the nozzles in each cell for pipes leading to the HPT would be cut off. At least one additional cell-to-cell feedthrough would have to be provided with all lines jumpered to the mating feedthrough on the opposite wall of the cell to provide a continuous set of lines along the length of the plant. Any line leakage within the feedthroughs or within the cells would drain to the cell liner and its sump. The major drawback of this approach is the congestion that this adds to the top area of the cells where access is needed to maintain the cell equipment.

Partial Entombment

With the partial entombment option, the HPT piping would be thoroughly flushed and then the pipe trench would be filled with concrete to a depth that would provide a few inches of cover over the embedded pipe while leaving a 0.3- to 0.6 m (1- to 2-ft) high space beneath the cover blocks. With the old piping abandoned, entombed and shielded in concrete, the remaining HPT should be accessible for manual installation of liners and new piping, or shop fabricated pipe modules as generally shown on Figure 16. New penetrations to the cells would be core drilled to provide new encased piping feedthroughs between the cells and HPT.

Partial Capping

The concept of partially capping the HPT as shown on Figure 17 has been suggested by Gunderson (Gunderson 1991). This concept would also require thorough flushing and abandonment of the existing HPT piping. Prefabricated high density concrete shield blocks would be placed in the aperture of the HPT opening and supported on the first step of the shield plug opening as shown on Figure 17.

With the lower HPT shielded, it is likely that the upper area could be entered to manually install a liner and new piping, or shop fabricated piping modules as depicted on Figure 16. New penetrations would have to be core drilled to the cells for new encased pipe feedthroughs.

Figure 16. B Plant Hot Pipe Trench Entombment with Hot Pipe Trench Piping Module.

79105126.50

Figure 17. B Plant Replaceable Hot Pipe Trench Piping Module with Lower Shielding Support Block.

This option has some advantage over the entombment option in that it keeps the options open for future final decommissioning of the plant and would probably be somewhat faster to install.

Modular Pipe Replacement

Removal of the existing HPT piping and its replacement with a smaller number of full length pipe runs is also an option. In this case the existing piping would be thoroughly flushed and then cut up in suitable lengths for removal and burial. The cutting operation can be accomplished with existing equipment designed for use with the canyon crane, or with similar equipment designed for use by remotely operated portable EMM modules (Figure 7). Trimming of pipe stubs and pipe segment pickup would be done with EMM modules. Scrap pipe and other dry waste would be loaded by the EMMs into a disposal box that would fit within a burial box. Movement of the disposal box to the burial box would be via the canyon crane. A means (such as a special High-Efficiency Particulate Air [HEPA] filtered vacuum cleaning machine) to remotely remove heavy accumulations of dust and small debris from the HPT floor would be needed. Also advisable (in this as well as the previous two options) would be a means to apply an epoxy sealer to the exposed HPT walls and floor before starting installation of new piping.

It is proposed that a series of identical, shop fabricated piping modules, Figure 18, be installed in the HPT. The module would:

- Have a structural frame lined with a corrosion resistant liner to form an 6800 L (1,800 gal) capacity container
- Have one instrumentation and control conduit, one air line, one water supply line for built-in spray nozzles and for flushing a waste drain line and up to nine 5 cm to 7.6 cm (2- to 3-in.) diameter process lines premounted inside on pipe supports
- Include a level sensor, high level alarm and an air jet sump pump that discharges to the waste drain line
- Provide leveling jacks on its corners and a means for installing anchor bolt for seismically anchoring the module to the HPT floor
- Provide precisely located dowel pins on the four corners to locate tie plates that would properly space the ends of the pipe runs within each module so that interchangeable jumpers can be used to join the piping and conduit of adjacent modules to provide continuous runs.

The canyon crane would be used to move pairs of the modules into position in the HPT. The EMM module would then be used to fine position, level, install anchor bolts, and install the interconnecting jumpers.

Case 4. Assessment

Table 1 summarizes some of the major factors in selecting a choice of HPT options.

Figure 18. B Plant Replaceable Hot Pipe Trench Piping Module.

Table 1. Hot Pipe Trench Options.

Description	Replace Cover Blocks	Solid Waste Relative Volume	Relative Cost
Abandonment	No	Very Low	Low
Partial entombment	Yes	High	High
Partial capping	Yes	High	High
Modular pipe replacement	No	Moderate	Moderate

In summary, of the four options for providing new piping to replace that in the HPT, the abandonment of the existing HPT and piping and provision of a few new encased lines routed through the upper part of the cells (cell-to-cell) is the most simple approach but may be the least attractive due to the added congestion it would add to the upper cell region.

The entombment of the existing piping in concrete and construction of a new, lined trench on top of the concrete encasement (Figure 16) is likely to be similar in cost to the partial capping option (Figure 17). Both are likely to require new high density raised HPT cover blocks to provide sufficient shielding and vertical clearance for a new pipe installation in between the cover blocks and capping blocks (or top of concrete pipe encasement). Both will incur an immediate cost for disposal of the existing cover blocks as they are replaced with new, raised blocks. The long term acceptability of entombment as related to final plant decontamination and decommissioning needs further research before a final selection.

Replacing the existing HPT piping with new pipe modules (Figure 18) will incur a moderate immediate cost for disposal of the existing piping from the trench. The existing HPT cover blocks will be reusable and the availability of the full depth of the HPT will allow the piping modules to be designed to maximize the leak retention capacity of each module.

CASE 5. CELL-TO-CELL WALL PENETRATION OPTIONS

A survey of technology for manually and remotely cutting penetrations in thick concrete walls identified the following four commonly applied methods:

- › Core drilling
- › Water jet cutting
- › Wire cutting
- › Cable cutting.

A copy of the report by Barrus (Barrus 1991) describing the survey is included in Appendix D-1. In summary, the core drilling and cable cutting have the greatest applicability to this project. The water jet cutting on the other hand creates objectionably large amounts of waste water, while the wire cutting equipment is delicate and is not considered suitable for remote operations.

The cable cutting system uses a multi-strand cable as a carrier for diamond studded rings that are threaded onto it. The ends of the cable are threaded through drilled starter holes and the ends clamped together to form a continuous loop. The loop is then pulled continuously through the holes by a drive system to cut the space between the starter holes. Figure 19 illustrates the technique and hardware. The system has been used extensively for cutting large slabs of rock in quarries, large slabs of concrete, and large rectangle penetrations in thick reinforced concrete walls. It is best operated where direct access is available for cable joining and installation of anchor bolts in the slab for removal and handling. Performance of these operations remotely with equipment like the EMM module is considered entirely feasible. Figures 20 to 23 illustrate a remotely operated version of the system and an alternative concept for making new penetrations between the cells. Appendix D-2 provides a detailed description of the operation of this system.

The core drilling technique of making penetrations in thick walls and floors has been used extensively at Hanford and in B Plant. During the major modernization and refit of B Plant for Cesium and Strontium recovery in the late 1960's, over 400 holes 35.6 cm (14-in.) in diameter were core drilled in the 2.1 m (7-ft) thick wall between the cells and the air tunnel to improve cell ventilation. That work was accomplished with manually operated equipment and direct access to the cells. Figure 4 illustrates a proposed manually operated core drill setup for the TRUEX upgrade in those cells where manned access is still possible. Figures 6, 7, 11, and 12 illustrate a remotely operated core drilling and core extraction/ disposal system for remotely core drilling in those cells where manned access is not possible. With this system, the core drill tube is used only once and serves as the disposal container for the core slug parts and fragments. Appendix D-3 provides a graphical illustration of the sequence of operation of this system.

Case 5. Assessment

Of the most likely candidates for cutting new penetrations between the cells and cells and HPT, diamond impregnated cable cutting and core drilling are the more rugged and generate the least waste. The actual system to use in modifying B Plant for TRUEX will depend on the dose rates from the cells after clean out, and final design configuration of the new installation. Either technique can be applied remotely or with manual operation.

CASE 6. AIRBORNE CONTAMINATION CONTROL OPTIONS

Although the issue of airborne contamination control in the canyon during demolition and reconstruction will require intense study and planning to implement and is beyond the scope of this report a few concepts are provided. Appendix D-4 includes copies of a few sheets from (Swanson 1986) that describe the major attributes of the B Plant canyon/cell ventilation system. Swanson 1986 and information provided by B Plant Engineering personnel provides the following information:

- o Canyon ventilation flow rate is 75,000 cfm
- o Canyon air change rate, about 3/hr

Figure 19. Manually Operated Diamond Impregnated Wire Cutting Machine.

TYPICAL WALL CUT

©1988 Cutting Technologies, Inc.
All Rights Reserved

Figure 20. B Plant Process Piping Installation Remotely
Operated Diamond Cable Cutting System.

Figure 21. B Plant Process Piping Installation Remotely Operated
Diamond Cable Cutting System, Plan and Elevation Views.

79105126.31

Figure 22. B Plant Process Piping Installation Diamond Cable
Cutting Water/Vacuum System.

79105126.41

Figure 23. B Plant Process Piping Installation After Remote Diamond Cable Cutting.

- Canyon air discharges via the gaps around the cell cover blocks to the cells then via twelve 35.6 cm (14-in.) diameter holes to the air tunnel and exhaust stack
- Average cell ventilation flow rate, approximately 1,900 cfm (with cover blocks in place)
- Cell air change rate, about 20 to 30 volumes/hr
- The number of cells open at one time is now limited to two cells by B Plant operating procedures
- Air flow in the HPT is essentially stagnant based on smoke tests that have been performed. The HPT ventilation ducts to the air tunnel have been partially if not fully closed.

Case 6. Assessment

In order to efficiently perform the work of modifying 15 to 25 cells in B Plant for the TRUEX process, it will be necessary to have an estimated 3 to 5 cells open at a time (cover blocks removed) after initial clean out and radiological survey.

The initial removal of equipment and cleaning of the cell walls and floor will be the most difficult phase from the contamination control viewpoint. During this phase it will be necessary to maintain a face velocity of air entering the open cell of 130 to 150 ft/min or about 30,000 to 35000 cfm while still maintaining air flow to the other closed cells as well as some air flow to other open cells that have already been cleaned and a fixer coating applied to the cell walls and floor. It is probable that an increase in the plant exhaust capacity will be required to enable the canyon ventilation to increase to around 200,000 cfm.

In the event that heavy flushing with water is not allowed, more exotic means of surface cleaning such as vacuum blasting or dry ice blasting may be required. Vacuum blasting employs an integrated sand blasting nozzle and vacuum pickup shroud to immediately control and collect particulates. Dry ice blasting uses small particles of dry ice as the impact media to remove particulate matter from the cell walls or floor. The ice evaporates immediately leaving the dry particulates from the cell surfaces. The dry particulates can then be collected by a HEPA filtered vacuum system. A fixative coating then applied to the cell surfaces may then allow a further reduction in air feedthrough while the cell liner is installed. Depending on the liner design, it may then be safe to temporarily plug some of the cell/air tunnel ventilation holes and again reduce the cell air feedthrough during installation of new process equipment.

A slightly different approach to contamination control might be applied to the major clean out of the HPT and installation of new piping modules. There, a large self contained blower module (composed of an intake HEPA filter, blower, and exhaust HEPA filter) could be mounted over each end of the HPT after removing the end cover blocks. Demolition and clean up would start at the center of the HPT and work each way towards the ends. The exhausters would pull air into the HPT at its center work area and exhaust it back to the canyon near the end zones using the HPT as the duct to the exhausters. As the

pipng is removed at the work face, the HPT walls and floor would be cleaned (as previously described) and a fixative coating applied. The next cover blocks from the center would then be removed and the cleaning process repeated until the full HPT is stripped and cleaned.

SUMMARY AND CONCLUSIONS

In summary, the following points are made.

- The existing embedded process pipe between cells should not be used as a conduit for new more corrosion resistant pipe.
- Some of the existing embedded pipe to the cells from the cold side should be retained for transporting compatible makeup chemicals, steam, air and water.
- New encapsulated process piping can be installed between the cells or cells and HPT using core drilled penetrations and shop fabricated pipe feedthroughs. This can be done either directly if background dose rates permit access, or remotely.
- New wiring and instrument lines can be installed to the cells from the pipe gallery by core drilling penetrations and inserting removable utility feedthroughs such as those used in manned hot cells for years.
- The replacement of pipe in the hot pipe trench with more corrosion resistant lines is feasible at reasonable cost using shop fabricated modules that also include a built-in containment system.
- The most rugged and suitable methods of making new penetrations are core drilling and diamond impregnated steel cable cutting.
- Doubling or tripling the canyon ventilation capacity will be needed to allow multiple cells (estimated at 3 to 5) to be open simultaneously so that work in the canyon can proceed at an economical pace.
- The rate of clean out of the cells and their relining will be controlled by the available ventilation air.
- The refurbishment of the cells will probably require a combination of manual and remote operations. The amount of in-cell work that can be performed manually will be controlled by the residual background dose rate after removal of the existing cell equipment.
- A new approach to in-canyon work must be applied that does not rely on the canyon crane as the sole means of remotely performing in-cell work during plant modification and subsequent operation. This approach will employ the canyon crane as the primary means of equipment moving, but will rely on portable robotics units to enable simultaneous work on several cells

- Robotics equipment that has a time tested track record is available and provides a sound planning basis for construction, new process design, and future in situ maintenance of operational process equipment.

REFERENCES

- Barrus, H. G., to G. F. Howden, 1991, "Concrete Cutting (Drilling) Technology Assessment," internal memo, dated June 27, 1991, Westinghouse Hanford Company, Richland, Washington.
- Gunderson, M. J., to G. F. Howden and B. K. Horsager, 1991, "Interim Report on the Feasibility Study of Replacing Existing Embedded Piping in B Plant," internal memo 91-154-DSI, dated May 6, 1991, Westinghouse Hanford Company, Richland, Washington.
- Howden, G. F., to M. L. Grygiel, 1991a, "B Plant Process Piping Replacement Study--Embedded Pipe Lining Assessment Report," internal memo 85330-91-020, dated June 17, 1991, Westinghouse Hanford Company, Richland, Washington.
- Howden, G. F., to M. L. Grygiel, 1991b, "B Plant Process Piping Replacement Study--Structural Assessment Report," internal memo 85330-91-019, dated June 6, 1991, Westinghouse Hanford Company, Richland, Washington.
- Swanson, L. L., 1986, *B Plant Safety Analysis Report*, WHC-SD-WM-SAR-013, Rev. 2, Westinghouse Hanford Company, Richland, Washington.
- WHC, 1967, *Cell 19 In-Cell Piping Arrangement*, Drawing H-2-60878, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

This page intentionally left blank.

APPENDIX D-1
CONCRETE CUTTING (DRILLING) TECHNOLOGY ASSESSMENT

This page intentionally left blank.

Westinghouse
Hanford Company

Internal
Memo

From: Equipment Engineering
Phone: 6-0931 H5-03
Date: June 27, 1991
Subject: CONCRETE CUTTING (DRILLING) TECHNOLOGY ASSESSMENT

To: G. F. Howden

cc: M. L. Grygiel S6-65
B. K. Horsager S4-68
G. R. Porter R3-46
M. W. Young H5-03
HGB File/LB

Attached is the letter report of the findings from the technology survey you requested. This report completes the first deliverable specified in your letter (85330-91-013) to M. W. Young dated April 25, 1991.

H. G. Barrus
Senior Engineer

Concurrence:

M. W. Young
Equipment Engineering

srh

Attachment

This page intentionally left blank.

STATUS REPORT

CONCRETE CUTTING TECHNOLOGY ASSESSMENT

SUMMARY AND CONCLUSIONS

A brief search has revealed existence of several methods for cutting new process piping holes through the 7-ft thick concrete walls between the adjacent cells of B Plant.

Apparatus for remotely cutting holes could not be located, however, all methods found could do the cutting from a shielded staging platform suspended from the cell wall, (Figure 1).

A few methods could be developed for remote operation, namely Diamond Core Drilling (Figure 21) and Ultra High Pressure Water Abrasive Jet Nozzle (Deep Kerfer) cutting (Figure 3, 4, 5). A third method, (Diamond Cable Saw cutting Figure 6), could make subsequent operations much easier.

RECOMMENDATIONS

The need for remotely cutting all holes in all cells has not been established. While it is desirable to have machinery cut holes in any cell wall remotely, it is apparent that cutting holes remotely will cost much more than to provide manned access for hands on work. Therefore, it is recommended that wherever possible, staging platforms and shielding (Figure 1) be provided for hands on work.

When shielded platforms are provided, diamond wire or cable concepts (Figures 11, 12, and 16), require less Operator Action with less radiation exposure than diamond core drilling, and is therefore recommended.

Apparatus for remotely cutting holes through cell walls should be developed only if hands on work is unacceptable.

If it is found acceptable to remotely cut slots down through the top of the cell walls (Figures 10 and 13), with wire or cable, then there is no need to develop the remote diamond core drilling.

The use of high pressure abrasive water jet or Deep Kerfer water jet cutting is not recommended since it is much slower than the other methods and it will generate thousands of gallons of contaminated water. Much more operator attention will be required to operate this apparatus than cable or wire methods.

INTRODUCTION

The discussion section that follows is a collection of notes taken during the survey of available concrete cutting technologies.

DISCUSSION

The following companies were contacted about the possibility of cutting holes through 7-ft thick concrete walls with re-bar and embedded stainless steel pipe. They were told that we preferred to do the cutting remotely because of high radiation. They were also told about access to the top of the wall and either side of the wall with remote crane operation.

FLOW INDUSTRIES
21414 68TH AVENUE S
KENT WASHINGTON 98031
TELEPHONE (206) 938-3569
CONTACT: JIM WHITE

LASER TECHNOLOGY INC
10624 VENTURA BLVD
NORTH HOLLYWOOD CALIFORNIA 91504
TELEPHONE 1-800-237-6792
CONTACT: TYRONE

KAISER ENGINEERS HANFORD
TELEPHONE 6-2974
CONTACT: GEORGE LINGUS

WESTINGHOUSE HANFORD COMPANY
100N AREA
CONTACT: RAY JENNINGS

INDUSTRIAL DIAMOND TOOL
29TH GRAY FERRY RD
PHILADELPHIA PENNSYLVANIA
TELEPHONE (215) 952-1900
CONTACT: BOB FRAZIER (NUCLEAR SPECIALIST)

CUTTING TECHNOLOGIES
2002 FORD CIRCLE
SUITE E
MILLFORD OHIO
TELEPHONE (513) 249-9800
CONTACT: TIM BECKMAN

VETTER STONE COMPANY
P O DRAWER 38
KOSTA MINNESOTA 56050
CONTACT: BILL VETTER

SAWING SYSTEMS
KNOXVILLE TENNESSEE
TELEPHONE (615) 525-0600
CONTACT: BOB LECOULTER

DRILLCO DEVICES LIMITED
2921 S MAIN STREET SUITE G
SANTA ANA CALIFORNIA 92707
TELEPHONE (714) 549-7725
CONTACT: MAURICE DAVIS

BACKGROUND INFORMATIONMay 21, 1991

A video tape inventory of T Plant canyon taken in 1986 was reviewed. It was borrowed from Howard Charnock at T Plant. The geometries of T, U, and B plants are identical. Viewing the tape provides visual familiarity with cell geometry and helps identify problems with cutting new process piping holes through cell walls at B Plant.

Typically there are 16 pipes between adjacent cells and about 10 pipes between the cell and the pipe gallery. The cell walls next to the pipe trench are bare with no piping observed.

According to instructions from Gary Howden no cutting would be done through the wall into the pipe gallery.

Each connector appeared to have a channel iron bracket behind it and an angle iron under it.

RESULTS OF SURVEYHIGH-PRESSURE ABRASIVE/WATER JET CUTTINGMay 9, 1991

Flow Industries
21414 68th Avenue S
Kent Washington 98031
Telephone (206) 938-3569
Jim White

In talking to Jim, he said the 90 hp high-pressure abrasive/water jet cutting tool we have here at Hanford is too small to do the job of cutting through 7 ft of concrete or even 3 ft. The 200 hp, 35,000 psi machine they recommend would not cut 7 ft, but would cut about 4 1/2 ft and recommends we cut half way through from either side. Figure 8 shows a typical nozzle which would be mounted on the manipulating machinery to do the cutting.

Cutting could be done 3,112-ft deep at a linear speed of about 1/4 in. per minute using about 5,112 gal of water per minute, (other reports indicate 4.2 gpm maximum water usage). He suggests we not reuse the water because the most expensive part of the system is the extremely high pressure pump which if contaminated becomes very expensive to service, he suggests we keep the water clean in the Pump A Diagram of Cutting Operations Vacuum System (Figure 7) showing water collection is typical for such a job. He suggests that the machinery might cost about \$200,000, not including the manipulator and fixturing for the application.

Jim sees no major problems with remote manipulation of the nozzle.

May 13, 1991

Ray Jennings at 100N Reactor area was contacted about the 90 hp Flow Industries machine here at Hanford. It is on a trailer about 6-ft wide and 12-ft long.

On the Unit high pressure valves by Autoclave Engineers can be seen as well as a six cylinder internal combustion (diesel) engine for driving the high pressure water pump and a gas powered electric generator.

The unit had been used for decontamination washing and cleaning with the high pressure blast. It has been used by Battelle in the 300 Area since it was used at the 100K Area for cutting a hole through a 2-ft thick concrete floor.

May 14, 1991

Jim White at Flow Industries was contacted once more and will send information from West Valley Nuclear Plant where they have been cutting contaminated concrete in a manner similar to what we are proposing.

When asked about nozzle wear, he said the ceramic focus tube at the nozzle of the 200 hp unit needs to be changed about every 20 hours when deep cutting is being done.

The cost of operating the 200 hp unit is about \$25/hour plus \$4/hour nozzle wear plus about \$100/hour for grit. The 200 hp unit uses about 300 lbs grit per hour for deep cutting.

The grit is introduced at or near the nozzle (Figure 8).

The electrical generator included with the machine here at Hanford was intended for use to power the robotics to manipulate the nozzle, but he said that kind of thing is not necessary now.

Jim said the 200 hp unit could be powered by an electric motor, but does not recommend it, suggesting instead a diesel engine.

May 28, 1991

Received the following reports from Flow Industries:

- DOE/NE/44139-58 (DE90011904), *The Use of the Deep Kerfer for Thick Steel Reinforced Concrete Cutting*, Dana M. Pezzimenti, Peter M. Vlad, and Brian Landau, August 1989, prepared by West Valley Nuclear Services Company.
- DOE/NE/44139-8 (DE86012253), *Use of a Cutting and Cleaning System at the West Valley Demonstration Project*, L. W. Wiedemann and P. N. Standish, April 1986, prepared by West Valley Nuclear Service Company, Inc.

The Deep Kerfer System (Figure 5) involves an ultra high pressure (35,000 psi) water jet with abrasive grit injection nozzle (Figure 3) on the end of a rod that rotates and travels around a computer controlled path to cut holes in concrete. The depth it cuts depends on the length of the nozzle probe which could be designed to cut through 7-ft thick walls.

The apparatus (Figure 4) could be remotely fastened to a surface such as a wall and remotely operated. The results would be cut blocks similar to (Figure 19) that could be pushed out of the hole with a remotely operated Porta-Power.

May 29, 1991

In a tele-con with Jim White of Flow Industries, he indicated the Deep Kerfer apparatus would actually be more efficient than their former method. As the nozzle cuts deeper into the concrete it cuts at the same efficiency whether 1-in. deep or 6-ft deep.

Mr. White said their Research and Development group developed the apparatus for Nuclear applications and indicated he would have them contact us, they might even have a video of the machine operating that could be sent.

DIAMOND IMPREGNATED WIRE SAWING

May 9, 1991

Laser Technology Inc
10624 Ventura Blvd North Hollywood, California 91504
Telephone 1-800-237-6792
Contact: Tyrone

At Laser Technology, Tyrone was contacted about Diamond Wire cutting of concrete. He indicated they had cut about every thing you can think of with the machine shown in Figure 14, but had never cut thick blocks of concrete. He mentioned that Jerry Potter at Hanford has been using some of their wire to cut Niobium. They sell components such as Capstan Drive Units, Pulleys, and Diamond Wire (Figure 11) for do it your self projects such as Figure 14.

The wire is fastened to and wound on a capstan (both ends) and runs through a series of pulleys on whatever apparatus we want (Figure 14). The capstan is rotated clockwise then counterclockwise moving the wire back and forth in a sawing motion for 100 ft in each direction.

The diamond impregnated wire travels at about 25 mph using a 2 hp motor. The largest wire they make (.050 in) would be the best for the job, no estimate of how fast we could cut with it was given. The .050 in. wire can be tensile loaded to 202 lbs tension which is very tight. He said that the cut is very straight and clean. He had no idea how much lubricating water would be needed.

A starter hole is needed to string the wire through. If the starter hole were not straight or in the right place where it comes out, adjustments would be needed. When cutting the hole it is necessary to start and end on top of the block being cut so the block will not fall into and bind up the wire. The starter hole could be cut remotely (Figure 2), but threading the wire and attaching it to the capstan remotely would not be easy.

The 100-ft long wire costs \$620 (Figure 11), and it would probably take a few wires to cut each 6 ft x 1 ft x 7 ft hole.

May 14, 1991

A combined technology method for cutting new process piping holes would involve cutting a starting hole with a small core drill or water jet, (Flow Industries), then continue the hole with a diamond wire on pulleys mounted on the same manipulator as the water jet would use. The hole would be cut rectangular in shape so that a module with proper piping could then be inserted. The wire would probably be difficult to install on the capstan remotely however.

May 15, 1991

A brochure was received from Laser Technology, Inc. The information was very good for small sample cutting but contained very little about the cutting of large stones and concrete. It did claim their diamond wire has made the use of 3/8 or 1/2 in. stone cutting cables obsolete.

DIAMOND CORE DRILLING

May 10, 1991

Kaiser Engineers Hanford
George Lingus
Telephone 376-2974

George Lingus at Kaiser Engineers was contacted (he is Denny Devine's boss), about core drilling 7 ft through B plant cell walls. George located Mr. Jacka (telephone 373-2104) the B plant area superintendent and they called back.

Mr. Jacka said that they typically drill 2 ft then shoot a Hilti stud into the core, then break it off and pull it out with a come-along, then drill 2 more feet. He said they can drill long distances this way. They need to clamp the machine to the wall somehow. He does not think it is possible to do the cutting remotely.

They suggest that we meet with Chuck Clemans and Carlos Cruz. Mr. Jacka indicated that only a trickle of water would be needed (a few gallons per hour to keep the dust down).

May 20, 1991

Drillco Devices Limited
2921 S Main Street
Suite G
Santa Ana California 92707
Telephone (714) 549-7725

Maurice Davis at Drillco was contacted about details of a sketch forwarded from Gary Howden at B Plant (similar to Figure 2). Maurice Indicated he made the sketch for Mike Gunderson of B plant.

The sketch (Figure 2), shows a device which has never been built as a unit but utilizes some off the shelf components. The jackscrews would be remotely operated as well as the feed mechanism and the rotary motion of the bit. The bit, the likes of which has never been built would be a 9-ft long, 16-in.-diameter diamond core drill bit.

Maurice estimated we could expect the drilling to take about 1 1/2 hours at about 1 inch per minute. The drill bit should last about 4 or 5 holes. Each drill bit would cost about \$5,300, and Maurice estimates the drilling machine would cost about \$50,000 at the outside. Replacement of the bit requires removing the machine from the cell.

The machine would use 90 to 100 PSI air pressure to operate the drill motor, jackscrews and feed control. Collant water supplied through a hollow spindle would be collected with a vacuum collar around the outside of the hole and it would be recirculated from a waste water drum.

His main concern is what do we do if a drill bit gets stuck to the core when removing the core? It probably would mean loosing the bit. He also said that re-bar would cause a lot more tool wear.

May 23, 1991

Gary Howden is concerned about several things as follows:

- Do the cores of core drilled holes stay in one piece or do they break up?
- How do we get the plug out of the hole? Without damaging the bit?
- What if the slug is broken up in pieces?
- Can the drill bits be made less expensive so that we plan to only drill one hole and sacrifice the bit? How much less expensive?
- Will the drill rig support the core if it is pulled back out with the bit?

Maurice Davis at Drillco Devices Limited was contacted about the questions, he said most of the time cores 4 in. in diameter or larger stay in one piece. This will depend on the condition of the concrete and how big a pipe or pipes are drilled through.

We need to be able to pick up the drill machine and dump out the core if a piece is broken off inside. He indicated that the machine would be able to pick up the core inside the bit if the whole core is drawn back with the bit. The machine would be a bad design if it could not handle the whole core inside the bit.

It was mentioned that some craftsmen now use a Hilti Stud fired into the plug to pull a Plug out with a come-along once it is broken off. Studs could easily remotely fasten a plate to the end of the plug to hold it in place during retraction of the bit.

He is looking into using one of their Specially designed studs to see if it could be installed remotely. He said that a 1/2-in. bolt would support a minimum of 7,000 lb using their design. It was suggested to him that if an "I" bolt were installed before retracting the bit that a bar could be inserted in the loop so the core would not retract with the bit. The "I" bolt could then be used to lift the core.

Once the bit is retracted and the machine removed a simple porta power could be remotely used to push the core out of the hole. Several holes could be drilled and the cores left in place until all could be pushed out together getting maximum crane use efficiency.

Maurice is not really concerned with damage to the bit. He said that the cost of a bit with half of the diamonds would not be half the cost, but did not know exactly what the difference would be, probably 20% less or so. He said drilling dry would cut tool life substantially.

May 29, 1991

A catalogue was received from Drillco Devices Limited. It contains descriptions of various hand operated machines, drill bits, cutting wheels, Maxi-Bolt anchors, etc.

DIAMOND CABLE CUTTING

May 14, 1991

Vetter Stone Company
P O Drawer 38
Kosta Minnesota 56050
Bill Vetter

Bill Vetter was called to ask about stone cutting equipment. Mr. Vetter suggested calling the following companies.

W J SAVAGE COMPANY
KNOXVILLE TENNESSEE
TELEPHONE (615) 637-9441
CONTACT: JACK ELKINS

PARK INDUSTRIES
ST CLOUDE MINNESOTA
TELEPHONE (612) 251-5077
CONTACT: TOM SEHLOUGH

May 14, 1991

SAWING SYSTEMS
KNOXVILLE TENNESSEE
TELEPHONE (615) 525-0600
CONTACT: BOB LECOULTER

Bob LeCoulter was called to discuss our cutting problems. He said to call the following two companies.

INDUSTRIAL DIAMOND TOOL
29TH GRAY FERRY RD
PHILADELPHIA PENNSYLVANIA
TELEPHONE (215) 952-1900
CONTACT: BOB FRAZIER (NUCLEAR SPECIALIST)

CUTTING TECHNOLOGIES
2002 FORD CIRCLE
SUITE E
MILLFORD OHIO
TELEPHONE (513) 249-9800
CONTACT: TIM BECKMAN

It turns out that Industrial Diamond Tool and Cutting Technologies have merged and assumed the name of the latter keeping the same address and phone number.

After describing our problem to Mr Frazier, he indicated their company has worked on similar projects (Figure 15), at Baltimore Gas & Electric's Calvert Cliff Nuclear plant and the Oyster Creek Nuclear plant among others. He said they are presently working on cutting concrete on the floating bridge in Seattle if we want to go look at how they are doing it.

Mr Frazier said their crew is experienced in working in contaminated zones, and indicated they would work on our staging equipment and do the set up and operation of their own equipment for \$7,000 To \$10,000 per opening (1-ft high by 6-ft wide through 7-ft thick concrete).

He said they would need about 8 ft of clearance next to the wall for setting up and operating their equipment (Figures 16 and 17) and that a staging platform (Figure 1) next to the wall would be needed.

He said that they would drill four holes at the corners of the opening then insert a diamond wire (Figure 12), loop between two holes at a time pulling it towards the machine (Figure 18) to do the cutting. He suggests that the setup would be typically an hour for the four holes, and the rest of the cutting which is done by remote operation for ALARA reasons would take about 8 hrs for all four cuts.

He said that the coolant used would be water and that their machinery includes a vacuum, cleaner, filter, and recirculating system with a 55 gal drum. The drum would be about two thirds full of water and the residue (concrete fines) would settle out about 2-in. thick in the bottom of the barrel. The coolant would be used on both the drilling and the wire cutting to keep the dust down and lubricate the tools.

Mr. Fraizer indicated that he is sending a video of one of their operations which shows the technique and speed which is involved.

The challenge of putting holes through the B Plant cell walls using remote technology, or "no manned access to the cells with the cover plugs off," makes the job of cutting the holes very difficult and expensive. On the other hand, if one is allowed to put a specially constructed (shielded) staging platform

(Figure 18) below the level 6 ft down from the top where personnel can have access for short periods, then the task becomes orders of magnitude easier.

May 15, 1991

One method of diamond cable or wire cutting the hole involves remotely cutting down through the top of the cell wall to a point around 7 ft down then around the rectangular pattern (Figure 10) until completed. This could be done completely with a remotely operated machine with no personnel access to the cell.

If the slot down from the top was cut using Laser Technologies special wire (Figure 11) it would be .050-in. wide. The Cutting Technologies diamond cable (Figure 12) slot would be .5-in. wide and either could be re-grouted after the cutting is done if necessary.

The question as to whether the 3 ft cantilevered sections of wall (Figure 10) would be strong enough needs to be addressed.

May 16, 1991

Bob Frazier at Industrial Diamond Tool was called to get the answers to some questions. He said the wire they use is actually 3/16-in.-diameter braided aircraft type cable with diamond beads on it.

The starter holes drilled through the wall would be rotary carbide drilled to accept the 3/16-in.-diameter cable. He said that all four holes could be drilled in the 1 hour set up time he quoted. The 1 hour set up time assumes that no delays occur such as suiting up and bagging equipment in and out.

He indicated the four starter holes would come out plus or minus about 1 1/2 in. over the 7 ft (the hole might wander that much). If we wanted improved accuracy (plus or minus 1/2 in.) they could achieve it with diamond core drills.

They could build a machine which would cut everything remotely. He also indicated they could build a machine to saw down from the top 7 ft then to the side 6 ft, then up 1 ft, then to the side 6 ft to form the 6-ft wide by 1-ft high slot through the 7-ft thick wall.

If we do the cutting dry then we cut the cable (wire) life in half. The cost of water waste disposal will probably amount to more than the loss in Tool life if no water is used.

He said that the cutting speed is 12 to 15 square feet per hour. In other words the 1-ft by 6-ft opening in the 7-ft thick wall would take about 6.6 hours after set up, this converts to about 2 linear feet per hour or .4 inch per minute. The amount of reinforcing bar and pipe encountered may slow this down a little.

The cable, which cost \$6,370 for a 75-ft long cable, would do about 3 of the (6 ft x 1 ft x 7 ft) openings.

He or someone else from their company would be glad to come out and look over the job.

He is sending a letter and some sketches, etc., that can be discussed at a - later date. He indicated that if we wanted him to come here we should send him some drawings so he can be better prepared. It would be nice to know what the strength of the concrete is and how many pipes are in it, etc.

May 28, 1991

An information packet from Cutting Technologies Inc. arrived. The packet contained a video tape about 5 min long of various diamond cable cutting projects at the Zimmer Power Station and brochures on other projects describing their capabilities (Figures 12, 15, 16, and 17).

May 30, 1991

A slightly different concept could be accomplished remotely using Diamond Cable Saw cutting or Diamond Impregnated Wire saw cutting. It involves making another lid or cover out of the wall between cells (Figure 13). It can be cut in such a way that it can be lifted out just like one of the cover lids.

A block tapered from 8-ft wide at the top to 7-ft wide at the bottom (Figure 13) cut across the top of the cell wall would not stick when lifting it out of the hole.

The block weighing about 48,000 lbs could be lifted with a lifting device secured to the top of the block with bolts. A block 1 ft x 6 ft x 7 ft is cut forming the new process piping opening either before or after the tapered block is lifted out. Half of the cell walls have a joint in the middle. The blocks of such walls can be bolted together before cutting is done.

The process piping module is then put in place and the tapered block replaced over it. This technique would make putting the process piping in place very easy. Cutting a tapered block from the cell wall creates slots where radiation leakage (shining) may occur up through the canyon deck. Attaching steel plates to the top edge of the block (Figure 13) will stop the leakage. The Diamond Cable Saw cutting creates a very smooth straight cut.

May 30, 1991

Bill McMullen at Cutting Technologies Inc., Philadelphia, was contacted to find out if a diamond cable can cut straight down through a wall without a bow between pulleys. He indicated that in general a cut being made through a 7-ft thick wall with a diamond cable saw would be straight between two pulleys but the cutting rate would slow down near the end of the cut.

COMPARISON OF DIAMOND WIRE VERSUS DIAMOND CABLE

The comparison of the two technologies is a little like comparing jewelry making to blacksmithing, however if the jeweler (wire) can do the job more

economically than the blacksmith (cable) then one would be foolish to give the job to the blacksmith.

TOOL WEAR

The cost of a 75 ft cable is \$6,375 and would cut three openings 6-ft x 1-ft x 7-ft thick. The .050 in diamond impregnated wire costs \$620 for 100 ft. Electroplating is used to hold the diamonds on both, however, the cable is much more labor and material intensive to manufacture than the wire. These facts account for most of the price difference.

The newness of the .050 in. diamond impregnated wire technology prompt the following estimate be made as to what the wear rate difference between the two would be.

The rings containing the diamonds on the cable account for about 1/4 of the surface area of the cable. If one assumes the same density of diamonds on the wire as on the ring of the cable then a calculation reveals that .39 in² of diamonds per linear inch of cable compares to .16 in² of diamonds per linear inch of wire. Further calculation reveals that the cable is removing ten times as much material (volume) with 2.44 times the diamonds as the wire. One might assume therefore that the cable will wear out faster than the wire.

WASTAGE

The power required to pull the wire through the cut is going to be less than for the cable, but just how much is not known at this time.

The smaller wire will generate 10 times less solid waste. The amount of waste water generated is going to be less with the smaller wire than with the cable, but just how much less is not known at this time.

TECHNIQUE

The cable concept drags the cable in an arcing pattern around or past the corners of a cement block. In contrast the diamond impregnated wire usually cuts in a straight line between two pulleys. Will the wire cut at the corners like the cable does without getting kinked? The wire does run over small radius pulleys so it would likely cut over corners as does the-cable.

The technique of cutting large stones in a quarry using cables has been around for more than a hundred years, but just recently have diamonds been use on the cables in stead of abrasive sand in a slurry. However, the smaller diamond wire saw cutting (a miniature version of the stone quarry technique) was developed in the 1960s.

ALIGNMENT

The fineness of the cut from the wire will make alignment in certain instances more critical. For instance, it is conceivable that a block cut out might have places where the wire walked around a pipe embedded in the concrete forming a

sort of key lobe that would leave the block locked in place. This can probably be avoided by slanting the cuts so that the block like a tapered plug will push out of the hole from one side but not from the other. This is one instance where the 1/2-in. wide slot from the cable would have an advantage.

COMPARISON OF DIAMOND CORE DRILLING VERSUS DIAMOND CABLE SAWING

Comparison of the two methods of cutting new process piping holes through 7 ft of concrete is not simple. The cable cut removable block (Figure 13), for example might cost more initially but make future access and replacement of process piping modules less costly. The remote cantilevered insertion of replacement pipes into core drilled holes between cells could be tricky.

The Diamond cable saw cutting through 7 ft of concrete is well established technology. The diamond core drilling 7 ft through a wall has not been done on large diameter holes in one plunge cut. It is a big unknown (SEE) questions by Gary Howden May 23, 1991, and George Lingus May 10, 1991.

STAGING PLATFORM

Either method could be performed easily from the staging platforms (Figures 1 and 18), in which case the cable cutting would be performed as described by Bob Frazier May 16, 1991, with four core drilled starter holes.

The diamond core drilling would be done as described by Mr. Jacka May 10, 1991, by drilling 2 ft, breaking off the core and pulling it out with a come-along then drilling 2 ft more, until they get all of the way through. It does get more difficult to get the broken off cores out the deeper you go.

Both methods are expected to use minimal amounts of water but could be vacuumed up on a continuous basis.

OPERATING COST

One Diamond Cable saw cut hole (6 ft x 1 ft x 7 ft) would presumably allow more process pipes than the four diamond core drilled holes 16 in. in diameter which would fit in the same space. The cost in materials and time to drill four holes would be \$5,300 in bits and take about 6 hours. The Diamond Cable cutting would cost about \$2,123 for cable wear and takes about 7 hours.

COMPARISON OF DEEP KERFER CUTTING VERSUS ABRASIVE JET NOZZLE CUTTING

The two methods use basically the same cutting nozzle except the Deep Kerfer (Figure 3) travels deeper each pass around the pattern while the standard abrasive jet nozzle (Figure 8) cuts to the full 3 1/2-ft deep on a single pass. The standard abrasive jet nozzle must then be set up to cut through the opposite side of the wall to meet in the middle. The Deep Kerfer can continue to cut around the pattern until it cuts the full 7 ft through the wall.

The Deep Kerfer would cut the bottom and two sides of the pattern all the way

through the wall first, then cut the top last which allows the concrete block to fall away from the nozzle. The standard nozzle apparatus would also finish up its cut on the top for the same reason.

The Deep Kerfer nozzle removes the waste from the cut much more effectively and is always at the optimal cutting distance from the surface, while the standard nozzle loses efficiency with increased depth.

In all the Deep Kerfer is faster, generates less waste, is more accurate and lends itself to remote operation more easily than does the standard abrasive jet cutting.

COMPARISON OF DEEP KERFER CUTTING VERSUS DIAMOND CABLE SAW CUTTING

The Diamond Cable Saw cutting according to Bob Frazier generates about 2 in. of concrete fines in the bottom of a 55 gal drum, and recirculates the same water to end up with all waste contained in the drum.

The Deep Kerfer requires around 4 to 5 gal per minute of clean water handled by the vacuum system (Figure 7) translating to thousands of gallons of contaminated water, and would generate about 2.26 times the volume of fines as the Diamond Cable Saw.

The Deep Kerfer requires much more attention during operation than the Diamond Cable Saw. The nozzle wears out every one or two hours. While the diamond cable would last through about 3 openings (6 ft x 7 ft x 1 ft) or probably about 20 hours.

OPERATING COST

The Diamond Cable cutting would cost about \$2,123 (per 6-ft x 1-ft x 7-ft opening) for cable wear and take about 7 hours. The Deep Kerfer cutting would cost \$3,120 in materials and take about 24 hours for the same size opening.

79105126.22

MANUALLY OPERATED CELL-TO-CELL CORE DRILL WITH SHIELDED PLATFORM

FIGURE 1

MANUALLY OPERATED CELL-TO-CELL CORE DRILL - NO SHIELDED PLATFORM

FIGURE 2

Previously Flow Research, Inc., now QUEST Integrated, Inc.

Figure 3 Diagram of Deep Kerf Stem

Figure 4 Diagram of Deep Kerf 3-Axis Motion

Figure 5 Diagram of Deep Kerfer System

D1-24

WHC-SD-WM-TA-032
Revision 0

79105126.16

MANUALLY OPERATED DIAMOND CABLE CONCRETE SAW

FIGURE 6

Figure 7 Diagram of Cutting Operations Vacuum System

ABRASIVE JET CONCRETE CUTTING NOZZLE ASSEMBLY

FIGURE 8

79105126.26

MANUALLY OPERATED DIAMOND WIRE SAW

FIGURE 9

79105126.20

SPOOL SIZE	WIRE SIZE	DIAMOND SIZE	SPOOL SIZE
100 Feet	.030" dia. Superlok	160 micron	\$ 460.00
1000 Feet	.030" dia. Superlok	160 micron	\$4,500.00
100 Feet	.040" dia. Superlok	180 micron	\$ 540.00
1000 Feet	.040" dia. Superlok	180 micron	\$5,300.00
100 Feet	.050" dia. Superlok	200 micron	\$ 620.00
1000 Feet	.050" dia. Superlok	200 micron	\$6,100.00

WIRE SIZE		DIAMOND SIZE	KERF SIZE	
INCH	MM		INCH	MM
.030	1.18	160 micron	.030	1.18
.040	1.57	180 micron	.040	1.57
.050	1.96	200 micron	.050	1.96

LARGE WIRE

It is the consensus of opinion of our many customers that a Diamond Wire does a great job of cutting all kinds of materials. When customers have anything to say about wire saws, they say, "I wish it cut faster." Now it does.

The new large wire has a core of extremely high tensile strength--460,000 PSI. The .050" diameter wire has a breaking strength of 435 lbs. This wire can be run on a large-wire saw at 300 lbs. of tension. As higher tensions are applied to the wire, more thrust can be used between the wire and the part being cut. This is what accounts for the additional cutting speed.

This large wire must have a 20-pitch capstan on the saw for it run in the grooves provided. The large wire will not work on saws made prior to 1990.

If you choose to make a "do-it-yourself" saw, power plants with 20-pitch threads, yokes, ball bearings, shaft and pulley assemblies, and tensioning devices are all available. You make the frame.

We'll be glad to look at your design and give you the benefit of our 27 years of experience before you spend your money. There is no charge for this service.

LASER TECHNOLOGY, INC.
10624 Ventura Blvd.
No. Hollywood, CA 91604-3593

Call Toll Free 1-800-237-6792 or In Calif. (818) 763-7091 (213) 877-8270
Cable Address: LASTEC (No. Hollywood)
FAX: (818) 763-7382

DIAMOND CUTTER WIRE DATA

FIGURE 11

TYPICAL DIAMOND CUTTING WIRE

FIGURE 12

LARGE WIRE SAW

H.B. McLaughlin, Founder

Nothing Cuts Like a Diamond Wire

Laser Technology Inc.

10624 Ventura Blvd.

North Hollywood, CA 91604

(818) 763-7091

(213) 877-8270

BEST COPY AVAILABLE

FIGURE 14

CASE STUDY NO. 4

Diamond Wire Concrete Cutting

APPLICATION

An old nuclear research reactor facility being decommissioned encountered a major stumbling block. Decontamination equipment required in the basement of the Radwaste Building would not fit through existing openings. Due to very tight schedule constraints, the on-site contractor had to quickly devise a scheme to create an access opening 11' high X 9' wide through the 30" inch thick reinforced concrete wall.

ALTERNATIVES

Line drilling could handle the job but was time consuming and considered unacceptable to the project's schedule. Jack-hammers would be labor intensive, expensive and possibly create an airborne contamination problem. Wall saws would require line drilling the corners to eliminate structural problems caused by severe overcuts.

SOLUTION

Cutting Technologies, Inc. (CTI) was able to mobilize on one day's notice over a weekend and complete the project, including setup, in 1½ "shifts", so required activities could resume as scheduled on Monday. The block, weighing approximately 20 tons was easily removed in one piece.

Pacific Northwest Office
2007 E. Stewart St. • Tacoma, WA 98421
(206) 572-3108
Facsimile (206) 272-9017

Headquarters
2002 Ford Circle Suite G • Milford, OH 45150
(513) 248-9800
Facsimile (513) 248-9801

©1987 Cutting Technologies, Inc. All Rights Reserved

BEST AVAILABLE COPY

BEST COPY AVAILABLE

FIGURE 15

TYPICAL WALL CUT

FIGURE 16

TYPICAL FLOOR CUT

FIGURE 17

79105126.21

CELL-TO-CELL SLOT CUTTING WITH DIAMOND WIRE SAW

FIGURE 18

West Wall Block Being Removed

REMOTELY OPERATED CELL-TO-CELL CONCRETE CORE DRILLING MACHINE

FIGURE 21

This page intentionally left blank.

APPENDIX D-2
DIAMOND CABLE CUTTING SEQUENCE

This page intentionally left blank.

DIAMOND CABLE CUTTING SEQUENCE

1. The B Plant consists of 20 modules with 2 cells each. Each cell has a seam between it, and one of the cells next to it.

Walls between cells will be cut forming new covers for new process piping to be installed (Figure 5).

Bolt holes are drilled for lifting bails. The split sections may be fastened together using a combination of bolts and the lifting bail itself.

The lifting bails and joining bolts are installed with all cell covers in place keeping radiation exposure to a minimum.

The top of the wall between cells is marked for location of the cutting machine.
2. Covers of two adjacent cells are removed in a conventional fashion.
3. With the machine in a low radiation zone a new cable is installed, the remote control is checked out and the power head left in position to start the first cut.
4. The machine is remotely placed on top of the wall using the B Plant crane and TV cameras for guidance.
5. The remotely controlled Main Frame Adjusting Strut and water supply system are positioned. (See Figures 6, 7 & 8)
6. The machine is turned on, and the cut started. (Figure 1)
7. After remotely cutting a half inch deep slot, the pulley arms are progressively moved lower and to the side in small steps forming the slanted slot. As the diamond cable cuts deeper, the stroke cylinder easily compensates for cable stretch and bow over the wall.
8. When the swiveled pulley arms reach the bottom of their desired travel, the cable is allowed to cut until it is straight through the wall with no bow. (Figure 2)
9. After operation 8, the arms are moved horizontally to the side in steps (Figure 3) until the bottom cut is completed.
10. With the cable continuing to run, turn off and retract the water system and reverse the path of the arms until the cable has remotely traveled back to the starting point in operation 6.
11. The swiveled pulley arms and water system are remotely positioned to start the other slanted cut at the top of the wall.
12. Cutting continues as in operations 7 and 8, approaching the horizontal cut from operation 9, if the block cracks off, cutting should continue without binding up until the horizontal slot is reached.

13. After the horizontal cut is reached, the water system is shut off and retracted while the cable continues to run. The swiveled pulley arms are returned to the starting point at operation 11.
14. The machine with the main frame is returned to the low radiation zone to be made ready for the next cell operation.
15. The block (or joined blocks) may now be remotely lifted out and taken to a low radiation zone for further hands-on work.
16. The process piping slot shown in the bottom of the lifted out block (Figure 5) could be cut with this machine. Radiation shine out of the slots is eliminated with a steel radiation shield (Figure 6) fastened to the top of the block.

79105126.43

B Plant Piping Installation
Remote Diamond Cable Cutting

Figure 1

B Plant Piping Installation
Remote Diamond Cable Cutting

Figure 2

B Plant Piping Installation
Remote Diamond Cable Cutting

Figure 3

79105126.46

B Plant Piping Installation
Remote Diamond Cable Cutting

Figure 4

B Plant Process Piping Installation
After Remote Diamond Cable Cutting

Figure 5

D2-10

79105126.41

WMC-SD-WM-TA-032
Revision 0

Figure 6

B Plant Plant Piping Installation Diamond Cable Cutting Water/Vacuum System

Figure 7

B Plant Process Piping Installation Remotely Operated Diamond Cable Cutting System

Figure 8

B Plant Process Piping Installation
Remotely Operated Diamond Cable Cutting System

APPENDIX D-3
REMOTELY OPERATED CORE DRILLING SEQUENCE

This page intentionally left blank

Cross Section Looking West

79105126.10

WHC-SD-WM-TA-032
Revision 0

Step 3

Step 4

Step 5

Step 6

Step 7

Step 8

Step 9

79105126.10J

Step 10

Step 11

79105126.101

Step 12

79105126.10m

Step 13

79105126.10n

This page intentionally left blank

APPENDIX D-4

B PLANT CANYON/CELL VENTILATION
(Excerpts from the SAR)

This page intentionally left blank.

The temperature controller (TC-3) (freeze-stat) shuts down the supply fans if the air temperature on the outlet of the preheat coil (PHC-1.1) falls below 35°F. Manual reset must be repositioned before the unit can be restarted. The temperature controller (TC-2) senses the water temperature in the humidifier sump on a drop in temperature below 50°F and the temperature controller (TC-2) modulates the control valve (TCV-4) to maintain a temperature of 50°F. Differential pressure indicators (DPI) measure the static pressure drop across the filter sections. Recirculating pump motor (P-1) in the humidifier section is electrically interconnected with the motor (SF-1) and turns on/off in sequence with the fan motor.

5.4.2.2 Gallery Exhaust Fans EF-1 through EF-7 (Figure 5-17). There are seven outside mounted exhaust fans of which six fans, EF-2 through EF-7, serve the pipe gallery, and one of the fans, EF-1, serves the electrical gallery in the first section of the building (H-2-38395).

These fans are manually started by depressing the fan starter push buttons at their respective station and connected to a master shutdown switch located in Room 205 (dispatcher's office) of the 271-8 Building. When the fans are operating, gallery exhaust air is drawn through prefilter and HEPA filter banks and discharged to the atmosphere through the fan outlet.

Control of each system is performed manually. Air flow rate of each fan (except EF-4) is controlled by adjusting the fan vaned inlet damper or volume dumper to maintain a positive static pressure in the pipe gallery with respect to the 221-8 Canyon and negative with respect to the 271-8 Building office and shop areas.

5.4.3 Canyon Ventilation System (Figure 5-18)

The canyon ventilation system capabilities are based on the reliability of the supply and exhaust ventilation fans to maintain a continuous controlled airflow pattern utilizing a system of pressure differentials to govern the flow of radioactive aerosols and/or particulates that can escape the structural containment barriers of the canyon. Typical performance of the ventilation system is described below:

- Maximum air flowrate through the canyon of 75,000 ft³/min
- Maintenance of sufficient air flow through the cells to maintain the cell temperature below 125°F for the protection of electrical and instrument systems and to minimize thermal gradients between the canyon and cell air
- Provision of sufficient openings and restrictions to provide an air flow rate of 37,500 ft³/min (160 fpm) through an open cell.

5.4.3.1 Canyon Air Flow. A system of pressure differential has been used to govern the flow of airborne radioactive materials that escape the containment.* Pressure differentials of 0.97 in. WG and 1.07 in. WG between the canyon and the cell and the canyon and the air tunnel respectively, can be

*To be reviewed upon 221-3 ventilation system test.

maintained at an air flow of 75,000 ft³/min. Vacuum greater than the atmospheric pressure of the outside environment is maintained at all times to ensure a positive flow of air into the cell. At the estimated design flow rate of 75,000 ft³/min, the air change in the canyon occurs every 20 min; whereas, two air changes per minute occur in the cell. There is an inleakage of 25,000 ft³/min including the air from 224-8 vessel vent.

During normal operation (Figure 5-19), the confinement capabilities are based on the filtered and washed air being drawn in from the environment by the supply units along the crane cabway from where it flows over the parapet wall and down onto the canyon deck. The air stream infiltrates through the calibrated openings which are 1.045 ft² minimum and 8.361 ft² maximum to the cells. The air is drawn through the 14-in. holes at 165 fpm in each cell leading to the air tunnel. The air at an average velocity of 11 ft per second from the air tunnel is filtered and monitored before release.

Vessel vent 1 (Reference Section 5.8.2) system consists of a header which vents process vessels that do not contain significant quantities of ammonium compounds. The header exhausts through steam heater (E-22-3), a pre filter, and a HEPA filter in series (F-22-5), one 1,200 ft³/min steam jet (J-22-4) which discharge to the air tunnel. Thus gases passing through the vessel vent 1 system are subjected to four stages of high efficiency filtration before release to the atmosphere. Vessel vent 2 system services tanks which contain ammonium compounds. The system exhausts through scrubber (T-22-2) for removal of ammonia vapors, steam heater (E-22-7), a glass wool prefilter (F-22-6), two HEPA filters (F-22-8) in series, two backup high efficiency filters in series (F-22-9), a 125 cfm steam jet, and discharges to the atmosphere via the 24-in. sewer. All gases exhausted through the vessel vent 2 system are therefore subjected to the glass wool prefilter and four stages of high efficiency filters prior to atmospheric release.

5.4.3.2 Canyon Supply Fans (Reference 5-35 and 5-36). There are ten canyon supply fans, one for each section, rated at 5,000 ft³/min and 2.35-in. static pressure and run by a 3.1 BHP motor. These supply fans, along with the canyon exhaust fans, establish air flow patterns for contamination control. During normal operation, flow rate is maintained by the operation of two supply fans. The start/stop switches for the ten units are centralized on the dispatcher's panel. The supply fans 1, 5, 9, 13, or 17 will shut off if the canyon-to-operating-gallery pressure approaches 0.04 in. and the fans 3, 7, 11, 15, or 19 supply fans will shut down in the event of canyon-to-gallery differential pressure of 0.03 in. The supply fans are tied into the Emergency shutdown switch on the dispatcher's panel, along with the gallery and other miscellaneous 271-8 exhaust fans, to shut down all at once. The fans are started by pressing the specified supply fan "start" button.

SD-WM-SAR-013 REV 2

FIGURE 5-19

FIGURE 5-19. Ventilation Diagram of the D Plant Processing and Service Area.

APPENDIX E
COST DATA

This page intentionally left blank.

June 14, 1991

To: M. L. Grygiel

From: G. F. Howden

cc: M. A. Cahill
B. K. Horsager
M. E. Johnson

Subject: DW Program Redefinition Studies, Embedded Pipe Repair/Replacement
Cost Estimate

The attachment has been given to KEH Estimating as guidance in developing an incremental cost estimate to the W-095 Short form Data Sheet estimate for adding replacement of existing embedded piping. The work scope is for a max and min case that I believe bounds the problem. If you have any comments on the scope of this work, please advise by 6-19.

This page intentionally left blank.

B Plant Process Piping
Replacement Feasibility Study

Cost Estimate Work Scope
June 14, 1991

PURPOSE

A number of feasibility studies and assessments have been initiated in support of redefining the DST waste disposal strategy. The B Plant Process Piping Replacement Feasibility Study, which is one element of that work addresses the feasibility of partial or extensive process piping replacement if corrosion or other conditions preclude use of some or all of the existing process piping. This cost estimate will address the economic aspect of either partial or extensive pipe replacement.

SCOPE OF WORK

This estimate will address two options to provide bounding incremental cost adders to the Project W-095 Construction Project Data Sheet costs for the B Plant TRUEX Upgrades. The options are:

Option 1

Option 1 is the minimum case. It assumes that all existing embedded piping and piping in the Hot Pipe Trench (HPT) will be usable in some limited form, that the B Plant structure is acceptable to the EPA and WDoEc as the secondary containment, that only limited high corrosion resistant piping is needed between a few selected adjacent cells, and that those cells can be cleaned out and shielded to allow personal access to the upper ten feet of the cells.

Option 2

Option 2 is the maximum case. It assumes that the existing embedded piping to the HPT, between adjacent cells, and the HPT piping is unusable, that the embedded piping to the cold side piping gallery is usable, that the B Plant structure is not acceptable to the regulatory agencies as the means of secondary containment, that double containment of all process piping will be required, and that all work will be done by new remote means.

The details of each option and reference data are given below.

REFERENCES

1. Howden, G. F., to M. L. Grygiel, 1991, "B Plant Process Piping Replacement Feasibility Study-Architectural Assessment," Internal memo 85330-91018, dated May 31, 1991.
2. Howden, G. F., to M. L. Grygiel, 1991, "B Plant Process Piping Replacement Feasibility Study-Structural Assessment." Internal memo 85330-91019, dated June 6, 1991.
3. Drawings listed in references in 1 and 2 above.
4. Drawing H-2-41253, Structural Concrete, New Cover Blocks for Concentration Cell.

OPTION 1 DETAILS

The following are the basis of the Option 1 estimate:

1. Assume 5 adjacent cells require the high corrosion resistant piping between them.
2. Three 15-in.-diameter core drilled penetrations through each of the 7-ft thick adjacent walls between each pair of cells. Holes to be 5 ft-9 in. down from the canyon floor. (see Figure 1) Drilling to be done manually from shielded platform. (see Figure 2)
3. Shop fabricated Hastelloy C-22 feed throughs like Figure 3. Manually install, place anchor/alignment bolt, and field weld prefabricated pipe runs to opposite side of feed through as generally shown on Figure 4.
4. Include cost of two shielded platforms, all core drilling equipment, waste water collection equipment, and materials as expendable hardware.
5. New 4-ft thick high density concrete shielding blocks will be provided for each of the 5 cells.
6. Assume all fabrication work and installation as QA-2, and include final as-built survey of new nozzles for absolute position measurements.

OPTION 2 DETAILS

The following are the basis of the Option 2 estimate:

1. Assume thirty seven cells and the HPT will be modified. Lining of the cells is not included in this work scope.
2. The HPT to be remotely stripped out, cleaned and painted. The embedded process piping lines from the cells to the HPT will be left as 2-in. stubs in the HPT. The nozzles in the cells of pipes to the HPT will be left but capped.
3. Three new 15-in.-diameter penetrations will be cut between each cell and the HPT at elevation (-) 5 ft-9 in. Five new 15-in.-diameter penetrations will be cut between adjacent cells at elevation (-) 5 ft-9 in.
4. The HPT will be repiped using 20-ft long remotely placed, shop fabricated piping modules as shown on Figure 5. Piping feed throughs will be as shown on Figures 5 and 6 for both cell to HPT and cell to cell. Assume 12 pipes and one I & C conduit in each HPT module with one vertical "T" tap on the top of each line. All pipes to be fitted with (3) PUREX nozzles. Each module to have a leak level sensor and transfer air jet to drain the module, a shielded electric valve to control the air jet and a leak alarm to the plant control room.
5. The HPT module materials are assumed as follows:
 - Structural outer frame, 3-in. sq. SS tubing
 - Liner 16 Ga. Hastelloy C-22 or Inconel 600
 - Pipe, conduit, and supports Hastelloy C-22 or Inconel 600
 - Wetted instrumentation and jets same as pipe materials
 - Non-wetted I & C in 304L SS enclosure
 - Non-wetted mechanical components such as leveling screws, horizontal wedging jacks of C'st.
6. Remote equipment such as shown in Appendix A is to be the assumed means of "hands-on" work in the cells or HPT. This equipment is not to be costed. Already in W-095 estimate.
7. Remote core drilling equipment as shown on Figures 7 and 8 and Appendix B is to be estimated, including expendable core drill tubes. Assume one core drill tube per hole. The tube will be the disposal container for the 2,000 lb. concrete slug or it's parts. Plan on three machines. Assume the same control equipment used for the remote manipulator module will also operate and control this machine. Assume that this machine will plug into the same special wall mounted control and power connector at each cell that will be required for the manipulator operation at each cell.

WHC-SD-WM-TA-032
Revision 0

8. Assume that all feed throughs and HPT piping and jumpers will be QA-2.
9. Include an allowance for remotely operated laser survey equipment to measure tooling reference points on each HPT module and each feed through for as-built reference dimensions of the nozzles.
10. Provide new 4-ft thick high density concrete shielding blocks for each cell and new 2-ft thick high density blocks for the HPT. See Reference 4.

This estimate should include the costs of jumpers to connect the HPT modules (11 Pipe and one elect.) and the feed through nozzles to the HPT line nozzles.

B Plant Cross Section Looking East

79105126.13

TYPICAL EMBEDMENTS IN CELL EAST WALL

FIGURE 1

79105126.25

SHIELDED WORK PLATFORM

FIGURE 2

79105126.24

MANUALLY INSTALLED PIPING FEEDTHROUGH

FIGURE 3

MANUALLY INSTALLED CELL PIPING ARRANGEMENT

FIGURE 4

B Plant Replaceable Hot Trench Module

FIGURE 5

79105126.23

REMOTELY INSTALLED PIPING FEEDTHROUGH

FIGURE 6A

REMOTELY OPERATED CORE DRILLING MACHINE POSITIONED IN CELL

FIGURE 7

PAGE 1 OF 7
DATE 09/13/91 14:20:17
BY M T SUSIENE

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 1
KENR01 - PROJECT COST SUMMARY

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 1

COST CODE	DESCRIPTION	ESCALATED TOTAL COST	CONTINGENCY %	TOTAL DOLLARS
000	ENGINEERING	230,000	35	310,000
501	BUILDINGS	6,050,000	40	8,470,000
	(ADJUSTED TO MEET DOE \$100.4)	20,000	-0-	20,000
	PROJECT TOTAL	6,280,000	40	8,760,000

TYPE OF ESTIMATE	STUDY	SEPTEMBER 13, 1991	REMARKS: ESTIMATE IS AN ALTERNATE ESTIMATE ESTIMATE DOES NOT STAND ALONE. REFERENCE THE FOLLOWING ESTIMATES:
ARCHITECT			ER1269 OPT 2A
ENGINEER			ER1269 OPT 2B
OPERATING CONTRACTOR			ER1269 OPT 2C

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

WHC-SD-WM-TA-032
Revision 0

KAISER ENGINEERS HANFORD WESTINGHOUSE HANFORD COMPANY JOB NO. ERT269 OPT 1			** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE KENRO2 - WORK BREAKDOWN STRUCTURE SUMMARY				PAGE 2 OF 7 DATE 09/13/91 14:20:20 BY W T SUSIENE		
WBS DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	SUB TOTAL	CONTINGENCY %	TOTAL DOLLARS		
111110 ENGINEERED EQUIPMENT DEFIN DESIGN	111999	0	111999	37.72	42246	35	208231		
SUBTOTAL 11 DEFINITIVE DESIGN	111999	0	111999	37.72	42246	35	208231		
121110 E/I - ONSITE A-E - PROCUREMENT SUPT	16100	0	16100	45.98	7403	35	31729		
121120 E/I - ONSITE A-E - ONSITE INSTALL	32400	0	32400	54.86	17775	35	67736		
SUBTOTAL 12 E/I DURING CONSTRUCTION	48500	0	48500	51.91	25178	35	99465		
SUBTOTAL 1 ENGINEERING	160499	0	160499	42.01	67424	35	307696		
211110 ENGINEERED EQUIPMENT PROCUREMENT	413692	0	413692	34.45	142586	40	779069		
211120 HARDWARE PROCUREMENT	947946	0	947946	34.45	326567	35	1720593		
SUBTOTAL 21 ONSITE CONTR PROCUREMENT	1361838	0	1361838	34.45	469153	37	2499662		
231110 BURY BOX PROCUREMENT - UNC	466800	0	466800	34.45	160813	40	878658		
SUBTOTAL 23 OPERATING CONTRACTOR PROCUR	466800	0	466800	34.45	160813	40	878658		
SUBTOTAL 2 PROCUREMENT	1828638	0	1828638	34.45	629966	37	3378320		
311110 TEMPORARY CONSTRUCTION	189011	0	189011	42.52	80367	49	401110		
311120 CORE DRILLING	183602	0	183602	42.52	78068	50	392198		
311140 INSTALL FEEDTHROUGHS	74065	0	74065	42.52	31492	50	158336		
311150 BURIAL FEES AND COSTS	1581163	0	1581163	42.52	672311	40	3154863		
311160 SHIFT DIFFERENTIAL COSTS	159338	0	159338	42.52	67750	40	318909		
SUBTOTAL 31 ONSITE CONSTR CONTR	2187179	0	2187179	42.52	929988	42	4425416		
331110 SUPPORT FOR ONSITE CONTRACTOR	117436	0	117436	34.45	40457	40	221050		
SUBTOTAL 33 OPER CONTR CONSTRUCTION	117436	0	117436	34.45	40457	40	221050		
341110 OPER CONTR PROJ MGMT	214687	0	214687	45.97	98692	40	438730		
SUBTOTAL 34 OPER CONTR PROJ MGMT	214687	0	214687	45.97	98692	40	438730		
SUBTOTAL 3 CONSTRUCTION	2519302	0	2519302	42.44	1069137	42	5085196		
PROJECT TOTAL	4,508,439	0	4,508,439	39.18	1,766,527	40	8,771,212		

PAGE 3 OF 7
DATE 09/13/91 09:24:04
BY W T SUSIENE

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 1
KENROS - ESTIMATE BASIS SHEET

KAISER ENGINEERS HANFORD
WESTINHOUSE HANFORD COMPANY
JOB NO. ERT269 OPT 1

1. DOCUMENTS AND DRAWINGS
===== DOCUMENTS: DRAFT, B PLANT PROCESS PIPING REPLACEMENT FEASIBILITY STUDY REPORT BY GARY F. HOWDEN, DATED SEPTEMBER 6, 1991
DRAWINGS: =====
2. MATERIAL PRICES
===== UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL. VENDOR INFORMATION WAS OBTAINED FOR SELECTED ITEMS AS INDICATED ON THE EQUIPMENT LIST ATTACHED TO ESTIMATE ERT269 OPTION 2A.
3. LABOR RATES
===== CURRENT HANFORD BASE RATES AS ISSUED BY KEN (ISSUE # 14, REV. 0, DATED 4-1-91) INCLUDE FRINGE BENEFITS, LABOR INSURANCE, TAXES AND TRAVEL WHERE APPLICABLE.
4. GENERAL REQUIREMENTS/TECHNICAL SERVICES
===== A.) ONSITE CONSTRUCTION FORCES GENERAL REQUIREMENTS AND TECHNICAL SERVICES COSTS ARE INCLUDED AS A COMPOSITE PERCENTAGE BASED ON THE KEN ESTIMATING FACTORYBILLING SCHEDULE REVISION 12 DATED APRIL 01, 1991. THE TOTAL COMPOSITE PERCENTAGE APPLIED TO ONSITE CONSTRUCTION FORCES LABOR FOR THIS PROJECT IS 84% FOR SHOP WORK AND 115% FOR FIELD WORK WHICH IS REFLECTED IN THE "ONHP / B & I" COLUMN OF THE ESTIMATE DETAIL.
5. ESCALATION
===== ESCALATION CALCULATED BY THE HANFORD MATERIAL & LABOR ESCALATION STUDY, FEBRUARY, 1991. RATES SELECTED ARE BASED UPON A MIDPOINT OF ENGINEERING OF JULY, 1997, PROCUREMENT OF JULY, 1998 AND CONSTRUCTION OF JULY, 1999.
6. ROUNDING - LINE ITEMS:
===== U.S. DEPARTMENT OF ENERGY - DOE ORDER 5100.4, PAGE J-2 SUPPLEMENT (M), REQUIRES ROUNDING OF A COST ESTIMATE TO \$10,000 FOR ITEM COST AND \$100,000 FOR TOTAL COST. REFERENCE: DOE 5100.4, FIGURE J-11, DATED 10-31-84.
7. REMARKS
===== A) ESTIMATE IS FOR OPTION 1 AS DESCRIBED IN VMC FEASIBILITY STUDY. ESTIMATE ASSUMES 5 PITS TO BE MODIFIED BY MANUALLY DRILLING 3 HOLES IN EACH OF 4 SEPARATE WALLS BETWEEN ADJACENT CELLS. EACH HOLE SHALL BE FILLED WITH A 15" DIA FEEDTHROUGH SIMILAR TO THAT SHOWN ON FIGURE 2 OF THE VMC FEASIBILITY STUDY. WORK IS TO BE PERFORMED MANUALLY USING ON-SITE CONSTRUCTION FORCES WITH ASSIST FROM PUREX OPERATIONS PERSONNEL.
B) ESTIMATE ASSUMES THAT CELLS WILL BE DECONTAMINATED BY VMC UNDER A SEPARATE PROJECT. REMAINING RADIATION EXPOSURE TO CONSTRUCTION FORCES WILL BE REDUCED BY SHIELDING TO LEVELS THAT WILL ALLOW WORK TO PROCEED WITHOUT BUTNOT. NO BURNOUT IS INCLUDED IN THIS ESTIMATE.
C) ESTIMATE ASSUMES THAT IN-CELL WORK WILL REQUIRE A SHIELDED WORK PLATFORM WITH A COVERING GREENHOUSE, AND ISOLATED PORTABLE SHIELDING. A TEMPORARY VENTILATION SYSTEM WILL BE INSTALLED IN EACH GREENHOUSE.
D) PASSTHROUGH FABRICATION IS ASSUMED TO BE IDENTICAL TO THAT DESCRIBED IN ESTIMATE ERT269 OPT 2A.
E) ESTIMATE ASSUMES A RELATIVELY SMALL CREW WILL BE REQUIRED AND NO ESCORT PROVISIONS ARE INCLUDED IN THIS ESTIMATE.
F) ESTIMATE ASSUMES WORK TO BE PERFORMED ON 3 SHIFTS PER DAY FIVE DAYS PER WEEK.

KAISER ENGINEERS HANFORD
WESTINHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 1

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 1
KENR04 - COST CODE ACCOUNT SUMMARY

PAGE 4 OF 7
DATE 09/13/91 14:20:25
BY W T SUSIENE

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION % TOTAL	SUB TOTAL	CONTINGENCY % TOTAL	TOTAL DOLLARS
=====	=====	=====	=====	=====	=====	=====	=====	=====
000	ENGINEERING							
111110	ENGINEERED EQUIPMENT DEFIN DESIGN	111999	0	111999	37.72	42246	35	208231
121110	E/I - ONSITE A-E - PROCUREMENT SPT	16100	0	16100	45.98	7403	35	31729
121120	E/I - ONSITE A-E - ONSITE INSTALL	32400	0	32400	54.86	17775	35	67736
TOTAL 000	ENGINEERING	160499	0	160499	42.01	67424	35	307696
501	BUILDINGS							
211110	ENGINEERED EQUIPMENT PROCUREMENT	413892	0	413892	34.45	142586	40	779069
211120	HARDWARE PROCUREMENT	947946	0	947946	34.45	326567	35	1720593
231110	BURY BOX PROCUREMENT - WMC	466800	0	466800	34.45	160813	40	878658
311110	TEMPORARY CONSTRUCTION	189011	0	189011	42.52	80367	49	401110
311120	CORE DRILLING	183602	0	183602	42.52	78068	50	392198
311140	INSTALL FEEDTHROUGHS	74065	0	74065	42.52	31492	50	158336
311150	BURIAL FEES AND COSTS	1581163	0	1581163	42.52	672311	40	3154863
311160	SHIFT DIFFERENTIAL COSTS	159338	0	159338	42.52	67750	40	318909
331110	SUPPORT FOR ONSITE CONTRACTOR	117436	0	117436	34.45	40457	40	221050
341110	OPER CONTR PROJ MGMT	214687	0	214687	45.97	98692	40	438730
TOTAL 501	BUILDINGS	4347940	0	4347940	39.08	1699103	40	8463516
PROJECT TOTAL		4,508,439	0	4,508,439	39.18	1,766,527	40	8,771,212

E-20

WMC-SD-WM-TA-032
Revision 0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 1

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE
KENROS - ESTIMATE SUMMARY BY CSI DIVISION

PAGE 5 OF 7
DATE 09/13/91 14:20:29
BY N T SUSIENE

WBS DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	SUB TOTAL	CONTINGENCY %	TOTAL DOLLARS
ENGINEERING							
00 TECHNICAL SERVICES	160499	0	160499	42.01	67424	35	307696
TOTAL ENGINEERING	160499	0	160499	42.01	67424	35	307696
CONSTRUCTION							
01 GENERAL REQUIREMENTS	465785	0	465785	40.49	188574	44	941069
02 SITEWORK	2047963	0	2047963	40.68	833124	40	4033521
03 CONCRETE	825879	0	825879	36.24	299332	38	1557979
05 METALS	236334	0	236334	34.45	81417	35	428964
15 MECHANICAL	557292	0	557292	35.52	197964	41	1063253
19 PROJECT MANAGEMENT	214607	0	214607	45.97	98692	40	438730
TOTAL CONSTRUCTION	4347940	0	4347940	39.08	1699103	40	8463516
PROJECT TOTAL	4,508,439	0	4,508,439	39.18	1,766,527	40	8,771,212

PAGE 1 OF 7
DATE 09/13/91 16:20:17
BY W T SUSIENE

KAISER ENGINEERS HAMFORD
WESTIMHOUSE HAMFORD COMPANY
JOB NO. ER1269 OPT 1

COST CODE	DESCRIPTION	ESTIMATED TOTAL COST	CONTINGENCY %	TOTAL	TOTAL DOLLARS
000	ENGINEERING	230,000	35	80,000	310,000
501	BUILDINGS	6,050,000	40	2,420,000	8,470,000
	(ADJUSTED TO MEET DOE \$100.4)	20,000		-0-	20,000
	PROJECT TOTAL	6,280,000	40	2,500,000	8,780,000

TYPE OF ESTIMATE	STUDY	SEPTEMBER 13, 1991	REMARKS: ESTIMATE IS AN ALTERNATE ESTIMATE ESTIMATE DOES NOT STAND ALONE. REFERENCE THE FOLLOWING ESTIMATES:
ARCHITECT ENGINEER	<i>[Signature]</i>		ER1269 OPT 2A ER1269 OPT 2B ER1269 OPT 2C
OPERATING CONTRACTOR			

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

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 1

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 1
KEHR02 - WORK BREAKDOWN STRUCTURE SUMMARY

PAGE 2 OF 7
DATE 09/13/91 14:20:20
BY W T SUSIENE

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION % TOTAL	SUB TOTAL	CONTINGENCY % TOTAL	TOTAL DOLLARS		
111110	ENGINEERED EQUIPMENT DEFIN DESIGN	111999	0	111999	37.72	42246	154245	35	53986	208231
	SUBTOTAL 11 DEFINITIVE DESIGN	111999	0	111999	37.72	42246	154245	35	53986	208231
121110	E/I - ONSITE A-E - PROCUREMENT SUPT	16100	0	16100	45.98	7403	23503	35	8226	31729
121120	E/I - ONSITE A-E - ONSITE INSTALL	32400	0	32400	54.06	17775	50175	35	17561	67736
	SUBTOTAL 12 E/I DURING CONSTRUCTION	48500	0	48500	51.91	25178	73678	35	25787	99465
	SUBTOTAL 1 ENGINEERING	160499	0	160499	42.01	67424	227923	35	79773	307696
211110	ENGINEERED EQUIPMENT PROCUREMENT	413892	0	413892	34.45	142586	556478	40	222591	779069
211120	HARDWARE PROCUREMENT	947946	0	947946	34.45	326567	1274513	35	446079	1720593
	SUBTOTAL 21 ONSITE CONTR PROCUREMENT	1361838	0	1361838	34.45	469153	1830991	37	668670	2499662
231110	BURY BOX PROCUREMENT - MHC	466800	0	466800	34.45	160813	627613	40	251045	878658
	SUBTOTAL 23 OPERATING CONTRACTOR PROCUR	466800	0	466800	34.45	160813	627613	40	251045	878658
	SUBTOTAL 2 PROCUREMENT	1828638	0	1828638	34.45	629966	2458604	37	919715	3378320
311110	TEMPORARY CONSTRUCTION	189011	0	189011	42.52	80367	269378	49	131732	401110
311120	CORE DRILLING	183602	0	183602	42.52	78068	261670	50	130529	392198
311140	INSTALL FEEDTHROUGHS	74065	0	74065	42.52	31492	105557	50	52779	158336
311150	BURIAL FEES AND COSTS	1581163	0	1581163	42.52	672311	2253474	40	901389	3154863
311160	SHIFT DIFFERENTIAL COSTS	159338	0	159338	42.52	67750	227088	40	91819	318909
	SUBTOTAL 31 ONSITE CONSTR CONTR	2187179	0	2187179	42.52	929988	3117167	42	1308248	4425416
331110	SUPPORT FOR ONSITE CONTRACTOR	117436	0	117436	34.45	40457	157893	40	63157	221050
	SUBTOTAL 33 OPER CONTR CONSTRUCTION	117436	0	117436	34.45	40457	157893	40	63157	221050
341110	OPER CONTR PROJ MGMT	214687	0	214687	45.97	98692	313379	40	125351	438730
	SUBTOTAL 34 OPER CONTR PROJ MGMT	214687	0	214687	45.97	98692	313379	40	125351	438730
	SUBTOTAL 3 CONSTRUCTION	2519302	0	2519302	42.44	1069137	3588439	42	1496756	5085196
=====										
PROJECT TOTAL		4,508,439	0	4,508,439	39.18	1,766,527	6,274,966	40	2,496,244	8,771,212

E-23

MHC-SD-MH-TA-032
Revision 0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 1

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE
OPTION 1
KENRO3 - ESTIMATE BASIS SHEET

PAGE 3 OF 7
DATE 09/13/91 09:24:04
BY W T SUSTENE

1. DOCUMENTS AND DRAWINGS

DOCUMENTS: DRAFT, B PLANT PROCESS PIPING REPLACEMENT FEASIBILITY STUDY REPORT BY GARY F. HOWDEN, DATED SEPTEMBER 6, 1991

DRAWINGS:

2. MATERIAL PRICES

UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL. VENDOR INFORMATION WAS OBTAINED FOR SELECTED ITEMS AS INDICATED ON THE EQUIPMENT LIST ATTACHED TO ESTIMATE ER1269 OPTION 2A.

3. LABOR RATES

CURRENT HANFORD BASE RATES AS ISSUED BY KEN (ISSUE # 14, REV. 0, DATED 4-1-91) INCLUDE FRINGE BENEFITS, LABOR INSURANCE, TAXES AND TRAVEL WHERE APPLICABLE.

4. GENERAL REQUIREMENTS/TECHNICAL SERVICES

A.) ONSITE CONSTRUCTION FORCES GENERAL REQUIREMENTS AND TECHNICAL SERVICES COSTS ARE INCLUDED AS A COMPOSITE PERCENTAGE BASED ON THE KEN ESTIMATING FACTOR/BILLING SCHEDULE REVISION 12 DATED APRIL, 01, 1991. THE TOTAL COMPOSITE PERCENTAGE APPLIED TO ONSITE CONSTRUCTION FORCES LABOR FOR THIS PROJECT IS 04% FOR SHOP WORK AND 115% FOR FIELD WORK WHICH IS REFLECTED IN THE "O&B" / B & I" COLUMN OF THE ESTIMATE DETAIL.

5. ESCALATION

ESCALATION CALCULATED BY THE HANFORD MATERIAL & LABOR ESCALATION STUDY, FEBRUARY, 1991. RATES SELECTED ARE BASED UPON A MIDPOINT OF ENGINEERING OF JULY, 1997, PROCUREMENT OF JULY, 1998 AND CONSTRUCTION OF JULY, 1999.

6. ROUNDING - LINE ITEMS:

U.S. DEPARTMENT OF ENERGY - DOE ORDER 5100.4 PAGE J-2 SUBPARAGRAPH (K), REQUIRES ROUNDING OF A COST ESTIMATE TO \$10,000 FOR ITEM COST AND \$100,000 FOR TOTAL COST. REFERENCE: DOE 5100.4, FIGURE I-11, DATED 10-31-84.

7. REMARKS

A) ESTIMATE IS FOR OPTION 1 AS DESCRIBED IN WMC FEASIBILITY STUDY. ESTIMATE ASSUMES 5 PITS TO BE MODIFIED BY MANUALLY DRILLING 3 HOLES IN EACH OF 4 SEPARATE WALLS BETWEEN ADJACENT CELLS. EACH HOLE SHALL BE FILLED WITH A 15" DIA FEEDTHROUGH SIMILAR TO THAT SHOWN ON FIGURE 2 OF THE WMC FEASIBILITY STUDY. WORK IS TO BE PERFORMED MANUALLY USING ON-SITE CONSTRUCTION FORCES WITH ASSIST FROM PUREX OPERATIONS PERSONNEL.

B) ESTIMATE ASSUMES THAT CELLS WILL BE DECONTAMINATED BY WMC UNDER A SEPARATE PROJECT. REMAINING RADIATION EXPOSURE TO CONSTRUCTION FORCES WILL BE REDUCED BY SHIELDING TO LEVELS THAT WILL ALLOW WORK TO PROCEED WITHOUT SHUTOUT. NO SHUTOUT IS INCLUDED IN THIS ESTIMATE.

C) ESTIMATE ASSUMES THAT IN-CELL WORK WILL REQUIRE A SHIELDED WORK PLATFORM WITH A COVERING GREENHOUSE, AND ISOLATED PORTABLE SHIELDING. A TEMPORARY VENTILATION SYSTEM WILL BE INSTALLED IN EACH GREENHOUSE.

D) PASSTHROUGH FABRICATION IS ASSUMED TO BE IDENTICAL TO THAT DESCRIBED IN ESTIMATE ER1269 OPT 2A.

E) ESTIMATE ASSUMES A RELATIVELY SMALL CREW WILL BE REQUIRED AND NO ESCORT PROVISIONS ARE INCLUDED IN THIS ESTIMATE.

F) ESTIMATE ASSUMES WORK TO BE PERFORMED ON 3 SHIFTS PER DAY FIVE DAYS PER WEEK.

WMC-SD-WM-TA-032
Revision 0

** KAISER ENGINEERS INTERACTIVE ESTIMATING **									
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION									
STUDY ESTIMATE OPTION 1									
KEMR04 - COST CODE ACCOUNT SUMMARY									
PAGE 4 OF 7									
DATE 09/13/91 14:20:25									
BY W T SUSIENE									

KAISER ENGINEERS HANFORD
WESTINHOUSE HANFORD COMPANY
JOB NO. ERI269 OPT 1

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE
KENR05 - ESTIMATE SUMMARY BY CSI DIVISION

PAGE 5 OF 7
DATE 09/13/91 14:20:29
BY W T SUSIENE

UBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION X TOTAL	SUB TOTAL	CONTINGENCY % TOTAL	TOTAL DOLLARS
00	TECHNICAL SERVICES	160499	0	160499	42.01	67424	35	307696
	TOTAL ENGINEERING	160499	0	160499	42.01	67424	35	307696
	CONSTRUCTION							
01	GENERAL REQUIREMENTS	465785	0	465785	40.49	188574	44	941069
02	SITENWORK	2047963	0	2047963	40.48	833124	40	4033521
03	CONCRETE	825879	0	825879	36.24	299332	38	1557979
05	METALS	236334	0	236334	34.45	81417	35	428964
15	MECHANICAL	557292	0	557292	35.52	197964	41	1063253
19	PROJECT MANAGEMENT	214687	0	214687	45.97	98692	40	436730
	TOTAL CONSTRUCTION	4347940	0	4347940	39.08	1699103	40	8463516
	PROJECT TOTAL	4,508,439	0	4,508,439	39.18	1,766,527	40	8,771,212

KAISER ENGINEERS HANFORD
WESTINHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 1

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 1
KENR06 - CONTINGENCY ANALYSIS BASIS SHEET

PAGE 6 OF 7
DATE 09/13/91 09:24:19
BY W T SUSIENE

REFERENCE: ESTIMATE BASIS SHEET
COST CODE ACCOUNT SUMMARY

PAGE 3 OF 7
PAGE 4 OF 7

THE U.S. DEPARTMENT OF ENERGY - RICHLAND ORDER 5700.3 "COST ESTIMATING, ANALYSIS AND STANDARDIZATION" DATED 3-27-85, PROVIDES GUIDELINES FOR ESTIMATE CONTINGENCIES. THE GUIDELINE FOR A STUDY ESTIMATE SHOULD HAVE AN OVERALL RANGE OF 20 TO 50% .

CONTINGENCY IS EVALUATED AT THE THIRD COST CODE LEVEL AND SUMMARIZED AT THE PRIMARY AND SECONDARY COST CODE LEVEL OF THE DETAILED COST ESTIMATE.

ENGINEERING

ENGINEERING CONTINGENCY IS ASSIGNED AT 35 PER CENT ON THE FOLLOWING BASIS:

- THE POTENTIAL RADIATION SOURCE MAY REQUIRE AN UNKNOWN AMOUNT OF ENGINEERING ON THE PORTABLE WORK PLATFORM
- THE DEFINITIVE DESIGN OF THE PUREX CONNECTOR NOZZLES WITH NEWER ALLOYS WILL REQUIRE EXPLORATORY ENGINEERING IN THE SIDE EFFECTS OF SUCH MATERIALS.
- REMOTE SURVEY REQUIREMENTS ARE UNKNOWN.
- AVAILABLE INFORMATION AT THIS STAGE OF THE STUDY IS QUITE SUBJECTIVE.

AVERAGE ENGINEERING CONTINGENCY 35%

CONSTRUCTION

CONSTRUCTION CONTINGENCY IS ASSIGNED AT 40 PER CENT ON THE FOLLOWING BASIS:

- THE POTENTIAL RADIATION EXPOSURE IS UNKNOWN WHICH COULD AFFECT THE COSTS OF THE WORK PLATFORM AND LABOR PRODUCTIVITY.
- UNKNOWN POTENTIAL PROBLEMS EXIST WITH CORE DRILLING THROUGH BUILDING EXPANSION JOINTS.
- THE USE OF DIFFERENT ALLOWYS FOR PUREX JUMPER CONNECTORS MAY INCREASE MATERIAL AND MACHINING COSTS DRAMATICALLY.
- AVAILABLE INFORMATION AT THIS STAGE OF THE STUDY IS QUITE SUBJECTIVE.

AVERAGE CONSTRUCTION CONTINGENCY 40%

AVERAGE PROJECT CONTINGENCY 40%

E-27

MHC-SD-MM-TA-032
Revision 0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 1

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 1
KEHR07 - ONSITE INDIRECT COSTS BY WBS

PAGE 7 OF 7 PAGES
DATE 09/13/91 14:20:32
BY W T SUSIENE

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	CONTRACT ADMINISTRATION % TOTAL	BID PACK PREP.	OTHER INDIRECTS	TOTAL INDIRECTS
=====	=====	=====	=====	=====	=====	=====
111110	ENGINEERED EQUIPMENT DEFIN DESIGN	111999	0.00	0	0	0
121110	E/I - ONSITE A-E - PROCUREMENT SUPT	16100	0.00	0	0	0
121120	E/I - ONSITE A-E - ONSITE INSTALL	32400	0.00	0	0	0
211110	ENGINEERED EQUIPMENT PROCUREMENT	413892	0.00	0	0	0
211120	HARDWARE PROCUREMENT	947946	0.00	0	0	0
231110	BURY BOX PROCUREMENT - WMC	466800	0.00	0	0	0
311110	TEMPORARY CONSTRUCTION	189011	0.00	0	0	0
311120	CORE DRILLING	103602	0.00	0	0	0
311140	INSTALL FEEDTHROUGHS	74065	0.00	0	0	0
311150	BURIAL FEES AND COSTS	1581163	0.00	0	0	0
311160	SHIFT DIFFERENTIAL COSTS	159338	0.00	0	0	0
331110	SUPPORT FOR ONSITE CONTRACTOR	117436	0.00	0	0	0
341110	OPER CONTR PROJ MGMT	214687	0.00	0	0	0
=====						
PROJECT TOTAL		4,508,439		0	0	0

WMC-SD-WM-TA-032
Revision 0

This page intentionally left blank.

** KAISER ENGINEERS INTERACTIVE ESTIMATING **											
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION											
STUDY ESTIMATE											
KEHROB - ESTIMATE DETAIL BY WBS / COST CODE											
PAGE 1											
DATE 09/13/91 14:20:37											
BY W T SUSIENE											
ACCOUNT	DESCRIPTION	COST	QUANTITY	HANHOUS	LABOR	EQUIP	MATERIAL	SUB-	EQUIP-	OR&P	TOTAL
NUMBER		CODE				USAGE		CONTRACT	MENT	/ B & I	DOLLARS
111110	ENGINEERED EQUIPMENT DEFIN DESIGN										
111110.00	TECHNICAL SERVICES	000	0	0	0	0	0	0	0	0	0
111110.0000000	*****	000									
111110.0000004	DEFINITIVE DESIGN TO INCLUDE PROCUREMENT SPECIFICATIONS FOR FEEDTHROUGHS NOZZLES, AND COVER BLOCKS AND DRAWINGS AND SPECIFICATIONS FOR TEMPORARY WORK PLATFORMS AND INSTALLATION.	000	1 LS	1866	111999	0	0	0	0	0	111999
111110.0000005		000	0	0	0	0	0	0	0	0	0
SUBTOTAL	TECHNICAL SERVICES			1,866	111,999	0	0	0	0	0	111,999
TOTAL	COST CODE 00000			1,866	111,999	0	0	0	0	0	111,999
	WBS 111110										
	(ESCALATION 37.72 % - CONTINGENCY 35.00 %)										
TOTAL WBS 111110	ENGINEERED EQUIPMENT DEFIN DESIGN			1,866	111,999	0	0	0	0	0	111,999

KAISER ENGINEERS HANFORD
WESTHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 1

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 2
DATE 09/13/91 14:20:39
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOUS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ONMP / B & I	TOTAL DOLLARS
121110	E/I - ONSITE A-E - PROCUREMENT SUPT										
121110.00	TECHNICAL SERVICES	000	0	0	0	0	0	0	0	0	0
121110.00000000											
121110.00000004	ENGINEERING AND INSPECTION DURING CONSTRUCTION - PROCUREMENT SUPPORT.	000	1 LS	268	16100	0	0	0	0	0	16100
SUBTOTAL	TECHNICAL SERVICES			268	16,100	0	0	0	0	0	16,100
TOTAL	COST CODE 00000 WBS 121110 (ESCALATION 45.98 % - CONTINGENCY 35.00 %)			268	16,100	0	0	0	0	0	16,100
TOTAL WBS 121110	E/I - ONSITE A-E - PROCUREMENT SUPT			268	16,100	0	0	0	0	0	16,100

KAISER ENGINEERS HAMFORD
WESTINGHOUSE HAMFORD COMPANY
JOB NO. ER1269 OPT 1

KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 1
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 3
DATE 09/13/91 14:20:40
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	SUB- CONTRACT	EQUIP- MENT	ORHP / B & I	TOTAL DOLLARS
121120	E/J - ONSITE A-E - ONSITE INSTALL									
121120.00	TECHNICAL SERVICES	000	0	0	0	0	0	0	0	0
121120.00000000										
121120.00000004	ENGINEERING AND INSPECTION DURING CONSTRUCTION ON-SITE INSTALLATION SUPPORT	000	1 LS	540	32400	0	0	0	0	32400
SUBTOTAL	TECHNICAL SERVICES			540	32,400	0	0	0	0	32,400
TOTAL	COST CODE 00000 WBS 121120 (ESCALATION 54.86 % - CONTINGENCY 35.00 %)			540	32,400	0	0	0	0	32,400
TOTAL WBS 121120 E/J - ONSITE A-E - ONSITE INSTALL				540	32,400	0	0	0	0	32,400

Kaiser Engineers Hamford Westinhouse Hamford Company Job No. ERT269 OPT 1									
** Kaiser Engineers Interactive Estimating ** Defense Waste Remediation Program Redefinition Study Estimate Kenrob - Estimate Detail by WBS / Cost Code									
ACCOUNT NUMBER DESCRIPTION COST CODE QUANTITY HANHOUS LABOR EQUIP USAGE MATERIAL SUB- CONTRACT EQUIP- MENT OH&P / B & I DOLLARS TOTAL									
21110	ENGINEERED EQUIPMENT PROCUREMENT								
21110.15	MECHANICAL								
21110.1500000	*****	501	0	0	0	0	0	0	0
21110.1500004	15" DIA FEEDTHROUGH WITH SEA 2" JUMPER LINES ENCASED WITHIN SST ENCASEMENT AND KICKPLATES/INCONEL 600 PIPE AND NOZZLES. (INCLUDES 10 NOZZLES AND KICKPLATES) SHIPPED PARTIALLY KNOCKED DOWN	501	12 EA	0	0	0	0	0	360000
21110.1500005		501	0	0	0	0	0	0	0
SUBTOTAL MECHANICAL SALES TAX 7.80 % WAREHOUSING 7.17 % COST CODE 50115 WBS 21110 (ESCALATION 34.45 % - CONTINGENCY 40.00 %)									
TOTAL 360,000 28,080 25,812 413,892									
TOTAL WBS 21110 ENGINEERED EQUIPMENT PROCUREMENT 0 0 0 413,892 413,892									

KAISER ENGINEERS HANFORD
WESTINHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 1

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 1
KEHR08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 5
DATE 09/13/91 14:20:42
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
211120	HARDWARE PROCUREMENT										
211120.03	CONCRETE										
211120.0300000	*****	501	0	0	0	0	0	0	0	0	0
211120.0300004	CORE DRILL CASINGS 15" OD X 8' LONG	501	12 EA	0	0	0	72000	0	0	0	72000
211120.0300006	CORE DRILL MACHINE W/WATER RECIRCULATION SYSTEM FOR 16" DIA X 8' LONG HOLES	501	1 EA	0	0	0	35000	0	0	0	35000
211120.0300104	PIT COVER BLOCKS - PRECAST W/ HI-DENSITY CONCRETE 4' THICK	501	15 EA	0	0	0	450000	0	0	0	450000
SUBTOTAL	CONCRETE			0	0	0		0	0	0	
	SALES TAX 7.80 %					557,000			0		557,000
	WAREHOUSING 7.51 %					43446			0		43446
						41831					41831
TOTAL	COST CODE 50103 WBS 211120 (ESCALATION 34.45 % - CONTINGENCY 35.00 %)			0	0	0	642,277	0	0	0	642,277
211120.05	METALS										
211120.0500000	*****	501	0	0	0	0	0	0	0	0	0
211120.0500004	PURCHASE LEAD SHIELDED WORK PLATFORM TO FIT IN CELL AND PROVIDE SHIELDED WORK SPACE FOR CORE DRILL AND OPERATIONS - PLATFORM TO WEIGHT APPROXIMATELY 35 TON & ANCHOR SECURELY INSIDE CELL TO SUPPORT ACCURATE	501	2 EA	0	0	0	204000	0	0	0	204000
211120.0500005	PLACEMENT OF NOZZLES NOTE: SHIP PARTIALLY KNOCKED DOWN FOR FINAL ASSY IN CANYON	501	0	0	0	0	0	0	0	0	0
SUBTOTAL	METALS			0	0	0		0	0	0	
	SALES TAX 7.80 %					204,000			0		204,000
	WAREHOUSING 8.05 %					15912			0		15912
						16422					16422

E-34

MHC-SD-MM-TA-032
Revision 0

KAISER ENGINEERS HANFORD WESTINGHOUSE HANFORD COMPANY JOB NO. ER1269 OPT 1		** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE KENROB - ESTIMATE DETAIL BY WBS / COST CODE		PAGE 6 DATE 09/13/91 14:20:43 BY W T SUSIENE
--	--	--	--	--

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOUS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
TOTAL	COST CODE 50105 WBS 211120 (ESCALATION 34.45 % - CONTINGENCY 35.00 %)			0	0	0	236,334	0	0	0	236,334
211120.15	MECHANICAL	501	0	0	0	0	0	0	0	0	0
211120.1500000											
211120.1500004	2" W.A.E NOZZLES - PUREX - G-30 ALLOY GFE TO FEEDTHROUGH VENDOR	501	120 EA	0	0	0	57240	0	0	0	57240
SUBTOTAL	MECHANICAL			0	0	0	57,240	0	0	0	57,240
	SALES TAX 7.80 %						4465				4465
	WAREHOUSING 13.33 %						7630				7630
TOTAL	COST CODE 50115 WBS 211120 (ESCALATION 34.45 % - CONTINGENCY 35.00 %)			0	0	0	69,335	0	0	0	69,335
TOTAL WBS 211120	HARDWARE PROCUREMENT			0	0	0	947,946	0	0	0	947,946

KAISER ENGINEERS HANFORD
WESTINHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 1

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 1
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 7
DATE 09/13/91 14:20:45
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
231110	BURY BOX PROCUREMENT - WMC										
231110.02	SITEWORK										
231110.0200000	*****	501	0	0	0	0	0	0	0	0	0
231110.0200006	BURY BOXES FOR CORE DRILL PLUGS - 24X10X6' BOXES - STEEL/PRECAST CONCRETE	501	1 EA	0	0	0	200000	0	0	0	200000
231110.0200008	NOTE: 4 WALLS 3 15" CASINGS X 8' LONG PER CELL - 12 TOT V/56 CASINGS PER BURY BOX = .214 BOX	501	0	0	0	0	0	0	0	0	0
231110.0200010	BURY BOXES FOR SHIELDED PIT WORK PLATFORMS, CORE DRILLS, GREENHOUSES & MISC. CONSTRUCTION WASTE.	501	1 EA	0	0	0	200000	0	0	0	200000
231110.0200011	ASSUMES USE OF SPACE IN CORE DRILL BOX AND ONE ADDITIONAL BOX.	501	0	0	0	0	0	0	0	0	0
SUBTOTAL	SITEWORK			0		0		0		0	
	SALES TAX 7.80 %				0		400,000		0		400,000
	WAREHOUSING 8.90 %						31200		0		31200
							35600				35600
TOTAL	COST CODE 50102 WBS 231110 (ESCALATION 34.45 % - CONTINGENCY 40.00 %)			0	0	0	466,800	0	0	0	466,800
TOTAL WBS 231110	BURY BOX PROCUREMENT - WMC			0		0		0		0	
					0		466,800		0		466,800

E-36

WMC-SD-WM-TA-032
Revision 0

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	O&P / B & I	TOTAL DOLLARS
311110	TEMPORARY CONSTRUCTION										
311110-01	GENERAL REQUIREMENTS	501	0	0	0	0	0	0	0	0	0
311110-0100000	GREENHOUSES										
311110-0100004	PRE-FABRICATE GREENHOUSE SECTIONS FOR CORE DRILLING PLATFORM COVER WITH FILTERED VENTILATION SYSTEM	501	3600 SF	144	3600	0	4500	0	0	4140	12240
	GENERAL REQUIREMENTS			144	3,600	0	4,500	0	0	4,140	
	CONSUMABLES 6.00 %						270				12,240
	SALES TAX 7.80 %						372				372
	WAREHOUSING 20.00 %						954				954
	COST CODE 50101										
	UBS 31110			144	3,600	0	6,096	0	0	4,140	13,036
	(ESCALATION 42.52 % - CONTINGENCY 35.00 %)										
311110-01	GENERAL REQUIREMENTS	501 M	0	0	0	0	0	0	0	0	0
311110-0100001	GREENHOUSES										
311110-0100006	FINAL ASSEMBLY OF GREENHOUSE IN CANTON SHIELDED WORK AREA FOR PIT DRILLING PLATFORM INCLUDES TEAR DOWN AND PREP FOR BURIAL & VENTILATION SYSTEM	501 M	2 EA	60	2000	0	0	0	0	2300	4300
311110-0100010	NOTE: SHIELDED WORK AREA IN CANTON TO BE PROVIDED BY UMC AS A SHIELDED AREA PROTECTED BY BURT BOXES @ THE EAST END OF CANTON AREA	501 M	0	0	0	0	0	0	0	0	0
311110-0100011	REQUIRES UMC CRANE OPR SUPT	501 M	0	0	0	0	0	0	0	0	0
311110-0100014	ASSEMBLE AND MOVE TEMPORARY SHIELDING WALLS AS REQUIRED FOR PERSONNEL PROTECTION IN	501 M	1 JOB	400	12484	0	75000	0	0	14357	101841

** KALSER ENGINEERS INTERACTIVE ESTIMATING **											
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION											
STUDY ESTIMATE											
OPTION 1											
KENROD - ESTIMATE DETAIL BY WBS / COST CODE											
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ONEP / B & I	TOTAL DOLLARS
311110.0100015	CANYON - FOR ISOLATED SHINE AREAS +++++	501 M	0	0	0	0	0	0	0	0	0
	REQUIRES WMC CRANE OPR SUPT										
311110.0100020	STEP-OFF PAD LABOR SUPPORT	501 M	120 MHR	120	2626	0	0	0	0	3020	5646
SUBTOTAL	GENERAL REQUIREMENTS		(MASK)	600	17,110	0	75,000	0	0	19,677	111,787
	SUP 100.00X			600	17110		4500				17110
	CONSUMABLES 6.00 X						4500				4500
	SALES TAX 7.00 X						6201				6201
	WAREHOUSING 20.00 X						15900				15900
	ONEP (ON MARKUPS ONLY)									19677	19677
TOTAL	COST CODE 50101			1,200	34,220	0	101,601	0	0	39,354	175,175
	WBS 311110										
	(ESCALATION 42.52 X - CONTINGENCY 50.00 X)										
				1,344	37,820	0	107,697	0	0	43,494	189,011
	TOTAL WBS 311110 TEMPORARY CONSTRUCTION										

E-39

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 1

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 1
KENROB - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 11
DATE 09/13/91 14:20:50
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
311120.0300120	STEP-OFF PAD LABOR SUPPORT	501 M	284 MHR	284	6214	0	0	0	0	7146	13360
SUBTOTAL	CONCRETE	(MASK)		1,420		0		0		47,786	
	SMP 100.00%			1420	41,553		2,050		0		91,389
	CONSUMABLES 6.00 %				41553						41553
	SALES TAX 7.80 %						123				123
	WAREHOUSING 20.00 %						169		0		169
	OH&P (ON MARKUPS ONLY)						435				435
										47786	47786
TOTAL	COST CODE 50103			2,840		0		0		95,572	
	WBS 311120				83,106		2,777		0		181,455
	(ESCALATION 42.52 % - CONTINGENCY 50.00 %)										
TOTAL WBS 311120 CORE DRILLING				2,872		0		0		96,561	
					83,966		3,075		0		183,602

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 1

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 1
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 12
DATE 09/13/91 14:20:51
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
311140	INSTALL FEEDTHROUGHS										
311140.15	MECHANICAL										
311140.1500000	***** INSTALL CELL-CELL FEEDTHRU'S *****	501 M	0	0	0	0	0	0	0	0	0
311140.1500004	INSTALL FEEDTHROUGHS FROM CELL TO CELL - 3 PER CELL SET SHIM AND ANCHOR *****	501 M	12 EA	288	8988	0	600	0	0	10336	19924
311140.1500005	REQUIRES WMC CRANE OPR SUPT	501 M	0	0	0	0	0	0	0	0	0
311140.1500010	STEP-OFF PAD SUPPORT LABOR	501 M	96 MHR	96	2100	0	0	0	0	2415	4515
SUBTOTAL	MECHANICAL	(MASK)		384	11,008	0	600	0	0	12,751	24,439
	SUP 100.00%			384	11008						11088
	CONSUMABLES 6.00 %						36				36
	SALES TAX 7.80 %						50		0		50
	WAREHOUSING 20.00 %						127				127
	OH&P (ON MARKUPS ONLY)									12751	12751
TOTAL	COST CODE 50115			768		0		0		25,502	
	WBS 311140				22,176		813		0		48,491
	(ESCALATION 42.52 % - CONTINGENCY 50.00 %)										
311140.15	MECHANICAL										
311140.1500008	SURVEY SUPPORT TO LOCATE AND AS-BUILT NOZZLE LOCATIONS	501 M	12 EA	96	4320	0	12500	0	0	0	16820
SUBTOTAL	MECHANICAL	(MASK)		96	4,320	0	12,500	0	0	0	16,820
	SUP 100.00%			96	4320						4320
	CONSUMABLES 6.00 %						750				750
	SALES TAX 7.80 %						1034		0		1034
	WAREHOUSING 20.00 %						2650				2650
TOTAL	COST CODE 50115			192		0		0		0	
	WBS 311140				8,640		16,934		0		25,574
	(ESCALATION 42.52 % - CONTINGENCY 50.00 %)										
TOTAL WBS 311140	INSTALL FEEDTHROUGHS			960	30,816	0	17,746	0	0	25,502	74,065

WMC-SD-WM-TA-032
Revision 0

E-41

KAISER ENGINEERS HANFORD
WESTINHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 1

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 1
KEHROB - ESTIMATE DETAIL BY LBS / COST CODE

PAGE 13
DATE 09/13/91 14:20:53
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
311150	BURIAL FEES AND COSTS										
311150.02	SITWORK										
311150.0200000	***** TRANSFER, WRAP AND HAUL COVER BLOCKS TO BURIAL *****	501 M	0	0	0	0	0	0	0	0	0
311150.0200006	WRAP COVER BLOCKS FOR HOT BURIAL 1600SF OF COVER/1500 LF TAPE EACH COVER W/PADDING/DUNNAGE	501 M	15 EA	120	2638	0	3525	0	0	3034	9197
311150.0200007	***** REQUIRES WMC CRANE OPR SUPT	501 F	0	0	0	0	0	0	0	0	0
311150.0200008	LOAD AND HAUL COVER BLOCKS TO HOT BURIAL	501 M	15 EA	60	1650	0	0	0	0	1898	3548
311150.0200010	BURIAL CHARGE FOR COVER BLOCKS	501 M	6200 CF	0	0	0	0	425444	0	0	425444
311150.0200100	***** REMOVE, TRANSFER, WRAP & INSTALL CORE DRILL CORES IN BURY BOXES	501 M	0	0	0	0	0	0	0	0	0
311150.0200101	*****	501 M	0	0	0	0	0	0	0	0	0
311150.0200104	REMOVE, TRANSFER, WRAP AND INSTALL CORE DRILL CORES IN BURY BOX	501 M	12 EA	96	2996	0	240	0	0	3445	6681
311150.0200105	***** REQUIRES WMC CRANE OPR SUPT	501 M	0	0	0	0	0	0	0	0	0
311150.0200110	BURIAL CHARGE FOR CORE DRILL CASINGS AND WASTED MATERIALS 1 EA BURY BOX	501 M	3850 CF	0	0	0	0	1112804	0	0	1112804
311150.0200220	STEP-OFF PAD LABOR SUPPORT	501 M	69 MHR	69	1510	0	0	0	0	1737	3247
SUBTOTAL	SITWORK	(MASK)		345		0		1,538,248		10,114	
	SWP 100.00X			345	8,794		3,765		0		1,560,921
	CONSUMABLES 6.00 X						226				226
	SALES TAX 7.80 X						311		0		311
	WAREHOUSING 20.00 X						798				798

E-42

WMC-SD-WM-TA-032
Revision 0

<p> ** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE OPTION 1 KERROB - ESTIMATE DETAIL BY MBS / COST CODE </p>										PAGE 14 DATE 09/13/91 14:20:54 BY M T SUSIENE
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HOURS	LABOR	EQUIP USAGE	SUB- CONTRACT	EQUIP- MENT	OH&P / 8 & 1	TOTAL DOLLARS
<p> OH&P (ON MARKUPS ONLY) </p>										
	COST CODE 50102									10113
	MBS 311150			690	17,588	0	1,538,248	0	20,227	10113
	(ESCALATION 42.52 % - CONTINGENCY 40.00 %)									1,581,163
<p> TOTAL MBS 311150 BURIAL FEES AND COSTS </p>										
				690	17,588	0	1,538,248	0	20,227	1,581,163

Kaiser Engineers Hanford Westinhouse Hanford Company Job No. ER1269 OPT 1										PAGE 15 DATE 09/13/91 14:20:55 BY W T SUSIENE	
** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE OPTION 1 KENR08 - ESTIMATE DETAIL BY VBS / COST CODE											
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
311160	SHIFT DIFFERENTIAL COSTS										
311160.01	GENERAL REQUIREMENTS										
311160.0100010	MANHOUR RATE DIFFERENTIAL	501	366 MHR	366	10706	0	0	0	0	12312	23018
	1955 MHR X .0625 = 122 MHRS										
	1955 MHR X .1250 = 244 MHRS										
	122 + 244 = 366 MHRS										
SUBTOTAL	GENERAL REQUIREMENTS			366	10,706	0	0	0	0	12,312	23,018
TOTAL	COST CODE 50101 VBS 311160 (ESCALATION 42.52 % - CONTINGENCY 43.00 %)			366	10,706	0	0	0	0	12,312	23,018
311160.01	GENERAL REQUIREMENTS										
311160.0100012	INCREASED FIELD OVERHEAD TO SUPPORT MULTIPLE SHIFT OPERATION.	501	1 LS	2272	136320	0	0	0	0	0	136320
SUBTOTAL	GENERAL REQUIREMENTS			2,272	136,320	0	0	0	0	0	136,320
TOTAL	COST CODE 50101 VBS 311160 (ESCALATION 42.52 % - CONTINGENCY 40.00 %)			2,272	136,320	0	0	0	0	0	136,320
TOTAL VBS 311160	SHIFT DIFFERENTIAL COSTS										
				2,638	147,026	0	0	0	0	12,312	159,338

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 1

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 1
KENR00 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 16
DATE 09/13/91 14:20:56
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
331110	SUPPORT FOR ONSITE CONTRACTOR										
331110.01	GENERAL REQUIRMENTS										
331110.0100004	WMC CRANE OPERATOR SUPPORT FOR COVER BLOCK REMOVAL	501	40 MHR	40	1880	0	0	0	0	0	1880
331110.0100006	WMC RPT SUPPORT FOR COVER BLOCK REMOVAL	501	20 MHR	20	900	0	0	0	0	0	900
331110.0100014	WMC CRANE OPERATOR SUPPORT FOR PLATFORM MOVEMENT SUPT	501	40 MHR	40	1880	0	0	0	0	0	1880
331110.0100016	WMC RPT SUPPORT FOR PLATFORM MOVEMENT SUPT	501	20 MHR	20	900	0	0	0	0	0	900
331110.0100018	WMC OPERATOR SUPPORT FOR PLATFORM MOVEMENT SUPT	501	20 MHR	20	940	0	0	0	0	0	940
331110.0100024	WMC CRANE OPERATOR SUPPORT FOR CORE DRILL OPERATIONS	501	284 MHR	284	13348	0	0	0	0	0	13348
331110.0100026	WMC RPT SUPPORT FOR CORE DRILL OPERATIONS	501	1136 MHR	1136	51120	0	0	0	0	0	51120
331110.0100028	WMC OPERATOR SUPPORT FOR CORE DRILL OPERATIONS	501	284 MHR	284	13348	0	0	0	0	0	13348
331110.0100040	WMC OPERATIONS ENGINEER AND MANAGER SUPPORT FOR ALL CPAF OPERATIONS ASSUME 184 SHIFTS	501	736 MHR	736	33120	0	0	0	0	0	33120
SUBTOTAL	GENERAL REQUIRMENTS			2,580		0	0	0	0	0	117,436
TOTAL	COST CODE 50101 WBS 331110 (ESCALATION 34.45 % - CONTINGENCY 40.00 %)			2,580		0	0	0	0	0	117,436
TOTAL WBS 331110	SUPPORT FOR ONSITE CONTRACTOR			2,580		0	0	0	0	0	117,436

E-45

WMC-SD-WM-TA-032
Revision 0

KAISER ENGINEERS HANFORD WESTINGHOUSE HANFORD COMPANY JOB NO. ERT269 OPT 1		** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE KENROB - ESTIMATE DETAIL BY WBS / COST CODE		PAGE 17 DATE 09/13/91 14:20:56 BY M T SUSIENE							
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	ONEP / B & I	TOTAL DOLLARS
341110	OPER CONTR PROJ MGMT										
341110.19	PROJECT MANAGEMENT										
341110.1900000	WRC PROJECT MANAGEMENT	501	1	LS	0	0	0	214,687	0	0	214,687
	ESTIMATED AT 5 PER CENT OF PROJECT COST										
SUBTOTAL PROJECT MANAGEMENT											
0 0 0 0 214,687 0 214,687											
TOTAL											
COST CODE 50119 0 0 0 214,687 0 214,687 WBS 341110 0 0 0 214,687 0 214,687 (ESCALATION 45.97 % - CONTINGENCY 40.00 %)											
TOTAL WBS 341110 OPER CONTR PROJ MGMT											
0 0 0 214,687 0 214,687											

KAISER ENGINEERS HANFORD WESTINGHOUSE HANFORD COMPANY JOB NO. ERT269 OPT 1		** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE KENR08 - ESTIMATE DETAIL BY MDS / COST CODE		PAGE 18 DATE 09/13/91 14:20:59 BY W T SUSIENE						
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	SUB- MATERIAL CONTRACT	EQUIP- MENT	ORHP / B L I	TOTAL DOLLARS
				13,758	595,151		1,752,935	0	198,096	4,508,438
REPORT TOTAL										

This page intentionally left blank.

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KEH001 - PROJECT COST SUMMARY

PAGE 1 OF 12
DATE 09/13/91 13:02:22
BY W T SUSIENE

COST CODE *****	DESCRIPTION *****	ESCALATED TOTAL COST *****	CONTINGENCY % *****	TOTAL *****	TOTAL DOLLARS *****
000	ENGINEERING	1,010,000	35	360,000	1,370,000
501	BUILDINGS	99,720,000	35	34,810,000	134,530,000
	(ADJUSTED TO MEET DOE 5100.4)	-30,000		30,000	

PROJECT TOTAL		100,700,000	35	35,200,000	135,900,000

TYPE OF ESTIMATE	STUDY	SEPTEMBER 13, 1991	REMARKS: ESTIMATE IS AN ALTERNATE ESTIMATE ESTIMATE DOES NOT STAND ALONE. REFERENCE THE FOLLOWING ESTIMATES: ER1269 OPT 1 ER1269 OPT 2B ER1269 OPT 2C
ARCHITECT ENGINEER	<i>[Signature]</i>		
OPERATING CONTRACTOR			

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

E-49

MHC-SD-MM-TA-032
Revision 0

WHC-SD-WM-TA-032
Revision 0

KAISER ENGINEERS HANFORD WESTINGHOUSE HANFORD COMPANY JOB NO. ER1269 OPT 2A		** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE KENRO2 - WORK BREAKDOWN STRUCTURE SUMMARY										PAGE 2 OF 12 DATE 09/13/91 13:02:25 BY M T SUSIENE	
WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	SUB TOTAL	CONTINGENCY %	SUB TOTAL	CONTINGENCY %	TOTAL DOLLARS			
111210	ENGINEERED EQUIPMENT DEFIN DESIGN	330000	0	330000	37.72	124476	35	159067	35	613543			
	SUBTOTAL 11 DEFINITIVE DESIGN	330000	0	330000	37.72	124476	35	159067	35	613543			
121210	E/I - ONSITE A-E - PROCUREMENT SUPT	109000	0	109000	45.98	50118	35	55691	35	214810			
121220	E/I - ONSITE A-E - ONSITE INSTALL	250998	0	250998	54.86	142086	35	140360	35	541464			
	SUBTOTAL 12 E/I DURING CONSTRUCTION	367998	0	367998	52.23	192204	35	196071	35	756274			
	SUBTOTAL 1 ENGINEERING	697998	0	697998	45.37	316680	35	355138	35	1369817			
211210	ENGINEERED EQUIPMENT PROCUREMENT	18092762	0	18092762	34.45	6508556	42	10649377	42	36050695			
211220	HARDWARE PROCUREMENT	16642000	0	16642000	34.45	5733173	35	7867544	35	30242724			
	SUBTOTAL 21 ONSITE CONTR PROCUREMENT	35534770	0	35534770	34.45	12241729	39	18516921	39	66293419			
231210	BURY BOX PROCUREMENT - WMC	4434600	0	4434600	34.45	1527720	30	1708696	30	7751016			
	SUBTOTAL 23 OPERATING CONTRACTOR PROCUR	4434600	0	4434600	34.45	1527720	30	1708696	30	7751016			
	SUBTOTAL 2 PROCUREMENT	39969370	0	39969370	34.45	13769449	38	20305617	38	74044435			
311210	TEMPORARY CONSTRUCTION	1614506	0	1614506	42.52	686522	41	932527	41	3233636			
311220	CORE DRILLING	1661858	0	1661858	42.52	706622	39	932914	39	3301395			
311240	INSTALL FEEDTHROUGHS	704447	0	704447	42.52	299531	40	401591	40	1405569			
311250	BURIAL FEES AND COSTS	15690626	0	15690626	42.52	6671654	30	4708484	30	29070964			
311260	SHIFT DIFFERENTIAL COSTS	2045711	0	2045711	42.52	869037	35	1020442	35	3935989			
	SUBTOTAL 31 ONSITE CONSTR CONTR	21717228	0	21717228	42.52	9236166	32	9996158	32	40947553			
331220	HOT PIPE TRENCH DECONTAMINATION	6523250	0	6523250	42.52	2775686	30	2789081	30	12086017			
331230	HOT PIPE TRENCH DEMOLITION	650775	0	650775	42.52	276710	30	278245	30	1205730			
331240	INSTALL FEEDTHROUGHS	89540	0	89540	42.52	38072	30	38284	30	165896			
331250	INSTALL WPT EQUIPMENT AND JUMPERS	515931	0	515931	42.52	219374	30	220591	30	955896			
331260	SUPPORT CPAF CONSTRUCTION	1336397	0	1336397	42.52	566236	30	571390	30	2476023			
	SUBTOTAL 33 OPER CONTR CONSTRUCTION	9115893	0	9115893	42.52	3876078	30	3897591	30	16889562			
341210	OPER CONTR PROJ MGMT	1430040	0	1430040	42.52	608053	30	611428	30	2649521			
	SUBTOTAL 34 OPER CONTR PROJ MGMT	1430040	0	1430040	42.52	608053	30	611428	30	2649521			
	SUBTOTAL 3 CONSTRUCTION	32263161	0	32263161	42.52	13718297	32	14505177	32	60486636			
	PROJECT TOTAL	72,930,529	0	72,930,529	38.12	27,804,426	35	35,165,932	35	135,900,088			

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KENR03 - ESTIMATE BASIS SHEET

PAGE 3 OF 12
DATE 09/13/91 09:24:04
BY W T SUSIENE

1. DOCUMENTS AND DRAWINGS

DOCUMENTS: DRAFT, B PLANT PROCESS PIPING REPLACEMENT FEASIBILITY STUDY REPORT BY GARY F. HOWDEN, DATED SEPTEMBER 6, 1991

DRAWINGS:

2. MATERIAL PRICES

UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL. VENDOR INFORMATION WAS OBTAINED FOR SELECTED ITEMS AS INDICATED ON THE ATTACHED EQUIPMENT LIST.

3. LABOR RATES

CURRENT HANFORD BASE RATES AS ISSUED BY KEH (ISSUE # 14, REV. 0, DATED 4-1-91) INCLUDE FRINGE BENEFITS, LABOR INSURANCE, TAXES AND TRAVEL WHERE APPLICABLE.

4. GENERAL REQUIREMENTS/TECHNICAL SERVICES

A.) ONSITE CONSTRUCTION FORCES GENERAL REQUIREMENTS AND TECHNICAL SERVICES COSTS ARE INCLUDED AS A COMPOSITE PERCENTAGE BASED ON THE KEH ESTIMATING FACTOR/BILLING SCHEDULE REVISION 12 DATED APRIL, 01, 1991. THE TOTAL COMPOSITE PERCENTAGE APPLIED TO ONSITE CONSTRUCTION FORCES LABOR FOR THIS PROJECT IS 84% FOR SHOP WORK AND 115% FOR FIELD WORK WHICH IS REFLECTED IN THE "OH&P / B & 1" COLUMN OF THE ESTIMATE DETAIL.

5. ESCALATION

ESCALATION CALCULATED BY THE HANFORD MATERIAL & LABOR ESCALATION STUDY, FEBRUARY, 1991. RATES SELECTED ARE BASED UPON A MIDPOINT OF ENGINEERING OF JULY, 1997, PROCUREMENT OF JULY, 1998 AND CONSTRUCTION OF JULY, 1999.

6. ROUNDING - LINE ITEMS:

U.S. DEPARTMENT OF ENERGY - DOE ORDER 5100.4 PAGE J-2 SUBPARAGRAPH (M), REQUIRES ROUNDING OF A COST ESTIMATE TO \$10,000 FOR ITEM COST AND \$100,000 FOR TOTAL COST. REFERENCE: DOE 5100.4, FIGURE 1-11, DATED 10-31-84.

7. REMARKS

A) ESTIMATE IS FOR OPTION 2A AS DESCRIBED IN WNC FEASIBILITY STUDY. ESTIMATE ASSUMES 37 PITS TO BE MODIFIED BY REMOTELY DRILLING 5 HOLES IN EACH OF 36 SEPARATE WALLS BETWEEN ADJACENT CELLS. THE HOLES SHALL BE FILLED WITH 15" DIA FEEDTHROUGHS AS SHOWN ON FIGURE 2 OF THE WNC FEASIBILITY STUDY. THE ENTIRE HOT PIPE TRENCH WILL BE REPIPED AS INDICATED ON FIGURE 3 OF THE WNC FEASIBILITY STUDY. AN ADDITIONAL TWO 15" DIAMETER HOLES PER CELL WILL BE REMOTELY DRILLED BETWEEN EACH CELL AND THE HOT PIPE TRENCH WHICH WILL ALSO BE FILLED WITH REMOTELY INSTALLED FEEDTHROUGHS IDENTICAL TO THE ABOVE. FOUR EACH 8" DIAMETER HOLES WILL BE MANUALLY DRILLED BETWEEN THE BUILDING GALLERIES AND THE CANYON AND CELLS PE CELL. THIS DRILLING WILL BE FROM THE COLD SIDE OF THE WALL. THESE HOLES WILL BE FILLED WITH 6" DIAMETER SHIELDED FEEDTHROUGHS OF DESIGN SIMILAR TO EXISTING DESIGNS. WORK IS TO BE PERFORMED REMOTELY USING ON-SITE OPERATIONS PERSONNEL WITH ASSIST FROM ONSITE CONSTRUCTION FORCES. MECHANICAL FABRICATIONS ARE ESTIMATED AS BEING SUPPLIED BY A SINGLE DESIGN AND FABRICATE VENDOR. GENERAL REQUIREMENTS FOR VENDOR QUOTE USED IN THIS ESTIMATE IS INCLUDED IN THIS ESTIMATE AS THE MECHANICAL FABRICATIONS REPORT (PAGE 10 OF 12 PAGES)

E-51

MHC-SD-MM-TA-032
Revision 0

Kaiser Engineers Hanford
Westinghouse Hanford Company
Job No. ER1269 - OPT 2A

** Kaiser Engineers Interactive Estimating **
Defense Waste Remediation Program Redefinition
Study Estimate Option 2A
KENRO3 - Estimate Basis Sheet

PAGE 4 OF 12
DATE 09/13/91 09:24:04
BY W T SUSIENE

- B) ESTIMATE ASSUMES A RELATIVELY SMALL CREW WILL BE REQUIRED AND NO ESCORT PROVISIONS ARE INCLUDED IN THIS ESTIMATE.
- C) ESTIMATE ASSUMES NO INCIDENTAL ASBESTOS REMOVAL WILL BE REQUIRED TO FACILITATE THE WORK COVERED UNDER THIS ESTIMATE.
- D) ESTIMATE ASSUMES ALL WORK INVOLVING EXPOSURE TO HIGH LEVELS OF RADIATION WILL BE PERFORMED REMOTELY AND NO BURNOUT IS INCLUDED IN THIS ESTIMATE.
- E) ESTIMATE ASSUMES WORK TO BE PERFORMED ON 3 SHIFTS PER DAY FIVE DAYS PER WEEK.
- F) ESTIMATE ASSUMES SAND AT BOTTOM OF HOT PIPE TRENCH WILL REMAIN IN PLACE. NO DECONTAMINATION OR CLEAN-UP OF HOT PIPE TRENCH IS INCLUDED IN THIS ESTIMATE. SEE ESTIMATE ER1269 OPT 2C.

PAGE 5 OF 12
DATE 09/13/91 13:02:31
BY W T SUSIENE

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KERRO4 - COST CODE ACCOUNT SUMMARY

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

WBS DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	SUB TOTAL	CONTINGENCY %	TOTAL DOLLARS
000 ENGINEERING							
111210 ENGINEERED EQUIPMENT DEFIN DESIGN	330000	0	330000	37.72	124476	35	613543
121210 E/I - ONSITE A-E - PROCUREMENT SUPT	109000	0	109000	45.98	50118	35	214810
121220 E/I - ONSITE A-E - ONSITE INSTALL	258998	0	258998	54.86	142086	35	541464
TOTAL 000 ENGINEERING	697998	0	697998	45.37	316680	35	1369817
501 BUILDINGS							
211210 ENGINEERED EQUIPMENT PROCUREMENT	18892762	0	18892762	34.45	6508556	42	36050695
211220 HARDWARE PROCUREMENT	16642008	0	16642008	34.45	5733173	35	30242724
231210 BURY BOX PROCUREMENT - WHC	4434600	0	4434600	34.45	1527720	30	7751016
311210 TEMPORARY CONSTRUCTION	1614586	0	1614586	42.52	686522	41	3233436
311220 CORE DRILLING	1661858	0	1661858	42.52	706622	39	3501395
311240 INSTALL FEEDTHROUGHS	704447	0	704447	42.52	299531	40	1405569
311250 BURIAL FEES AND COSTS	15690626	0	15690626	42.52	6671654	30	29070964
311260 SHIFT DIFFERENTIAL COSTS	2045711	0	2045711	42.52	869837	35	3935989
331220 HOT PIPE TRENCH DECONTAMINATION	6523250	0	6523250	42.52	2773686	30	12086017
331230 HOT PIPE TRENCH DEMOLITION	650775	0	650775	42.52	276710	30	2789081
331240 INSTALL FEEDTHROUGH'S	89540	0	89540	42.52	38072	30	1205730
331250 INSTALL HPT EQUIPMENT AND JUMPERS	515931	0	515931	42.52	219374	30	38284
331260 SUPPORT CPAT CONSTRUCTION	1336397	0	1336397	42.52	568236	30	220591
341210 OPER CONTR PROJ MGMT	1430040	0	1430040	42.52	608053	30	571390
TOTAL 501 BUILDINGS	72232531	0	72232531	38.05	27487746	35	135900888
PROJECT TOTAL	72,930,529	0	72,930,529	38.12	100,734,955	35	135,900,888

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KENROS - ESTIMATE SUMMARY BY CSI DIVISION

PAGE 6 OF 12
DATE 09/13/91 13:02:35
BY W T SUSIENE

WBS DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION % TOTAL	SUB TOTAL	CONTINGENCY % TOTAL	TOTAL DOLLARS
ENGINEERING							
00 TECHNICAL SERVICES	697998	0	697998	45.37	316680	35	1369817
TOTAL ENGINEERING	697998	0	697998	45.37	316680	35	1369817
CONSTRUCTION							
01 GENERAL REQUIRMENTS	3742449	0	3742449	42.52	1591290	33	7105315
02 SITEWORK	27299251	0	27299251	41.21	11249770	30	50113727
03 CONCRETE	12682599	0	12682599	35.74	4532637	38	23725518
05 METALS	220542	0	220542	42.52	93774	37	432186
15 MECHANICAL	22950963	0	22950963	34.75	7974418	38	42748492
16 ELECTRICAL	3906687	0	3906687	36.80	1437804	45	7756312
19 PROJECT MANAGEMENT	1430040	0	1430040	42.52	608053	30	2649521
TOTAL CONSTRUCTION	72232531	0	72232531	38.05	27487746	35	134531071
PROJECT TOTAL	72,930,529	0	72,930,529	38.12	27,804,426	35	135,900,888

E-54

MHC-SD-MM-TA-032
Revision 0

Kaiser Engineers Hanford
Westinghouse Hanford Company
Job No. ERT269 OPT 2A

** Kaiser Engineers Interactive Estimating **
Defense Waste Remediation Program Redefinition
Study Estimate
Option 2A
KERR06 - Contingency Analysis Basis Sheet

PAGE 7 OF 12
DATE 09/13/91 09:24:19
BY U T SUSIENE

REFERENCE: ESTIMATE BASIS SHEET
COST CODE ACCOUNT SUMMARY

PAGE 3 OF 12
PAGE 5 OF 12

THE U.S. DEPARTMENT OF ENERGY - RICHLAND ORDER 5700.3 "COST ESTIMATING, ANALYSIS AND STANDARDIZATION"
DATED 3-27-85, PROVIDES GUIDELINES FOR ESTIMATE CONTINGENCIES. THE GUIDELINE FOR A STUDY ESTIMATE
SHOULD HAVE AN OVERALL RANGE OF 20 TO 50%.

CONTINGENCY IS EVALUATED AT THE THIRD COST CODE LEVEL AND SUMMARIZED AT THE PRIMARY AND SECONDARY COST CODE
LEVEL OF THE DETAILED COST ESTIMATE.

ENGINEERING

ENGINEERING CONTINGENCY IS ASSIGNED AT 35 PER CENT ON THE FOLLOWING BASIS:
-THE NEED FOR CLOSE TOLERANCES FOR REMOTE OPERATIONS WILL REQUIRE POTENTIAL EXPLORATORY ENGINEERING FOR REMOTE
SURVEY TECHNIQUES
-THE DEFINITIVE DESIGN OF THE PUREX CONNECTOR NOZZLES WITH NEVER ALLOYS WILL REQUIRE EXPLORATORY ENGINEERING IN
THE SIDE EFFECTS OF SUCH MATERIALS.
-AVAILABLE INFORMATION AT THIS STAGE OF THE STUDY IS QUITE SUBJECTIVE.

AVERAGE ENGINEERING CONTINGENCY 35%

CONSTRUCTION

CONSTRUCTION CONTINGENCY IS ASSIGNED AT 34 PER CENT ON THE FOLLOWING BASIS:
-THE POTENTIAL RADIATION EXPOSURE FROM COLD SIDE CORE DRILLING IS UNKNOWN.
-UNKNOWN POTENTIAL PROBLEMS EXIST WITH CORE DRILLING THROUGH BUILDING EXPANSION JOINTS.
-THE USE OF DIFFERENT ALLOYS FOR PUREX JUMPER CONNECTORS MAY INCREASE MATERIAL AND MACHINING COSTS DRAMATICALLY
-AVAILABLE INFORMATION AT THIS STAGE OF THE STUDY IS QUITE SUBJECTIVE.
-MANY DETAILS NEED YET TO BE WORKED OUT ON THE MECHANICAL FABRICATIONS.

AVERAGE CONSTRUCTION CONTINGENCY 34%

AVERAGE PROJECT CONTINGENCY 34%

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KERR07 - ONSITE INDIRECT COSTS BY WBS

PAGE 8 OF 12
DATE 09/13/91 13:02:38
BY W T SUSIENE

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	CONTRACT %	ADMINISTRATION TOTAL	BID PACK PREP.	OTHER INDIRECTS	TOTAL INDIRECTS
=====	=====	=====	=====	=====	=====	=====	=====
111210	ENGINEERED EQUIPMENT DEFIN DESIGN	330000	0.00	0	0	0	0
121210	E/I - ONSITE A-E - PROCUREMENT SUPT	109000	0.00	0	0	0	0
121220	E/I - ONSITE A-E - ONSITE INSTALL	258998	0.00	0	0	0	0
211210	ENGINEERED EQUIPMENT PROCUREMENT	18892762	0.00	0	0	0	0
211220	HARDWARE PROCUREMENT	16642008	0.00	0	0	0	0
231210	BURY BOX PROCUREMENT - WMC	4434600	0.00	0	0	0	0
311210	TEMPORARY CONSTRUCTION	1614586	0.00	0	0	0	0
311220	CORE DRILLING	1661858	0.00	0	0	0	0
311240	INSTALL FEEDTHROUGHS	704447	0.00	0	0	0	0
311250	BURIAL FEES AND COSTS	15690626	0.00	0	0	0	0
311260	SHIFT DIFFERENTIAL COSTS	2045711	0.00	0	0	0	0
331220	HOT PIPE TRENCH DECONTAMINATION	6523250	0.00	0	0	0	0
331230	HOT PIPE TRENCH DEMOLITION	650775	0.00	0	0	0	0
331240	INSTALL FEEDTHROUGH'S	89540	0.00	0	0	0	0
331250	INSTALL HPT EQUIPMENT AND JUMPERS	515931	0.00	0	0	0	0
331260	SUPPCRT CPAF CONSTRUCTION	1336397	0.00	0	0	0	0
341210	OPER CONTR PROJ MGMT	1430040	0.00	0	0	0	0
=====							
PROJECT TOTAL		72,930,529		0	0	0	0

E-56

MHC-SD-WM-TA-032
Revision 0

WESTINGHOUSE
JOB NO. ER1269 OPT 2A

ITEM	QUANTITY	SPEC	VENDOR	CONTACT	TEL	PRICE
FLEXIBLE MTL NOSE ASSY	838		FLEXONCIS	BOB GRAVIS	512-629-8080	2,168
				FAX=		
COVER BLOCKS WPT	37		YAKIMA	ODM	509-248-1984	20,000
PIT	111		PRECAST	HOLLINGSBERRY		30,000
MECHANICAL FABRICATIONS INCLUDING:			ELLIS WATTS	DENNIS PAWLAK	513-752-9000	12,000,000
			(FRED BOOTH)	FAX 513-752-4983		
JUMPERS	481/838		(KEVIN LEFLER)			
15" PASSTHROUGH	254					
8" PNEU PASSTHROUGH	37					
8" ELEC PASSTHROUGH	74					
TRENCH MODULE	37					
CORE DRILL MACHINE DIRECT			DRILLCO	MAUREY DAVIS	714-549-7725	35,000
				FAX=714-549-0362		
REMOTE CORE DRILL	2		DRILLCO	MAUREY DAVIS	714-549-7725	600,000
				FAX=714-549-0362		
CORE DRILL BIT 16"	254		DRILLCO	MAUREY DAVIS	714-549-7725	5,800
CORE DRILL BIT 8"	111		DRILLCO	MAUREY DAVIS	714-549-7725	5,800
CLOSED CIRC TV SYSTEM	1 W/B CAMERAS		ESTIMATED			80,000
NOZZLES, MISC	VARIES		HAYNES	BOB PEDRICKS	FAX(713)937-4596	NOZZLES/CONNECT
NOZZLES, MISC	VARIES		GALLAGHER	JIM VANDEWEETERING	213-988-0844	ESTIMATED USING
				FAX 213-492-1148		MATERIAL PRICES
						FROM THESE VENDORS

MHC-SD-MM-TA-032
Revision 0

GENERAL:

1. ASSUME THIRTY SEVEN CELLS AND 740 LINEAL FEET OF THE HOT PIPE TRENCH (HPT) WILL BE MODIFIED.
2. TWO NEW 15" DIA PENETRATIONS WILL BE CUT BETWEEN EACH CELL AND THE HPT AND FIVE NEW 15" DIA PENETRATIONS WILL BE CUT BETWEEN ADJACENT CELLS @ ELEVATION (-) 5' 9".
3. THE HPT WILL BE REPIPED USING 37 NEW HPT MODULES. EACH MODULE SHALL INCLUDE 13 EACH 19' LONG PRE-INSTALLED, PIPE/ELECTRICAL LINES IN SHOP FABRICATED TRAYS AS SHOWN IN ATTACHMENT 2. PIPING PASS THROUGHS WILL BE AS SHOWN ON ATTACHMENTS 2 AND 3 FOR BOTH CELL TO HPT AND CELL TO CELL. TEN OF THE TWO-INCH PIPE LINES WILL HAVE A MALE HANFORD NOZZLE (FBO) ATTACHED TO A VERTICAL 90 DEGREE EL AT EACH END AND ANOTHER MALE NOZZLE ATOP A TEE AND PIPE STUB IN THE CENTER AS INDICATED ON FIGURES 4 AND 5. TWO OF THE PIPE JUMPERS WILL HAVE A 1" HANFORD MALE NOZZLE IN THE CENTER IN-LIEU OF THE 2" MALE CONNECTOR FOR ATTACHMENT TO THE 1" JET EJECTOR DRAIN JUMPER. THE 13TH JUMPER IN EACH HPT MODULE WILL BE FITTED WITH THREE ELECTRICAL NOZZLES AND WILL BE PROVIDED BY OTHERS. EACH HPT MODULE SHALL HAVE A LEAK LEVEL SENSOR IN THE PAN. THE 1" JET EJECTOR DRAIN JUMPER SHALL INCLUDE TWO-EACH 1" FEMALE CONNECTORS, A SHIELDED CONTROL VALVE, A JET EJECTOR (FBO), A CHECK VALVE AND SUCTION LEG TO REACH THE BOTTOM OF THE TRAY PER FIGURES 4 AND 5. MODULE TO MODULE AND FEEDTHROUGH TO MODULE WILL BE CONNECTED WITH 2" FLEXIBLE JUMPERS.
4. THE HPT MODULE MATERIALS ARE AS FOLLOWS:
 - STRUCTURAL OUTER FRAME - 3" SQ SST TUBING
 - LINER - 16 GA HASTELLOY C-22 OR INCONEL 600
 - PIPE, CONDUIT & SUPPORTS - HASTELLOY C-22 OR INCONEL 600
 - WETTED INSTRUMENTATION AND JETS - HASTELLOY C-22 OR INCONEL 600
 - NON-WETTED I & C - IN SST ENCLOSURES
 - NON-WETTED MECHANICAL COMPONENTS SUCH AS LEVELING SCREWS, SST.
 - HORIZONTAL WEDGING JACKS - CARBON STEEL
5. AN HPT MODULE WILL CONSIST OF:
 - A 20' TRAY SECTION WITH JACKS, STANDOFFS, SKIRTING TO EDGE OF HOT PIPE TRENCH, FRAME AND SHEET METAL SKIN CLOSURE & TRAY ABUTMENTS.
 - 12 EA 2" PIPE JUMPERS
 - 1 EA 2" ELECTRICAL JUMPER (FBO)
 - 1 EA TRAY LEAK DETECTOR
 - 1 EA 1" JET EJECTOR NOZZLE
 - SUPPORTS AND DUNNAGE IN TRAY TO SUPPORT ALL 2" PIPE AND ELECTRICAL JUMPERS
 - 7 EA FEEDTHROUGH ASSEMBLIES.
6. IN ADDITION TO ABOVE 1-EA TUBING PASS THRU AND 3-EA PASS THRU'S WILL BE REQUIRED FOR EACH CELL. THESE SHALL BE SIMILAR TO THOSE SHIELDED FEEDTHROUGHS USED PREVIOUSLY FOR SIMILAR RETROFIT OPERATIONS. THE COMPLEXITY OF THESE PASS THRU'S ARE INDICATIVE OF THAT REQUIRED FOR THE JUMPER PASS-THROUGH'S DESCRIBED ABOVE AND ON THE ATTACHED FABRICATION NOTES. MATERIAL FOR THE TUBING AND ELECTRICAL PASS THRU'S WILL BE HASTELLOY OR INCONEL INCLUDING TUBING. ELECTRICAL WIRE SHOULD BE CALCULATED AS POWER WIRE WITH RADIATION RESISTANT SHIELDING.

FABRICATION NOTES:

1. JUMPERS ARE GENERALLY REMOTELY REMOVEABLE SECTIONS OF PIPING, ELECTRICAL CONDUIT, AND/OR INSTRUMENTATION. JUMPERS ARE INSTALLED IN PROCESS CELLS, PUMP AND PIPING PITS, AND DIVERSION BOXES. THEY SERVE TO CONNECT PERMANENT WALL CONNECTIONS AND REMOVEABLE COMPONENTS IN THE CELL OR BETWEEN ADJACENT COMPONENTS OR BETWEEN PERMANENT WALL CONNECTIONS. JUMPERS ARE GENERALLY DESIGNED TO PERMIT REMOTE HANDLING BY MEANS OF LIFTING BAILS. SEALED CONNECTIONS ARE MADE BY USING A REMOTELY OPERATED IMPACT WRENCH TO TIGHTEN SPECIAL CONNECTORS WHILE THE JUMPER IS POSITIONED WITH AN OVERHEAD CRANE AND HOOK ATTACHED TO THE LIFTING BAIL.
2. JUMPERS ARE DESIGNATED RIGID OR FLEXIBLE. FLEXIBLE JUMPERS HAVE A CORRUGATED METAL HOSE COVERED WITH BRAIDED METAL ARMOR WELDED TO PIPE NIPPLES AND A CONNECTOR/NOZZLE AT EACH END. RIGID JUMPERS HAVE PIPE AND MAY BE BRACED AND BALANCED WITH STRUCTURAL MEMBERS CALLED DUNNAGE.
3. JUMPERS ARE FABRICATED TO ANSI B31.3.
4. FOR THE PURPOSES OF THIS FEASIBILITY STUDY EACH PIPE SPOOL IN EACH HPT TRAY SHALL BE CONSIDERED A RIGID JUMPER. THESE JUMPERS MUST BE BALANCED FOR LIFTING WITH A SINGLE LIFTING BAIL. RIGID JUMPERS MUST BE SPACE RELATED TO ITS TRAY SO THAT EACH PIPE CAN BE INSTALLED IN ONLY ONE POSITION WITHIN TOLERANCES OF 1/16 INCH AT NOZZLE LOCATIONS FOR CONNECTION TO RIGID JUMPERS AND 1/8" AT NOZZLE LOCATIONS FOR FLEXIBLE JUMPER CONNECTIONS. FLEXIBLE JUMPERS WILL BE FABRICATED, FIT AND SHIPPED FOR CONNECTING THE RIGID PIPE JUMPERS TO EACH OTHER FROM TRAY TO TRAY AND FROM TRAY TO PASS-THROUGH.
5. CONFIGURATION OF RIGID JUMPERS SHALL BE ESSENTIALLY AS SHOWN ON FIGURE 5. 370 JUMPERS WILL BE REQUIRED WITH 3 MALE 2" NOZZLES EACH AND 74 WILL BE REQUIRED WITH TWO 2" MALE NOZZLES AND ONE 1" MALE NOZZLES EACH.
6. PIPES WILL BE CONNECTED FROM MODULE TO MODULE WITH FLEXIBLE OR FIXED JUMPERS. PIPE WILL BE CONNECTED TO FEEDTHROUGHS WITH FLEXIBLE JUMPERS.
7. ALL MALE NOZZLES, FLEX METAL HOSE ASSEMBLIES, JET EJECTORS AND FEMALE CONNECTORS WILL BE FURNISHED BY BUYER FOR INCLUSION BY VENDOR.
8. "CRITICAL DIMENSIONS" ARE THOSE WHICH LOCATE CONNECTORS, NOZZLES, DOWEL PINS, AND DOWEL HOLES TO A CLOSE TOLERANCE TO INSURE PROPER JUMPER FIT. CRITICAL DIMENSIONS FOR IN-CELL SIDE OF PASS-THROUGH NOZZLES AND JET JUMPER NOZZLES SHALL BE PLUS OR MINUS 1/16". CRITICAL DIMENSIONS FOR PLACEMENT OF NOZZLES TO BE CONNECTED WITH FLEX CONNECTORS SHALL BE PLUS OR MINUS 1/8". ALL OTHER DIMENSIONS SHALL BE PLUS OR MINUS 1/2".
9. VALVES SHALL BE WELDED-INLINE. A ONE-INCH SHIELDED ELECTRIC VALVE AND A CHECK VALVE SHALL BE INCLUDED IN EACH DRAIN-JET JUMPER ESSENTIALLY AS SHOWN ON SKETCH SK-5.
10. ALL WETTED MATERIALS OF PIPE AND VALVES TO BE HASTELLOY C-22 OR INCONEL 600.
11. WELDING AND INSPECTION OF PRESSURE BOUNDARY WELDS SHALL BE IN ACCORDANCE WITH ANSI B31.1. ALL PRESSURE BOUNDARY WELDS SHALL BE VISIBLY INSPECTED FIRST AND FINAL PASS WITH A 5 PER CENT RANDOM X-RAY REQUIRED OF ALL LIKE WELDS. ALL OTHER WELDING SHALL BE PER ANSIB.31.3. WITH ALL WELDS VISUALLY INSPECTED ON THE FINAL PASS.
12. ALL JUMPERS SHALL BE HYDROSTATICALLY TESTED TO AT LEAST 200 PSIG. VALVES SHALL BE TESTED IN THE OPEN POSITION. BLANK CONNECTORS FOR ISOLATING JUMPERS WILL BE FURNISHED BY THE BUYER. MODIFICATIONS TO ACCOMMODATE TESTING PROBES WILL BE BY VENDOR.

E-59

WMC-SD-WM-TA-032
Revision 0

14. VENDOR SHALL ADD AN APPROPRIATE AMOUNT TO HIS BUDGET PRICE TO ALLOW FOR ADDITIONAL DUNNAGE REQUIRED FOR BALANCING JUMPERS AND SUPPORT OF LIFTING BALES. FINAL FABRICATION DRAWINGS WILL SHOW ALL DUNNAGE REQUIRED. DUNNAGE SHALL BE FABRICATED FROM SST.

15. COMPLETED JUMPERS SHALL BE CLEANED, STEAM FLUSHED, AIR DRIED INSIDE AND OUT. ALL OPENINGS SHALL BE SEALED TO THE ATMOSPHERE. JUMPERS SHALL BE IDENTIFIED AS FOLLOWS:

A. PAINT THE FOLLOWING YELLOW USING AMERCOAT 234
BAILS TOP 8"
DOWEL PINS TOP 2"
DOWEL HOLES 1-1/2" RING AROUND HOLE
FREEMUT RETAINERS ALL
CONNECTOR OPERATING NUT TOP ONLY - NO THREADS

B. PAINT THE FOLLOWING WHITE USING AMERCOAT 33
FLEX CONNECTORS 12" WIDE BAND AT EACH END OF BRAID

PAINT THE FOLLOWING ON ALL FIXED JUMPERS AND PASS-THROUGH'S USING BLACK AMERCOAT LETTERS 3/4-1-3/4" HIGH ON A BLACK AMERCOAT BACKGROUND.

LOCATION	DRAWING NUMBER	REV. NO
-----	-----	-----
XX(XX-XX)X	H-2-XXXXX	X

LOCATION MAY ALTERNATELY BE PLACED OVER THE DRAWING NUMBER. WHEREVER POSSIBLE, ID MUST BE VISIBLE FROM ABOVE.

STAMP ALL JUMPERS WITH QUALITY CONTROL RECORD NUMBER WITH 1/4" METAL STAMP ON BASE OF BALE OR AN EASILY IDENTIFIED AREA OF THE NEARBY DUNNAGE. ANY STAMPS ON PAINTED SURFACES SHALL BE READABLE AFTER PAINTING.

ALL FLEX JUMPERS SHALL BE PROVIDED WITH AN ID PLATE WITH TWO LINES OF 1/4" LETTERS CONTAINING THE LOCATION, DRAWING NUMBER, AND DRAWING REVISION NO. TAG SHALL BE SST OF 20-26 GA 1" X 6" WITH TWO 1/8" HOLES. FORM PLATE AS A BAND AROUND THE PIPE AND ATTACH WITH 20 GA SST WIRE.

17. VENDOR SHALL PROVIDE ALL DUNNAGE & MECHANICAL PROTECTION OF JUMPERS AND EQUIPMENT FOR SHIPMENT TO THE JOBSITE IN A SAFE MANNER.

18. VENDOR SHALL FAB AND INSTALL A LIFTING BAIL FOR EACH JUMPER. LIFTING BALES FOR FLEXIBLE JUMPERS SHALL ALLOW FOR DISCONNECTING ONE CONNECTOR AT ONE END OF THE JUMPER AFTER THAT CONNECTOR HAS BEEN SECURED TO THE MALE CONNECTOR AND MAINTAIN CONTROL OF THE CONNECTOR AT THE OTHER END OF THE JUMPER UNTIL IT HAS BEEN SECURED IN ITS FINAL POSITION. THE BAIL ASSEMBLY SHALL BE SUITABLE FOR REMOTE RE-ASSEMBLY TO THE SECOND CONNECTOR FOR BALANCED REMOVAL OF THE JUMPER.

This page intentionally left blank.

KAISER ENGINEERS HANFORD WESTINGHOUSE HANFORD COMPANY JOB NO. ER1269 OPT 2A									
** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE OPTION 2A KEHROB - ESTIMATE DETAIL BY WBS / COST CODE									
ACCOUNT NUMBER DESCRIPTION COST CODE QUANTITY MANHOURS LABOR EQUIP USAGE SUB- CONTRACT MATERIAL OH&P / B & I DOLLARS									
111210	ENGINEERED EQUIPMENT DEFIN DESIGN	000	0	0	0	0	0	0	0
111210.00	TECHNICAL SERVICES	000	0	0	0	0	0	0	0
111210.0000000	*****	000	0	0	0	0	0	0	0
111210.0000004	DEFINITIVE DESIGN TO INCLUDE	000	1 LS	5500	330000	0	0	0	0
	PROCUREMENT SPECIFICATIONS								
	FOR FEEDTHROUGHS, NOZZLES,								
	REMOTE CORE DRILL MACHINES,								
111210.0000005	CCTV SYSTEM, REMOTE SURVEY	000	0	0	0	0	0	0	0
	SYSTEM, HOT PIPE TRENCH								
	MODULES, JUMPERS AND COVER								
	BLOCKS.								
SUBTOTAL	TECHNICAL SERVICES		5,500	330,000	0	0	0	0	330,000
TOTAL	COST CODE 00000		5,500	330,000	0	0	0	0	330,000
	WBS 111210								
	(ESCALATION 37.72 % - CONTINGENCY 35.00 %)								
TOTAL WBS 111210	ENGINEERED EQUIPMENT DEFIN DESIGN		5,500	330,000	0	0	0	0	330,000

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KEHROB - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 2
DATE 09/13/91 13:02:46
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
121210	E/I - ONSITE A-E - PROCUREMENT SUPT										
121210.00	TECHNICAL SERVICES										
121210.0000000	*****	000	0	0	0	0	0	0	0	0	0
121210.0000004	ENGINEERING AND INSPECTION DURING CONSTRUCTION - ON-SITE INSTALLATION SUPPORT	000	1 LS	1817	109000	0	0	0	0	0	109000
SUBTOTAL	TECHNICAL SERVICES			1,817		0	0	0	0	0	
					109,000		0		0		109,000
TOTAL	COST CODE 00000 WBS 121210 (ESCALATION 45.98 % - CONTINGENCY 35.00 %)			1,817		0	0	0	0	0	
					109,000		0		0		109,000
TOTAL WBS 121210 E/I - ONSITE A-E - PROCUREMENT SUPT				1,817		0	0	0	0	0	109,000
					109,000		0		0		109,000

E-63

MHC-SD-WM-TA-032
Revision 0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KEMROB - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 3
DATE 09/13/91 13:02:47
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OWAP / B & I	TOTAL DOLLARS
121220	E/I - ONSITE A-E - ONSITE INSTALL										
121220.00	TECHNICAL SERVICES										
121220.0000000	*****	000	0	0	0	0	0	0	0	0	0
121220.0000004	ENGINEERING AND INSPECTION DURING CONSTRUCTION - PROCUREMENT SUPPORT.	000	1 LS	4317	258998	0	0	0	0	0	258998
SUBTOTAL	TECHNICAL SERVICES			4,317		0		0		0	
					258,998		0		0		258,998
TOTAL	COST CODE 00000 WBS 121220 (ESCALATION 54.86 % - CONTINGENCY 35.00 %)			4,317		0		0		0	
					258,998		0		0		258,998
TOTAL WBS 121220 E/I - ONSITE A-E - ONSITE INSTALL				4,317		0		0		0	
					258,998		0		0		258,998

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KENROB - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 4
DATE 09/13/91 13:02:47
BY W T SUSTENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
211210	ENGINEERED EQUIPMENT PROCUREMENT										
211210.03	CONCRETE										
211210.0300000	*****	501	0	0	0	0	0	0	0	0	0
211210.0300000	REMOTE CORE DRILLING MACHINE W/OPERATING PLATFORM AND CONTROL SYSTEM. FOR OPERATN WITH EMM MODULE	501	2 EA	0	0	0	1200000	0	0	0	1200000
SUBTOTAL	CONCRETE			0	0	0		0	0	0	
	SALES TAX 7.80 %						1,200,000		0		1,200,000
	WAREHOUSING 9.50 %						93600		0		93600
							114000				114000
TOTAL	COST CODE 50103			0	0	0		0	0	0	
	WBS 211210				0		1,407,600		0		1,407,600
	(ESCALATION 34.45 % - CONTINGENCY 50.00 %)										
211210.15	MECHANICAL										
211210.1500000	*****	501	0	0	0	0	0	0	0	0	0
211210.1500000	15" DIA FEEDTHROUGH WITH SEA 2" JUMPER LINES ENCASED WITHIN SST ENCASEMENT AND KICKPLATES/INCONNEL 600 PIPE AND NOZZLES. (INCLUDES 10 NOZZLES AND KICKPLATES) FOR CELL TO CELL INSTALL 7' 6" LONG	501	180 EA	0	0	0	5040000	0	0	0	5040000
211210.1500005	AND NOZZLES. (INCLUDES 10 NOZZLES AND KICKPLATES) FOR CELL TO CELL INSTALL 7' 6" LONG	501	0	0	0	0	0	0	0	0	0
211210.1500008	15" DIA FEEDTHROUGH WITH SEA 2" JUMPER LINES ENCASED WITHIN SST ENCASEMENT AND KICKPLATES/INCONNEL 600 PIPE AND NOZZLES. (INCLUDES 10 NOZZLES AND KICKPLATES) FOR CELL TO HPT INSTALL 8' LONG	501	74 EA	0	0	0	2072000	0	0	0	2072000
211210.1500009	AND NOZZLES. (INCLUDES 10 NOZZLES AND KICKPLATES) FOR CELL TO HPT INSTALL 8' LONG	501	0	0	0	0	0	0	0	0	0
211210.1500012	8" DIA PNEUMATIC FEEDTHROUGH INCONNEL 600 TUBING ENCASED WITHIN SST ENCASEMENT AND SLEEVE.	501	37 EA	0	0	0	370000	0	0	0	370000

E-65

MHC-SD-WM-TA-032
Revision 0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 5
DATE 09/13/91 13:02:49
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
211210.1500020	HOT PIPE TRENCH MODULES WITH NOZZLES, JET EJECTORS AND INTERCONNECTING FLEX JUMPERS - ALL WETTED PARTS & TRAY	501	37 EA	0	0	0	5920000	0	0	0	5920000
211210.1500021	OF INCONNEL 600	501	0	0	0	0	0	0	0	0	0
SUBTOTAL	MECHANICAL			0	0	0	0	0	0	0	0
	SALES TAX 7.80 %						13,402,000		0		13,402,000
	WAREHOUSING 6.04 %						1045356		0		1045356
							809481				809481
TOTAL	COST CODE 50115			0	0	0	0	0	0	0	0
	WBS 211210				0		15,256,837		0		15,256,837
	(ESCALATION 34.45 % - CONTINGENCY 40.00 %)										
211210.16	ELECTRICAL										
211210.1600000	*****	501	0	0	0	0	0	0	0	0	0
211210.1600004	CCTV SYSTEM FOR REMOTE DRILLING OPERATIONS EACH SYSTEM INCLUDES 8 CAMERAS WITH REMOTE OPERATORS AND	501	2 EA	0	0	0	160000	0	0	0	160000
211210.1600005	CONTROL SYSTEM	501	0	0	0	0	0	0	0	0	0
211210.1600012	8" DIA ELECTR FEEDTHROUGH W/ WIRES ENCASED IN SST ENCASEMENT AND SLEEVE - PIPE GALLERY TO CELLS	501	74 EA	0	0	0	703000	0	0	0	703000
211210.1600020	8" DIA ELECTR FEEDTHROUGS W/ WIRES ENCASED IN SST ENCASEMENT AND SLEEVE - OPERATING GALLERY TO CANYON	501	37 EA	0	0	0	351500	0	0	0	351500
211210.1600021	FOR CCTV AND CORE DRILLING MACHINE POWER & CONTROL INCLUDES SPECIAL CONNECTORS IN GALLERY	501	0	0	0	0	0	0	0	0	0
211210.1600104	ADDITIVE AMMOUNT FOR HP1 ELECTRICAL WORK BID BY VENDOR AS BY OTHERS	501	1 LS	0	0	0	740000	0	0	0	740000
SUBTOTAL	ELECTRICAL			0	0	0	0	0	0	0	0
	SALES TAX 7.80 %						1,954,500		0		1,954,500
	WAREHOUSING 6.21 %						152451		0		152451
							121374				121374

E-66

MHC-SD-MM-TA-032
Revision 0

KAISER ENGINEERS HANFORD		PAGE 6	
WESTINGHOUSE HANFORD COMPANY		DATE 09/13/91 13:02:51	
JOB NO. ER1269 OPT 2A		BY M T SUSIENE	

** KAISER ENGINEERS INTERACTIVE ESTIMATING **	
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION	
STUDY ESTIMATE OPTION 2A	
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE	

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OWEP / B & I	TOTAL DOLLARS
TOTAL	COST CODE 50116			0	0	0	2,228,325	0	0	0	2,228,325
	WBS 211210										
	(ESCALATION 36.45 % - CONTINGENCY 50.00 %)										

TOTAL WBS 211210 ENGINEERED EQUIPMENT PROCUREMENT											
				0	0	0	18,892,762	0	0	0	18,892,762

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KENR08 - ESTIMATE DETAIL BY MBS / COST CODE

PAGE 7
DATE 09/13/91 13:02:51
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
211220	HARDWARE PROCUREMENT										
211220.03	CONCRETE										
211220.0300000	*****	501	0	0	0	0	0	0	0	0	0
211220.0300004	15" DIA CORE DRILL CASINGS X 7'6" & 8'	501	254 EA	0	0	0	1524000	0	0	0	1524000
211220.0300008	8" DIA CORE DRILL CASINGS X 9'	501	111 EA	0	0	0	254190	0	0	0	254190
211220.0300009	8" DIA CORE DRILL CASINGS X 5'	501	37 EA	0	0	0	55130	0	0	0	55130
211220.0300104	PIT COVER BLOCKS - PRECAST 4' THICK W/ HI-DENSITY CONCRETE.	501	111 EA	0	0	0	3330000	0	0	0	3330000
211220.0300106	HPT COVER BLOCKS - PRECAST 2' THICK W/ HI-DENSITY CONCRETE. BLOCKS APPROX 10' X 11' X 24" OVERALL	501	74 EA	0	0	0	1480000	0	0	0	1480000
211220.0300110	HPT SHIELDING BLOCKS 30" THK PRECAST BLOCKS - HI DENSITY CONCRETE. BLOCKS APPROX 10' X 9' X 30" OVERALL	501	74 EA	0	0	0	1480000	0	0	0	1480000
SUBTOTAL	CONCRETE			0	0	0	0	0	0	0	0
	SALES TAX 7.80 %						8,123,320		0		8,123,320
	WAREHOUSING 6.06 %						633619		0		633619
							492273				492273
TOTAL	COST CODE 50103 MBS 211220 (ESCALATION 34.45 % + CONTINGENCY 35.00 %)			0	0	0	9,249,212	0	0	0	9,249,212
211220.15	MECHANICAL										
211220.1500000	***** ALL BELOW LISTED MATERIAL TO BE GFE TO MECHANICAL EQUIP FABRICATOR	501	0	0	0	0	0	0	0	0	0
211220.1500001	*****	501	0	0	0	0	0	0	0	0	0
211220.1500004	2" DIA X 4' FLEXIBLE METAL HOSE WITH 2" DIA PIPE NIPPLES @ EACH END OF	501	838 EA	0	0	0	1843600	0	0	0	1843600

E-68

MHC-SD-WM-TA-032
Revision 0

Kaiser Engineers Hanford Westinghouse Hanford Company Job No. ERT269 OPT 2A											
** Kaiser Engineers Interactive Estimating ** Defense Waste Remediation Program Redefinition Study Estimate KENR08 - Estimate Detail by WBS / Cost Code											
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / 8 & 1	TOTAL DOLLARS
211220.1500008	WASTELOY G22 W/SST BRAID	501	74 EA	0	0	0	15910	0	0	0	15910
211220.1500012	1" MALE PUREX NOZZLE	501	3798 EA	0	0	0	1697706	0	0	0	1697706
211220.1500016	2" MALE PUREX NOZZLE	501	74 EA	0	0	0	52614	0	0	0	52614
211220.1500018	1" FEMALE PUREX NOZZLE	501	3798 EA	0	0	0	56970	0	0	0	56970
211220.1500019	MATERIAL FROM G30 ALLOY	501	200 EA	0	0	0	311000	0	0	0	311000
211220.1500020	2" BLANK FEMALE CONNECTORS	501	1604 EA	0	0	0	2021040	0	0	0	2021040
211220.1500024	1" JET EJECTOR ASSY	501	37 EA	0	0	0	16465	0	0	0	16465
SUBTOTAL MECHANICAL											
SALES TAX 7.80 %											
WAREHOUSING 6.14 %											
COST CODE 50115											
WBS 211220											
(ESCALATION 34.45 % - CONTINGENCY 35.00 %)											
211220.16	ELECTRICAL	501	0	0	0	0	6,015,305	0	0	0	6,015,305
211220.16000G0	MATERIAL TO BE GFE TO MECHANICAL FABRICATOR	501	0	0	0	0	469194	0	0	0	469194
211220.1600001	ASSUME STD ELECTRICAL LWR	501	148 EA	0	0	0	236800	0	0	0	236800
211220.1600002	ELECTRICAL FEMALE PUREX CONN	501	148 EA	0	0	0	236800	0	0	0	236800
211220.1600003	ASSUME STD ELECTRICAL UPPER CONN	501	148 EA	0	0	0	236800	0	0	0	236800
SUBTOTAL ELECTRICAL											
TOTAL											
GRAND TOTAL											

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KEMROB - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 9
DATE 09/13/91 13:02:54
BY W T SUSIEME

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
	SALES TAX 7.80 %						36941		0		36941
	WAREHOUSING 6.00 %						28416				28416
TOTAL	COST CODE 50116		0		0	0		0		0	
	WBS 211220				0		538,957		0		538,957
	(ESCALATION 34.45 % - CONTINGENCY 40.00 %)										
TOTAL WBS 211220	HARDWARE PROCUREMENT		0		0		16,642,007		0		16,642,007

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KEHROB - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 10
DATE 09/13/91 13:02:55
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
231210	BURY BOX PROCUREMENT - WHC										
231210.02	SITWORK										
231210.0200000	*****	501	0	0	0	0	0	0	0	0	0
231210.0200006	BURY BOXES FOR CORE DRILL PLUGS - 24X10X6' BOXES - STEEL/PRECAST CONCRETE NOTE: 182 15" DIA CORES X 8' LONG 2 56 PER BOX = 3.25 BOXES 111 8" DIA CORES X 9' LONG 2 120 PER BOX = .925 BOXES 37 8" DIA CORES X 5' LONG	501	5 EA	0	0	0	1000000	0	0	0	✓ 1000000
231210.0200007	2 240 PER BOX = .154 BOXES 3.25 + .925 + .154 = 5 BOX MINIMUM	501	0	0	0	0	0	0	0	0	0
231210.0200008	BURY BOXES FOR CORE DRILL PLATFORMS AND MACHINES AT JOB CLEAN-UP. (INCLUDES MISC CONSTRUCTION WASTE).	501	2 EA	0	0	0	400000	0	0	0	✓ 400000
231210.0200010	BURY BOXES FOR CORE DRILL RESIDUE TANKS TO DISPOSE OF CONCRETE GROUND UP DURING DRILLING OPERATIONS NOTE: 37 TANKS 4 X 5 X 4' NESTED = 24 PER BURY BOX = 2 BOXES INCLUDES ROOM FOR CONCRETE MADE FROM RECYCLED DRILL WTR	501	2 EA	0	0	0	400000	0	0	0	✓ 400000
231210.0200014	BURY BOXES FOR CORE DRILL RESIDUE TANKS TO DISPOSE OF CONCRETE GROUND UP DURING 8" CORE MANUAL DRILLING	501	2 EA	0	0	0	400000	0	0	0	✓ 400000
231210.0200015	37 CELLS 4EA 8" CORE DRILLS PER CELL = 1 4X5X4 TANK PER CELL RECYCLED WATER SLURRY TO BE INCLUDED IN IN-CELL	501	0	0	0	0	0	0	0	0	0
231210.0200016	BURY BOXES	501	0	0	0	0	0	0	0	0	0
231210.0200020	BURY BOXES FOR GREENHOUSE DISPOSAL (8750 CF W/1150CF PER BOX = 8 BOXES	501	8 EA	0	0	0	1600000	0	0	0	✓ 1600000
SUBTOTAL	SITWORK			0	0	0	3,800,000	0	0	0	3,800,000

E-71

MHC-SD-WM-TA-032
Revision 0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 11
DATE 09/13/91 13:02:56
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
	SALES TAX 7.80 %						296400		0		296400
	WAREHOUSING 8.90 %						338200				338200
TOTAL	COST CODE 50102			0	0	0	4,434,600	0	0	0	4,434,600
	WBS 231210										
	(ESCALATION 34.45 % - CONTINGENCY 30.00 %)										
TOTAL WBS 231210 BURY BOX PROCUREMENT - WMC				0	0	0	4,434,600	0	0	0	4,434,600

KAISER ENGINEERS HAMFORD
WESTINGHOUSE HAMFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KENROB - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 12
DATE 09/13/91 13:02:57
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
311210	TEMPORARY CONSTRUCTION										
311210.01	GENERAL REQUIRMENTS										
311210.0100000	***** GREENHOUSES *****	501	0	0	0	0	0	0	0	0	0
311210.0100004	FABRICATE GREENHOUSES FOR CORE DRILLING FROM PIPE/ OPERATING GALLERY TO CANYON INCLUDE NEGATIVE AIR, HEPA FILTERS AND AIR LOCKS.	501	70000 SF	3500	87500	0	87500	0	0	100625	275625
311210.0100005		501	0	0	0	0	0	0	0	0	0
311210.0100104	FINAL ASSEMBLY OF REMOTE CORE DRILL MACHINE IN PROTECTED ZONE @ EAST END OF CANYON PROVIDED BY WMC	501	2 EA	800	24968	0	0	0	0	28713	53681
311210.0100105	USING EMPLY BURY BOXES ***** REQUIRES WMC CRANE OPER SUPT	501	0	0	0	0	0	0	0	0	0
SUBTOTAL	GENERAL REQUIRMENTS			4,300		0		0		129,338	
	CONSUMABLES 6.00 %				112,468		87,500		0		329,306
	SALES TAX 7.80 %						5250				5250
	WAREHOUSING 20.00 %						7235		0		7235
							18550				18550
TOTAL	COST CODE 50101 WBS 311210 (ESCALATION 42.52 % - CONTINGENCY 35.00 %)			4,300		0		0		129,338	
					112,468		118,535		0		360,341
311210.03	CONCRETE										
311210.0300008	FABRICATE DRIP COLLECTOR FOR CORE DRILL WATER	501	37 EA	296	7959	0	2035	0	0	9153	19147
SUBTOTAL	CONCRETE			296		0		0		9,153	
	CONSUMABLES 6.00 %				7,959		2,035		0		19,147
	SALES TAX 7.80 %						122				122
	WAREHOUSING 20.00 %						168		0		168
							431				431
TOTAL	COST CODE 50103 WBS 311210			296		0		0		9,153	
					7,959		2,757		0		19,869

E-73

MHC-SD-MM-TA-032
Revision 0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KENR08 - ESTIMATE DETAIL BY MBS / COST CODE

PAGE 13
DATE 09/13/91 13:02:59
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
	(ESCALATION 42.52 % - CONTINGENCY 35.00 %)										
311210.03	CONCRETE										
311210.0300000	*****	501 M	0	0	0	0	0	0	0	0	0
311210.0300004	CORE DRILL FOR ELECTRICAL FEEDTHROUGHS FROM OPN GAL TO CANYON ASSUME 8" DIA X 5' LONG HOLES	501 M	37 EA	1850	57739	0	555	0	0	66400	124694
311210.0300012	INSTALL AND REMOVE DRIP COLLECTOR TO WALL AT DRILL LOCATIONS AND TIE INTO WATER RECIRC SYSTEM.	501 M	37 EA	148	4619	0	1850	0	0	5312	11781
311210.0300016	INSTALL AND REMOVE CORE DRILL WATER RECIRCULATION PUMP, HOSE AND TANKS	501 M	37 EA	592	18476	0	1850	0	0	21247	41573
311210.0300020	MIX CEMENT W/DRILLING WASTE WATER AND SOLIDIFY FOR HOT BURIAL 1-4X5X4' TANK PER CELL	501 M	37 EA	296	7104	0	1850	0	0	8170	17124
311210.0300024	STEP-OFF PAD SUPPORT LABOR	501 M	722 MHR	722	15797	0	0	0	0	18167	33964
SUBTOTAL	CONCRETE	(HASK)		3,608		0		0		119,296	
	SWP 100.00%				103,735		6,105		0		229,136
	CONSUMABLES 6.00 %			3608	103735						103735
	SALES TAX 7.80 %						366				366
	WAREHOUSING 20.00 %						505		0		505
	OH&P (ON MARKUPS ONLY)						1294				1294
										119295	119295
TOTAL	COST CODE 50103			7,216		0		0		238,591	
	MBS 311210				207,470		8,270		0		454,332
	(ESCALATION 42.52 % - CONTINGENCY 50.00 %)										
311210.05	METALS										
311210.0500000	*****	501	0	0	0	0	0	0	0	0	0
311210.0500004	MATERIAL COST FOR 4X5X4' CS TANKS FOR MIXING AND DISPOSAL OF SOLIDIFIED LIQUID CORE DRILL SLURRY	501	37 EA	0	0	0	81400	0	0	0	81400
SUBTOTAL	METALS			0	0	0	81,400	0	0	0	81,400

E-74

MHC-SD-WM-TA-032
Revision 0

** KAISER ENGINEERS INTERACTIVE ESTIMATING **										PAGE 14	
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION										DATE 09/13/91 13:03:00	
STUDY ESTIMATE										BY W T SUSIENE	
KENROB - ESTIMATE DETAIL BY WBS / COST CODE											
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	ONHP / B & I	TOTAL DOLLARS
	CONSUMABLES 6.00 %						4884				4884
	SALES TAX 7.80 %						6730		0		6730
	WAREHOUSING 20.00 %						17257				17257
TOTAL	COST CODE 50105			0	0	0	110,271	0	0	0	110,271
	WBS 311210										
	(ESCALATION 42.52 % - CONTINGENCY 40.00 %)										
311210.16	ELECTRICAL										
311210.1600001	*****	501	0	0	0	0	0	0	0	0	0
311210.1600004	INSTALL CCTV POWER & SIGNAL FROM 37 LOCATIONS IN OPN GAL TO B-PLANT MASTER CONTROL ROOM - ALLOW FOR PARALLEL CIRCUITS	501	1 LS	980	30027	0	40000	0	0	34531	104558
311210.1600005	INSTALL NEW POWER DISTR. SYSTEM FOR REMOTE CORE DRILL MACHINES. ALLOW FOR PARALLEL CIRCUITS FOR SIMULTANEOUS RUNNING OF MORE THAN ONE MACHINE AT A TIME. ASSUME EXISTING 480 VAC POWER SOURCE AVAILABLE IN BUILDING. ASSUME USE OF ONE 480VAC XFMR AND MASTER PANEL WITH SEPARATE PANELS AND SWITCHES AT EACH CELL	501	0	0	0	0	0	0	0	0	0
311210.1600012		501	1 LS	2000	61280	0	80000	0	0	70472	211752
311210.1600013		501	0	0	0	0	0	0	0	0	0
311210.1600014		501	0	0	0	0	0	0	0	0	0
SUBTOTAL	ELECTRICAL			2,980	91,307	0	120,000	0	0	105,003	316,310
	CONSUMABLES 6.00 %						7200				7200
	SALES TAX 7.80 %						9922		0		9922
	WAREHOUSING 20.00 %						25440				25440
TOTAL	COST CODE 50116										
	WBS 311210			2,980	91,307	0	162,562	0	0	105,003	358,872
	(ESCALATION 42.52 % - CONTINGENCY 35.00 %)										
311210.16	ELECTRICAL										
311210.1600000	*****	501 M	0	0	0	0	0	0	0	0	0

** KAISER ENGINEERS INTERACTIVE ESTIMATING **											
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION											
STUDY ESTIMATE											
OPTION 2A											
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE											
PAGE 15											
DATE 09/13/91 13:03:02											
BY W T SUSIENE											
ACCOUNT	DESCRIPTION	COST	QUANTITY	MANHOURS	LABOR	EQUIP	MATERIAL	SUB-	EQUIP-	OH&P	TOTAL
NUMBER		CODE				USAGE		CONTRACT	MENT	/ B & I	DOLLARS
311210.1600008	INSTALL 8" SLEEVE AND FEED- THRU AND SPECIAL ELECTRICAL CONNECTORS A CANYON WALL FOR CCTV AND REMOTE CORE DRILL MACHINES ++++ REQUIRES WMC CRANE OPR SPT	501 M	37 SET	1480	45347	0	55500	0	0	52149	152996
311210.1600009		501 M	0	0	0	0	0	0	0	0	0
311210.1600010		501 M	0	0	0	0	0	0	0	0	0
311210.1600020	INSTALL CCTV SYSTEM ON RATE CORE DRILL MACHINE ++++ REQUIRES WMC CRANE OPR SPT	501 M	2 EA	240	0	0	200	0	0	0	200
311210.1600021		501 M	0	0	0	0	0	0	0	0	0
311210.1600120	STEP-OFF PAD SUPPORT LABOR ELECTRICAL	501 M	430 MHR (MASK)	430	9408	0	0	0	0	10819	20227
SUBTOTAL				2,150	54,755	0	55,700	0	0	62,968	173,423
	SWP 100.00%			2150	54755						54755
	CONSUMABLES 6.00 %						3342				3342
	SALES TAX 7.80 %						4605		0		4605
	WAREHOUSING 20.00 %						11808				11808
	OH&P (ON MARKUPS ONLY)									62968	62968
TOTAL				4,300	109,510	0	75,456	0	0	125,936	310,902
	COST CODE 50116										
	WBS 311210										
	(ESCALATION 42.52 % - CONTINGENCY 40.00 %)										
				19,092	528,714	0	477,850	0	0	608,022	1,614,585
TOTAL WBS 311210 TEMPORARY CONSTRUCTION											

E-77

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 17
DATE 09/13/91 13:03:05
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ONEP / B & I	TOTAL DOLLARS
TOTAL	COST CODE 50103 WBS 311220 (ESCALATION 42.52 % - CONTINGENCY 40.00 %)			23,032	671,586	0	14,786	0	0	772,325	1,458,697
311220.03	CONCRETE										
311220.0300104	MANUAL SURVEY TO LOCATE CORE DRILLS FROM GALLERY TO CELLS	501	1 LS	148	6660	0	0	0	0	0	6660
311220.0300106	FURNISH AND DEMONSTRATE REMOTE SURVEY EQUIPMENT AND TECHNIQUES FOR WMC NOZZLE LOCATION	501	1 LS	120	5400	0	45000	0	0	0	50400
SUBTOTAL	CONCRETE			268	12,060	0	45,000	0	0	0	57,060
	CONSUMABLES 6.00 %						2700				2700
	SALES TAX 7.80 %						3721		0		3721
	WAREHOUSING 20.00 %						9540				9540
TOTAL	COST CODE 50103 WBS 311220 (ESCALATION 42.52 % - CONTINGENCY 35.00 %)			268	12,060	0	60,961	0	0	0	73,021
311220.05	METALS										
311220.0500000	*****	501	0	0	0	0	0	0	0	0	0
311220.0500004	MATERIAL COST FOR 4X5X4' CS TANKS FOR MIXING AND DISPOSAL OF SOLIDIFIED LIQUID CORE DRILL SLURRY	501	37 EA	0	0	0	81400	0	0	0	81400
SUBTOTAL	METALS			0	0	0	81,400	0	0	0	81,400
	CONSUMABLES 6.00 %						4884				4884
	SALES TAX 7.80 %						6730		0		6730
	WAREHOUSING 20.00 %						17257				17257
TOTAL	COST CODE 50105 WBS 311220 (ESCALATION 42.52 % - CONTINGENCY 35.00 %)			0	0	0	110,271	0	0	0	110,271
TOTAL WBS 311220 CORE DRILLING				23,596	691,605	0	188,775	0	0	781,478	1,661,858

E-78

WMC-SD-WM-TA-032
Revision 0

E-79

KAISER ENGINEERS HANFORD WESTINGHOUSE HANFORD COMPANY JOB NO. ER1269 OPT 2A		** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE KEMROB - ESTIMATE DETAIL BY MBS / COST CODE		PAGE 19 DATE 09/13/91 13:03:09 BY W T SUSIENE							
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ONEP / B & I	TOTAL DOLLARS
	(ESCALATION 42.52 % - CONTINGENCY 40.00 %)										
TOTAL MBS 311240 INSTALL FEEDTHROUGHS			11,100	320,656	0	15,037	0	0	0	368,754	704,447

** KAISER ENGINEERS INTERACTIVE ESTIMATING **											
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION											
STUDY ESTIMATE OPTION 2A											
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE											
ACCOUNT	DESCRIPTION	COST	QUANTITY	MANHOURS	LABOR	EQUIP	MATERIAL	SUB-	EQUIP-	OR&P	TOTAL
NUMBER		CODE				USAGE		CONTRACT	MENT	/ B & I	DOLLARS
311250	BURIAL FEES AND COSTS										
311250.02	SITEMORK	501 M	0	0	0	0	0	0	0	0	0
311250.0200000	TRANSFER, WRAP AND HAUL										
	COVER BLOCKS TO BURIAL										
311250.0200001		501 M	0	0	0	0	0	0	0	0	0
311250.0200004	WRAP PIT COVER BLOCKS FOR	501 M	111 EA	1665	36430	0	24975	0	0	41895	103300
	BURIAL										
	1600SF OF COVER/1500 LF TAPE										
	EACH COVER W/PADDING/DUNNAGE										
311250.0200005	*****	501 M	0	0	0	0	0	0	0	0	0
	REQUIRES WHC CRANE OPR SUPT										
311250.0200006	WRAP TRENCH COVER BLOCKS FOR	501 M	74 EA	888	19429	0	12950	0	0	22343	54722
	BURIAL										
	1200SF OF COVER/1100 LF TAPE										
	EACH COVER W/PADDING/DUNNAGE										
311250.0200007	*****	501 M	0	0	0	0	0	0	0	0	0
	REQUIRES WHC CRANE OPR SUPT										
311250.0200008	LOAD AND HAUL PIT COVER	501 M	111 EA	444	12210	0	0	0	0	14042	26252
	BLOCKS TO HOT BURIAL										
311250.0200009	LOAD AND HAUL TRENCH COVER	501 M	74 EA	296	8140	0	0	0	0	9361	17501
	BLOCKS TO HOT BURIAL										
311250.0200100	*****	501 M	0	0	0	0	0	0	0	0	0
	TRANSFER, WRAP, BOX AND										
	HAUL CORE DRILL CORES										
311250.0200101	*****	501 M	0	0	0	0	0	0	0	0	0
311250.0200104	HANDLE WRAP AND BOX PIT TO	501 M	180 EA	720	15826	0	2700	0	0	18200	36726
	PIT CORES 16" DIA X 7' 6"										
	WHC REMOVAL										
311250.0200106	HANDLE WRAP AND BOX PIT TO	501 M	74 EA	296	6506	0	1110	0	0	7482	15098
	HPT CORES 16" DIA X 8'										
	WHC REMOVAL										
311250.0200108	HANDLE WRAP AND BOX GALLERY	501 M	74 EA	296	6506	0	1110	0	0	7482	15098
	TO CELL ELECTRICAL CORES										
	8" DIA X 9'										

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KEHR08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 21
DATE 09/13/91 13:03:11
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
311250.0200109	***** REQUIRES WHC CRANE OPR SUPT	501 M	0	0	0	0	0	0	0	0	0
311250.0200110	HANDLE WRAP AND BOX GALLERY TO CELL PNEUMATIC CORES 8" DIA X 9'	501 M	37 EA	148	3253	0	555	0	0	3741	7549
311250.0200111	***** REQUIRES WHC CRANE OPR SUPT	501 M	0	0	0	0	0	0	0	0	0
311250.0200114	HANDLE WRAP AND BOX GALLERY TO CANYON ELECTRICAL CORES 8" DIA X 5'	501 M	37 EA	130	2857	0	555	0	0	3286	6698
311250.0200115	***** REQUIRES WHC CRANE OPR SUPT	501 M	0	0	0	0	0	0	0	0	0
311250.0200138	LOAD & HAUL BURIAL BOXES TO BURIAL SITE	501 M	11 EA	66	1650	0	0	0	0	1898	3548
311250.0200200	***** HOT WASTE BURIAL CHARGES *****	501 M	0	0	0	0	0	0	0	0	0
311250.0200210	BURIAL CHARGE FOR PIT COVER BLOCKS	501 M	45880 CF	0	0	0	0	3148286	0	0	3148286
311250.0200211	BURIAL CHARGE FOR TRENCH CVR BLOCKS	501 M	14985 CF	0	0	0	0	1028271	0	0	1028271
311250.0200224	BURIAL CHARGE FOR CORE DRILL BURIAL BOXES (5 BURIAL BOXES)	501 M	9625 CF	0	0	0	0	2782010	0	0	2782010
311250.0200228	BURIAL CHARGE FOR CORE DRILL MACHINE & PLATFORM BURIAL BOXES (2 BURIAL BOXES)	501 M	3850 CF	0	0	0	0	1112804	0	0	1112804
311250.0200230	BURIAL CHARGE FOR CORE DRILL WASTE CONCRETE SLURRY BURIAL BOXES (4 BURIAL BOXES)	501 M	7700 CF	0	0	0	0	2225608	0	0	2225608
311250.0200236	BURIAL CHARGE FOR GREENHOUSE AND TEMP CONSTR MATL BURIAL BOXES (8 BURIAL BOXES)	501 M	15400 CF	0	0	0	0	4451216	0	0	4451216
311250.0200300	***** TRANSFER, WRAP AND BOX AND HAUL GREENHOUSES *****	501 M	0	0	0	0	0	0	0	0	0

E-82

MHC-SD-MM-TA-032
Revision 0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KENROB - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 22
DATE 09/13/91 13:03:12
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
311250.0200301	.	501 M	0	0	0	0	0	0	0	0	0
311250.0200330	TEAR DOWN & BOX CONTAMINATED GREENHOUSES - PACK IN BURIAL BOXES - INCLUDES ANCILLARY EQUIPMENT	501 M	70000 SF	2100	52500	0	0	0	0	60375	112875
311250.0200341	LOAD & HAUL BURIAL BOXES TO BURIAL SITE	501 M	8 EA	48	1200	0	0	0	0	1380	2580
311250.0200500	STEP-OFF PAD SUPPORT LABOR	501 M	1774 EA	1774	38815	0	0	0	0	44637	83452
SUBTOTAL	SITWORK (MASK)			8,871		0	14,748,195			236,122	
	SWP 100.00%			8871	205,322		43,955		0		15,233,594
	CONSUMABLES 6.00 %				205322						205322
	SALES TAX 7.80 %						2637				2637
	WAREHOUSING 20.00 %						3634		0		3634
	OH&P (ON MARKUPS ONLY)						9318				9318
										236120	236120
TOTAL	COST CODE 50102			17,742		0	14,748,195			472,242	
	WBS 311250				410,644		59,545		0		15,690,626
	(ESCALATION 42.52 % - CONTINGENCY 30.00 %)										
TOTAL WBS 311250 BURIAL FEES AND COSTS				17,742		0	14,748,195			472,242	
					410,644		59,545		0		15,690,626

** KAISER ENGINEERS INTERACTIVE ESTIMATING **										
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION										
STUDY ESTIMATE										
OPTION 2A										
KENROB - ESTIMATE DETAIL BY WBS / COST CODE										
PAGE 23										
DATE 09/13/91 13:03:13										
BY W T SUSIENE										
ACCOUNT	DESCRIPTION	COST	QUANTITY	MANHOURS	LABOR	EQUIP	SUB-	EQUIP-	CH&P	TOTAL
NUMBER		CODE				USAGE	CONTRACT	MENT	/ B & I	DOLLARS
311260	SHIFT DIFFERENTIAL COSTS									
311260.01	GENERAL REQUIREMENTS	501	0	0	0	0	0	0	0	0
311260.0100000										
311260.0100004	MANHOUR RATE DIFFERENTIAL	501	4470 MHR	4470	122031	0	0	0	0	122031
	23,845 MHR X .0625 = 1490									
	23,845 MHR X .125 = 2980									
	1490 + 2980 = 4470 MHR									
SUBTOTAL	GENERAL REQUIREMENTS			4,470	122,031	0	0	0	0	122,031
TOTAL	COST CODE 50101			4,470	122,031	0	0	0	0	122,031
	WBS 311260									
	(ESCALATION 42.52 % - CONTINGENCY 35.00 %)									
311260.01	GENERAL REQUIREMENTS									
311260.0100006	INCREASED FIELD OVERHEAD TO SUPPORT MULTIPLE SHIFT OPERATION	501	1 LS	34976	1923680	0	0	0	0	1923680
SUBTOTAL	GENERAL REQUIREMENTS			34,976	1,923,680	0	0	0	0	1,923,680
TOTAL	COST CODE 50101			34,976	1,923,680	0	0	0	0	1,923,680
	WBS 311260									
	(ESCALATION 42.52 % - CONTINGENCY 35.00 %)									
TOTAL WBS 311260 SHIFT DIFFERENTIAL COSTS				39,446	2,045,711	0	0	0	0	2,045,711

** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE KENR08 - ESTIMATE DETAIL BY WBS / COST CODE									
ACCOUNT NUMBER DESCRIPTION COST CODE QUANTITY MANHOURS LABOR EQUIP USAGE MATERIAL CONTRACT SUB-EQUIP-MENT OHEP / B & I DOLLARS TOTAL DOLLARS									
331220	HOT PIPE TRENCH DECONTAMINATION								
331220-02	SITEWORK	501	0	0	0	0	0	0	0
331220-0200000	HOT PIPE TRENCH PIPE FLUSHING								
331220-0200004	CRANE OPERATOR (1) 6-MONTHS	501	3100 MHR	3100	145700	0	0	0	145700
331220-0200006	CHEN OPERATOR (4) 6-MONTHS	501	12000 MHR	12000	564000	0	0	0	564000
331220-0200008	MAINTENANCE (0.5) 6-MONTHS	501	1550 MHR	1550	72850	0	0	0	72850
331220-0200010	RPT (1) 6-MONTHS	501	3100 MHR	3100	139500	0	0	0	139500
331220-0200012	ENGINEER (1) 6-MONTHS	501	3100 MHR	3100	139500	0	0	0	139500
331220-0200014	LIQUID WASTE DISPOSAL CHGE	501	1 LS	0	0	0	5000000	0	5000000
331220-0200016	NEW JUMPERS (30)	501	1 LS	0	0	0	300000	0	300000
331220-0200018	CHEMICALS	501	1 LS	0	0	100000	0	0	100000
331220-0200020	LABORATORY ANALYSIS	501	1 LS	0	0	50000	0	0	50000
SUBTOTAL SITEWORK			22,850	1,061,550	0	150,000	5,300,000	0	6,511,550
SALES TAX 7.80 %						11700		0	11700
TOTAL			22,850	1,061,550	0	161,700	5,300,000	0	6,523,250
COST CODE 50102									
WBS 331220									
(ESCALATION 42.52 % - CONTINGENCY 30.00 %)									
TOTAL WBS 331220 HOT PIPE TRENCH DECONTAMINATION									
			22,850	1,061,550	0	161,700	5,300,000	0	6,523,250

** KAISER ENGINEERS INTERACTIVE ESTIMATING **											
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION											
STUDY ESTIMATE OPTION 2A											
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE											
PAGE 25											
DATE 09/13/91 13:03:16											
BY W T SUSIENE											
ACCOUNT	DESCRIPTION	COST	QUANTITY	MANHOURS	LABOR	EQUIP	MATERIAL	SUB-	EQUIP-	ONEP	TOTAL
NUMBER		CODE				USAGE		CONTRACT	MENT	/ B & I	DOLLARS
331230	HOT PIPE TRENCH DEMOLITION										
331230.02	SITEWORK	501	0	0	0	0	0	0	0	0	0
331230.0200000	HOT PIPE TRENCH PIPE										
	JUMPER REMOVAL										
331230.0200004	CRANE OPERATOR (1)	501	75 MHR	75	3525	0	0	0	0	0	3525
331230.0200008	RPT (1)	501	75 MHR	75	3375	0	0	0	0	0	3375
331230.0200010	ENGINEER (1)	501	75 MHR	75	3375	0	0	0	0	0	3375
331230.0200012	SOLID WASTE DISPOSAL	501	1 LS	0	0	0	633000	0	0	0	633000
331230.0200014	EQUIPMENT	501	1 LS	0	0	7500	0	0	0	0	7500
SUBTOTAL	SITEWORK			225	10,275	7,500	0	633,000	0	0	650,775
TOTAL	COST CODE 50102			225	10,275	7,500	0	633,000	0	0	650,775
	WBS 331230										
	(ESCALATION 42.52 % - CONTINGENCY 30.00 %)										
TOTAL WBS 331230	HOT PIPE TRENCH DEMOLITION			225	10,275	7,500	0	633,000	0	0	650,775

[illegible]

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOURS	LABOR	EQUIP USAGE	SUB-MATERIAL CONTRACT	EQUIP-MENT	ONEP / B & I	TOTAL DOLLARS
** KATSER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE OPTION 2A KEHR00 - ESTIMATE DETAIL BY WBS / COST CODE										
KATSER ENGINEERS HANFORD										
WESTINGHOUSE HANFORD COMPANY										
JOB NO. ERT269	OPT 2A									
PAGE 27 DATE 09/13/91 13:03:18 BY W T SUSIENE										

PAGE 27
DATE 09/13/91 13:03:18
BY W T SUSIENE

```

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
EFENSE WASTE REMEDIATION PROGRAM REDEFINITION
TUDY ESTIMATE
KEHR08 - ESTIMATE DETAIL BY WBS / COST CODE
OPTION 2A

```

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
331250	INSTALL RPT EQUIPMENT AND JUMPERS										
331250.15	MECHANICAL	501	0	0	0	0	0	0	0	0	0
331250.1500000	INSTALL HOT PIPE TRENCH MODULES AND JUMPERS	501	0	0	0	0	0	0	0	0	0
331250.1500004	CRANE OPERATOR (1) 18-DAYS	501	432 MHR	432	20304	0	0	0	0	0	20304
331250.1500006	EMW OPERATOR (2.3) 54 DAYS	501	2981 MHR	2981	140107	0	0	0	0	0	140107
331250.1500008	RPT (2) 36 DAYS	501	2592 MHR	2592	116640	0	0	0	0	0	116640
331250.1500010	CHEN OPERATOR (1) 36 DAYS	501	864 MHR	864	38880	0	0	0	0	0	38880
331250.1500011	MISC TOOLS AND EQUIPMENT	501	1 LS	0	0	200000	0	0	0	0	200000
SUBTOTAL	MECHANICAL			6,869	315,931	200,000	0	0	0	0	515,931
TOTAL	COST CODE 50115 WBS 331250 (ESCALATION 42.52 % - CONTINGENCY 30.00 %)			6,869	315,931	200,000	0	0	0	0	515,931
TOTAL WBS 331250	INSTALL RPT EQUIPMENT AND JUMPERS			6,869	315,931	200,000	0	0	0	0	515,931

** KAISER ENGINEERS INTERACTIVE ESTIMATING **											PAGE 28
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION											DATE 09/13/91 13:03:19
STUDY ESTIMATE											BY M T SUSTENE
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE											
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ONEP / B & I	TOTAL DOLLARS
331260	SUPPORT CPAF CONSTRUCTION										
331260.01	GENERAL REQUIREMENTS	501	0	0	0	0	0	0	0	0	0
331260.0100000	SUPPORT CPAF CONSTRUCTION										
331260.0100004	PROVIDE CRANE AND EMH OPERATOR SUPPORT LABOR TO ASSIST CPAF CONSTRUCTION OPERATIONS:	501	4696	MHR	4696	220712	0	0	0	0	220712
331260.0100006	RPT SUPPORT FOR CPAF ZONE WORK	501	15849	MHR	15849	713205	0	0	0	0	713205
331260.0100008	OPERATIONS ENGR AND SUPV (4 MRS PER SHIFT)	501	8944	MHR	8944	402480	0	0	0	0	402480
SUBTOTAL	GENERAL REQUIREMENTS			29,489	1,336,397	0	0	0	0	0	1,336,397
TOTAL	COST CODE 50101 WBS 331260 (ESCALATION 42.52 % - CONTINGENCY 30.00 %)			29,489	1,336,397	0	0	0	0	0	1,336,397
TOTAL WBS 331260	SUPPORT CPAF CONSTRUCTION			29,489	1,336,397	0	0	0	0	0	1,336,397

KAISER ENGINEERS HANFORD WESTINGHOUSE HANFORD COMPANY JOB NO. ERT269 OPT 2A		** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE OPTION 2A KENROB - ESTIMATE DETAIL BY WBS / COST CODE		PAGE 29 DATE 09/13/91 13:03:21 BY W I SUSIENE						
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
341210	OPER CONTR PROJ MGMT									
341210.19	PROJECT MANAGEMENT									
341210.1900000	WHC PROJECT MANAGEMENT ESTIMATED AT 2 PER CENT OF PROJECT COST	501	1 LS	23834	1430040	0	0	0	0	1430040
	SUBTOTAL PROJECT MANAGEMENT			23,834	1,430,040	0	0	0	0	1,430,040
	TOTAL			23,834	1,430,040	0	0	0	0	1,430,040
	COST CODE 50119 WBS 341210 (ESCALATION 42.52 % - CONTINGENCY 30.00 %)									
	TOTAL WBS 341210 OPER CONTR PROJ MGMT			23,834	1,430,040	0	0	0	0	1,430,040

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2A

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2A
KEHROB - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 30
DATE 09/13/91 13:03:21
BY W T SUSIEME

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
=====											
REPORT TOTAL				207,801	8,939,061	207,500	40,872,276	20,681,195	2,230,496	0	72,930,528

This page intentionally left blank.

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2B
PAGE 1 OF 7
DATE 09/13/91 15:06:16
BY W T SUSIENE

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2B
KENR01 - PROJECT COST SUMMARY

COST CODE	DESCRIPTION	ESCALATED TOTAL COST	CONTINGENCY %	TOTAL	TOTAL DOLLARS
000	ENGINEERING	0	0	0	0
501	BUILDINGS	-1,320,000	32	-430,000	-1,750,000
	(ADJUSTED TO MEET OOE 5100.4)	20,000		30,000	50,000
OPTION 2B TOTAL					
		-1,300,000	32	-400,000	-1,700,000
TOTAL COST OF OPTION 2A					
		100,700,000	40	35,200,000	135,900,000
PROJECT TOTAL					
		99,400,000		34,800,000	134,200,000

REMARKS: ESTIMATE IS AN ALTERNATE ESTIMATE
ESTIMATE DOES NOT STAND ALONE. REFERENCE THE
FOLLOWING ESTIMATES:

ER1269 OPT 1
ER1269 OPT 2A
ER1269 OPT 2C

STUDY SEPTEMBER 13, 1991

ARCHITECT
ENGINEER
OPERATING
CONTRACTOR

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

WHC-SD-WM-TA-032
Revision 0

PAGE 2 OF 7
DATE 09/13/91 15:06:19
BY W T SUSIENE

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE
KENR02 - WORK BREAKDOWN STRUCTURE SUMMARY

KAISER ENGINEERS HANFORD
WESTINHOUSE HANFORD COMPANY
JOB NO. ERT1269 OPT 28

WBS DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION %	SUB TOTAL	CONTINGENCY %	TOTAL DOLLARS
111210 ENGINEERED EQUIPMENT DEFIN DESIGN	0	0	0	0.00	0	0	0
SUBTOTAL 11 DEFINITIVE DESIGN	0	0	0	0.00	0	0	0
121210 E/I - ONSITE A-E - PROCUREMENT SUPT	0	0	0	0.00	0	0	0
121220 E/I - ONSITE A-E - ONSITE INSTALL	0	0	0	0.00	0	0	0
SUBTOTAL 12 E/I DURING CONSTRUCTION	0	0	0	0.00	0	0	0
SUBTOTAL 1 ENGINEERING	0	0	0	0.00	0	0	0
211210 ENGINEERED EQUIPMENT PROCUREMENT	234600	0	234600	34.45	80820	50	157710
211220 HARDWARE PROCUREMENT	-1685128	0	-1685128	34.45	-580527	35	-792979
SUBTOTAL 21 ONSITE CONTR PROCUREMENT	-1450528	0	-1450528	34.45	-499707	33	-635269
231210 BURY BOX PROCUREMENT - WHC	233400	0	233400	34.45	80406	30	94142
SUBTOTAL 23 OPERATING CONTRACTOR PROCUR	233400	0	233400	34.45	80406	30	94142
SUBTOTAL 2 PROCUREMENT	-1217128	0	-1217128	34.45	-419301	33	-541127
311240 INSTALL FEEDTHROUGHS	101696	0	101696	42.52	43241	40	57975
311250 BURIAL FEES AND COSTS	24166	0	24166	42.52	10275	30	10332
311260 SHIFT DIFFERENTIAL COSTS	40959	0	40959	42.52	17416	35	20431
SUBTOTAL 31 ONSITE CONSTR CONTR	166821	0	166821	42.52	70932	37	88738
331250 INSTALL NPT EQUIPMENT AND JUMPERS	53020	0	53020	42.52	22544	30	22669
331260 SUPPORT CPAP CONSTRUCTION	22725	0	22725	42.52	9663	30	9716
SUBTOTAL 33 OPER CONTR CONSTRUCTION	75745	0	75745	42.52	32207	30	32385
341210 OPER CONTR PROJ MGMT	-19491	0	-19491	42.52	-8288	30	-8334
SUBTOTAL 34 OPER CONTR PROJ MGMT	-19491	0	-19491	42.52	-8288	30	-8334
SUBTOTAL 3 CONSTRUCTION	223075	0	223075	42.52	94851	35	112789
PROJECT TOTAL	-994,053	0	-994,053	32.64	-324,450	32	-1,746,839

Kaiser Engineers Hamford
Westinghouse Hamford Company
JOB NO. ER1269 OPT 2B

KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE
OPTION 2A
KENR03 - ESTIMATE BASIS SHEET

PAGE 3 OF 7
DATE 09/13/91 09:24:04
BY W T SUSIENE

1. DOCUMENTS AND DRAWINGS
=====
- DOCUMENTS: DRAFT, B PLANT PROCESS PIPING REPLACEMENT FEASIBILITY STUDY REPORT BY GARY F. HOWDEN, DATED SEPTEMBER 6, 1991
- DRAWINGS:
2. MATERIAL PRICES
=====
- UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL. VENDOR INFORMATION WAS OBTAINED FOR SELECTED ITEMS AS INDICATED ON THE EQUIPMENT LIST ATTACHED TO ESTIMATE ER1269 OPTION 2A.
3. LABOR RATES
=====
- CURRENT HAMFORD BASE RATES AS ISSUED BY KEH (ISSUE # 14, REV. 0, DATED 4-1-91) INCLUDE FRINGE BENEFITS,
LABOR INSURANCE, TAXES AND TRAVEL WHERE APPLICABLE.
4. GENERAL REQUIREMENTS/TECHNICAL SERVICES
=====
- A.) ONSITE CONSTRUCTION FORCES GENERAL REQUIREMENTS AND TECHNICAL SERVICES COSTS ARE INCLUDED AS A COMPOSITE PERCENTAGE BASED ON THE KEH ESTIMATING FACTOR/BILLING SCHEDULE REVISION 12 DATED APRIL, 01, 1991. THE TOTAL COMPOSITE PERCENTAGE APPLIED TO ONSITE CONSTRUCTION FORCES LABOR FOR THIS PROJECT IS 84% FOR SHOP WORK AND 115% FOR FIELD WORK WHICH IS REFLECTED IN THE "ON&P / B & I" COLUMN OF THE ESTIMATE DETAIL.
5. ESCALATION
=====
- ESCALATION CALCULATED BY THE HAMFORD MATERIAL & LABOR ESCALATION STUDY - FEBRUARY, 1991. RATES SELECTED ARE BASED UPON A MIDPOINT OF ENGINEERING OF JULY, 1997, PROCUREMENT OF JULY, 1998 AND CONSTRUCTION OF JULY, 1999.
6. ROUNDING - LINE ITEMS:
=====
- U.S. DEPARTMENT OF ENERGY - DOE ORDER 5100.4 PAGE J-2 SUBPARAGRAPH (M). REQUIRES ROUNDING OF A COST ESTIMATE TO \$10,000 FOR ITEM COST AND \$100,000 FOR TOTAL COST. REFERENCE: DOE 5100.4, FIGURE 1-11, DATED 10-31-84.
7. REMARKS
=====
- A) ESTIMATE IS FOR OPTION 2B AS DESCRIBED IN WMC FEASIBILITY STUDY. ESTIMATE IS ESSENTIALLY THE SAME AS ESTIMATE ER1269 OPTION 2A, EXCEPT THAT THE EXISTING PIPE IN THE HOT PIPE TRENCH WILL BE COVERED WITH POURED IN PLACE CONCRETE INSTEAD OF THE SHIELDING COVER BLOCKS IN OPTION 2A. SEE FIGURE 4 OF THE WMC FEASIBILITY STUDY. REFERENCE ESTIMATE ER1269 OPTION 2A FOR ALL DETAILS NOT NOTED HEREIN.
- B) ESTIMATE ASSUMES USE OF A REMOTE ELECTRICALLY OPERATED CONCRETE PLACEMENT, VIBRATION, SCREED, FLOAT AND FINISH MACHINE TO RUN ON THE LOWER COVER BLOCK EMBEDDED ANGLES. CONCRETE WILL BE DELIVERED BY PREMIX TRUCKS TO THE RAILROAD TUNNEL AND PUMPED INTO AN OVERSIZED BUCKET THAT WILL BE USED BY THE CANYON CRANE TO DELIVER THE CONCRETE TO THE REMOTE PLACEMENT MACHINE.
- C) THIS ESTIMATE DOES NOT STAND ALONE. IT IS ADDITIVE (DEDUCTIVE) TO ESTIMATE ER1269 OPTION 2A.
- D) ESTIMATE ASSUMES CURRENT SAND AT BOTTOM OF HOT PIPE TRENCH WILL BE WETTED AND MIXED WITH NEW CONCRETE COVER MATERIAL. NO DECONTAMINATION OR CLEAN-UP OF HOT PIPE TRENCH IS INCLUDED IN THIS ESTIMATE.

KAISER ENGINEERS HANFORD
WESTINHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 28

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 28
KERN04 - COST CODE ACCOUNT SUMMARY

PAGE 4 OF 7
DATE 09/13/91 15:06:23
BY W T SUSIENE

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION % TOTAL	SUB TOTAL	CONTINGENCY % TOTAL	TOTAL DOLLARS
000 ENGINEERING								
111210	ENGINEERED EQUIPMENT DEFIN DESIGN	0	0	0	0.00	0	0	0
121210	E/I - ONSITE A-E - PROCUREMENT SUPT	0	0	0	0.00	0	0	0
121220	E/I - ONSITE A-E - ONSITE INSTALL	0	0	0	0.00	0	0	0
TOTAL 000 ENGINEERING		0	0	0	0.00	0	0	0
501 BUILDINGS								
211210	ENGINEERED EQUIPMENT PROCUREMENT	234600	0	234600	34.45	80820	315420	473130
211220	HARDWARE PROCUREMENT	-1685128	0	-1685128	34.45	-580527	-2265655	-3058634
231210	BURY BOX PROCUREMENT - WNC	233400	0	233400	34.45	80406	313806	407948
311240	INSTALL FEEDTHROUGHS	101696	0	101696	42.52	43241	144937	202912
311250	BURIAL FEES AND COSTS	24166	0	24166	42.52	10275	34441	44774
311260	SHIFT DIFFERENTIAL COSTS	40959	0	40959	42.52	17416	58375	78806
331250	INSTALL NPT EQUIPMENT AND JUMPERS	53020	0	53020	42.52	22544	75564	98233
331260	SUPPORT CPAF CONSTRUCTION	22725	0	22725	42.52	9663	32388	42104
341210	OPER CON'R PROJ MGMT	-19491	0	-19491	42.52	-8288	-27779	-36112
TOTAL 501 BUILDINGS		-994053	0	-994053	32.64	-324450	-1318503	-1746839
=====								
PROJECT TOTAL		-994,053	0	-994,053	32.64	-324,450	-1,318,503	-1,746,839

WMC-SD-WM-TA-032
Revision 0

WHC-SD-WM-TA-032
Revision 0

PAGE 5 OF 7
DATE 09/13/91 15:06:25
BY M T SUSIENE

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE
OPTION 2B
KENR05 - ESTIMATE SUMMARY BY CSI DIVISION

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ERT269 OPT 2B

UBS DESCRIPTION	ESTIMATE SUBTOTAL	ON-SITE INDIRECTS	SUB TOTAL	ESCALATION % TOTAL	SUB TOTAL	CORINGENCY % TOTAL	TOTAL DOLLARS
ENGINEERING							
00 TECHNICAL SERVICES	0	0	0	0.00	0	0	0
TOTAL ENGINEERING	0	0	0	0.00	0	0	0
CONSTRUCTION							
01 GENERAL REQUIREMENTS	63684	0	63684	42.52	27079	33	120910
02 SITEWORK	257566	0	257566	35.21	90681	30	652722
03 CONCRETE	-1348632	0	-1348632	33.84	-456466	32	-2382592
15 MECHANICAL	53020	0	53020	42.52	22544	30	98233
19 PROJECT MANAGEMENT	-19491	0	-19491	42.52	-8286	30	-36112
TOTAL CONSTRUCTION	-994053	0	-994053	32.64	-324450	32	-1746839
PROJECT TOTAL	-994,053	0	-994,053	32.64	-324,450	32	-1,746,839

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2B

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2B
KEHR06 - CONTINGENCY ANALYSIS BASIS SHEET

PAGE 6 OF 7
DATE 09/13/91 09:24:19
BY W T SUSIENE

REFERENCE: ESTIMATE BASIS SHEET
COST CODE ACCOUNT SUMMARY

PAGE 3 OF 7
PAGE 4 OF 7

THE U.S. DEPARTMENT OF ENERGY - RICHLAND ORDER 5700.3 "COST ESTIMATING, ANALYSIS AND STANDARDIZATION" DATED 3-27-85, PROVIDES GUIDELINES FOR ESTIMATE CONTINGENCIES. THE GUIDELINE FOR A STUDY ESTIMATE SHOULD HAVE AN OVERALL RANGE OF 20 TO 50% .

CONTINGENCY IS EVALUATED AT THE THIRD COST CODE LEVEL AND SUMMARIZED AT THE PRIMARY AND SECONDARY COST CODE LEVEL OF THE DETAILED COST ESTIMATE.

ENGINEERING

ENGINEERING CONTINGENCY IS ASSIGNED AT 35 PER CENT AS NOTED IN ESTIMATE ER1269 OPT 2A AND APPEARS IN THIS ESTIMATE AS A FUNCTION OF THE ELEMENTS INCLUDED IN THIS OPTION ONLY.

AVERAGE ENGINEERING CONTINGENCY 0%

CONSTRUCTION

CONSTRUCTION CONTINGENCY IS ASSIGNED AT 40 PER CENT AS NOTED IN ESTIMATE ER1269 OPT 2A AND APPEARS IN THIS ESTIMATE AS A FUNCTION OF THE ELEMENTS INCLUDED IN THIS OPTION ONLY.

AVERAGE CONSTRUCTION CONTINGENCY 32%

AVERAGE PROJECT CONTINGENCY 32

E-98

MHC-SD-WM-TA-032
Revision 0

PAGE 7 OF 7 PAGES
DATE 09/13/91 15:06:28
BY W T SUSIEME

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE
OPTION 2B
KERRO7 - ONSITE INDIRECT COSTS BY WBS

KAISER ENGINEERS HANFORD
WESTINHOUSE HANFORD COMPANY
JOB NO. ERT269 OPT 2B

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	CONTRACT ADMINISTRATION %	ADMINISTRATION TOTAL	BID PACK PREP.	OTHER INDIRECTS	TOTAL INDIRECTS
111210	ENGINEERED EQUIPMENT DEFIN DESIGN	0	0.00	0	0	0	0
121210	E/I - ONSITE A-E - PROCUREMENT SUPT	0	0.00	0	0	0	0
211220	E/I - ONSITE A-E - ONSITE INSTALL	0	0.00	0	0	0	0
211210	ENGINEERED EQUIPMENT PROCUREMENT	234600	0.00	0	0	0	0
211220	HARDWARE PROCUREMENT	-1685128	0.00	0	0	0	0
231210	BURY BOX PROCUREMENT - WHC	233400	0.00	0	0	0	0
311240	INSTALL FEEDTHROUGHS	101696	0.00	0	0	0	0
311250	BURIAL FEES AND COSTS	24166	0.00	0	0	0	0
311260	SHIFT DIFFERENTIAL COSTS	40959	0.00	0	0	0	0
331250	INSTALL NPT EQUIPMENT AND JUMPERS	53020	0.00	0	0	0	0
331260	SUPPORT CPAT CONSTRUCTION	22725	0.00	0	0	0	0
341210	OPER CONTR PROJ MGMT	-19491	0.00	0	0	0	0
PROJECT TOTAL		-994,053		0	0	0	0

This page intentionally left blank.

** KAISER ENGINEERS INTERACTIVE ESTIMATING **											
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION											
STUDY ESTIMATE											
KERROB - ESTIMATE DETAIL BY WBS / COST CODE											
PAGE 1											
DATE 09/13/91 15:06:32											
BY W T SUSIENE											
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I DOLLARS	TOTAL
111210	ENGINEERED EQUIPMENT DEFIN DESIGN										
111210.00	TECHNICAL SERVICES	000	0	0	0	0	0	0	0	0	0
111210.0000000		000	0	0	0	0	0	0	0	0	0
111210.0000004	DEFINITIVE DESIGN WOULD NOT CHANGE FOR THIS OPTION. THE ENGINEERING SPENT TO DESIGN THE SHIELDING COVER BLOCKS WITH OPTION 2A WOULD NOW BE REQUIRED TO DESIGN THE REMOTE CONCRETE PLACEMENT MACHINE	000	0	0	0	0	0	0	0	0	0
111210.0000005		000	0	0	0	0	0	0	0	0	0

SUBTOTAL	TECHNICAL SERVICES			0	0	0	0	0	0	0	0

TOTAL	COST CODE 00000			0	0	0	0	0	0	0	0
	WBS 111210			0	0	0	0	0	0	0	0
	(ESCALATION 37.72 % - CONTINGENCY 35.00 %)			0	0	0	0	0	0	0	0

TOTAL WBS 111210	ENGINEERED EQUIPMENT DEFIN DESIGN			0	0	0	0	0	0	0	0

** KAISER ENGINEERS INTERACTIVE ESTIMATING **												
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION												
STUDY ESTIMATE												
KENROB - ESTIMATE DETAIL BY WBS / COST CODE												
PAGE 2												
DATE 09/13/91 15:06:33												
BY W T SUSIENE												
ACCOUNT	DESCRIPTION	COST	QUANTITY	MANHOURS	LABOR	EQUIP	USAGE	MATERIAL	SUB-	EQUIP-	ONSP	TOTAL
NUMBER		CODE							CONTRACT	MENT	/ B & I	DOLLARS
121210	E/I - ONSITE A-E - PROCUREMENT SUPT											
121210.00	TECHNICAL SERVICES	000	0	0	0	0	0	0	0	0	0	0
121210.0000000												
121210.0000004	ENGINEERING AND INSPECTION	000	0	0	0	0	0	0	0	0	0	0
	DURING CONSTRUCTION IS											
	CONSIDERED TO BE ESSENTIALLY											
	THE SAME AS OPTION 2A											
121210.0000005	* NO COST CHANGE	000	0	0	0	0	0	0	0	0	0	0
SUBTOTAL	TECHNICAL SERVICES			0	0	0	0	0	0	0	0	0
TOTAL	COST CODE 00000			0	0	0	0	0	0	0	0	0
	WBS 121210											
	(ESCALATION 45.98 % - CONTINGENCY 35.00 %)											
TOTAL WBS 121210	E/I - ONSITE A-E - PROCUREMENT SUPT			0	0	0	0	0	0	0	0	0

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2B

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2B
KENRDB - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 3
DATE 09/13/91 15:06:34
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
121220	E/I - ONSITE A-E - ONSITE INSTALL										
121220.00	TECHNICAL SERVICES										
121220.0000000	*****	000	0	0	0	0	0	0	0	0	0
121220.0000004	ENGINEERING AND INSPECTION DURING CONSTRUCTION COSTS WOULD BE THE SAME. TIME SPENT ON COVER BLOCKS WILL NOW BE SPENT ON THE REMOTE PLACEMENT MACHINE.	000	0	0	0	0	0	0	0	0	0
121220.0000005		000	0	0	0	0	0	0	0	0	0
SUBTOTAL	TECHNICAL SERVICES			0	0	0	0	0	0	0	0
TOTAL	COST CODE 00000 WBS 121220 (ESCALATION 54.86 % - CONTINGENCY 35.00 %)			0	0	0	0	0	0	0	0
TOTAL WBS 121220	E/I - ONSITE A-E - ONSITE INSTALL			0	0	0	0	0	0	0	0

** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE OPTION 2B KENROB - ESTIMATE DETAIL BY WBS / COST CODE									
Kaiser Engineers Hamford Westinhouse Hamford Company Job No. ERT269 OPT 2B									
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT / B & I DOLLARS
211210	ENGINEERED EQUIPMENT PROCUREMENT								
211210.03	CONCRETE	501	0	0	0	0	0	0	0
211210.0300000	CONCRETE	501	0	0	0	0	0	0	0
211210.0300004	REMOTE ELECTRICALLY OPERATED CONCRETE PLACEMENT MACHINE WITH MOTORIZED TROLLEY TO RIDE EMBEDDED COVER BLOCK ANGLES. MACHINE TO INCLUDE AGITATING, SCREEDING, FLOATING, AND FINISHING CAPABILITIES	501	1 EA	0	0	0	200000	0	0
211210.0300005		501	0	0	0	0	0	0	0
SUBTOTAL									
CONCRETE									
SALES TAX 7.80 %									
WAREHOUSING 9.50 %									
COST CODE 50103									
WBS 211210									
(ESCALATION 34.45 % - CONTINGENCY 50.00 %)									
TOTAL									
TOTAL WBS 211210 ENGINEERED EQUIPMENT PROCUREMENT									
234,600									

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2B

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2B
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 5
DATE 09/13/91 15:06:36
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
211220	HARDWARE PROCUREMENT										
211220.03	CONCRETE										
211220.0300110	HPT SHIELDING BLOCKS 30" THK PRECAST BLOCKS - H1 DENSITY CONCRETE. BLOCKS APPROX 10' X 9' X 30" OVERALL	501	-74 EA	0	0	0	-1480000	0	0	0	-1480000
	SUBTOTAL CONCRETE			0	0	0	-1,480,000	0	0	0	-1,480,000
	SALES TAX 7.10 %						-115440		0		-115440
	WAREHOUSING 6.06 %						-89688				-89688
	TOTAL COST CODE 50103			0	0	0	-1,685,128	0	0	0	-1,685,128
	WBS 211220										
	(ESCALATION 34.45 % - CONTINGENCY 35.00 %)										
	TOTAL WBS 211220 HARDWARE PROCUREMENT			0	0	0	-1,685,128	0	0	0	-1,685,128

WMC-SD-MM-TA-032
Revision 0

** KAISER ENGINEERS INTERACTIVE ESTIMATING **										
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION										
STUDY ESTIMATE										
KEMROB - ESTIMATE DETAIL BY WBS / COST CODE										
PAGE 6										
DATE 09/13/91 15:06:37										
BY W T SUSTENE										
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	SUB- CONTRACT	EQUIP- MENT	ONEP / 8 & 1	TOTAL DOLLARS
231210	BURY BOX PROCUREMENT - WMC									
231210.02	SITEWORK		0	0	0	0	0	0	0	0
231210.0200000	*****	501								
231210.0200004	BURY BOX FOR CONCRETE PLACEMENT MACHINE	501	1 EA	0	0	0	200000	0	0	200000
SUBTOTAL	SITEWORK				0	0		0	0	
	SALES TAX 7.80 %				0	0	200,000	0	0	200,000
	WAREHOUSING 8.90 %						15600	0	0	15600
							17800			17800
TOTAL	COST CODE 50102 WBS 231210 (ESCALATION 34.45 % - CONTINGENCY 30.00 %)				0	0	233,400	0	0	233,400
TOTAL WBS 231210 BURY BOX PROCUREMENT - WMC										
				0	0	0	233,400	0	0	233,400

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2B

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2B
KENROB - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 7
DATE 09/13/91 15:06:38
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	ON&P / B & I	TOTAL DOLLARS
311240	INSTALL FEEDTHROUGHS										
311240.03	CONCRETE										
311240.0300000	*****	501 W	0	0	0	0	0	0	0	0	0
311240.0300004	PUMP CONCRETE FROM PRECAST TRUCK TO BUCKET AT B-PLANT RAILROAD TUNNEL. *****	501 W	560 CY	560	12253	0	47600	19600	0	0	79453
311240.0300010	REQUIRES WMC OPERATOR SUPT (INCLUDED IN WBS 331250)	501 W	0	0	0	0	0	0	0	0	0
311240.0300120	STEP-OFF PAD LABOR SUPPORT	501 W	140 MHR	140	3063	0	0	0	0	0	3063
SUBTOTAL	CONCRETE	(SWP)		700		0		19,600		0	
	SWP 15.00%			105	15,316		47,600		0		82,516
	CONSUMABLES 6.00 %				2297						2297
	SALES TAX 7.80 %						2856				2856
	WAREHOUSING 20.00 %						3936		0		3936
							10091				10091
TOTAL	COST CODE 50103 WBS 311240 (ESCALATION 42.52 % CONTINGENCY 40.00 %)			805		0		19,600		0	
					17,613		64,483		0		101,696
TOTAL WBS 311240	INSTALL FEEDTHROUGHS			805		0		19,600		0	
					17,613		64,483		0		101,696

E-107

MHC-SD-MM-TA-032
Revision 0

** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE KENR08 - ESTIMATE DETAIL BY WBS / COST CODE									
PAGE 8 DATE 09/13/91 15:06:40 BY M T SUSIENE									
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I DOLLARS
311250	BURIAL FEES AND COSTS								
311250.02	SITENWORK								
311250.02000004	REMOVE DISASSEMBLE AND BOX REMOTE CONCRETE PLACEMENT MACHINE +++++	501 M	1 EA	200	4376	0	0	0	5032
311250.02000005	REQUIRES WMC CRANE OPER SUPT (INCLUDED IN WBS 311250)	501 M	0	0	0	0	0	0	0
311250.02000006	STEP-OFF PAD SUPPORT LABOR	501 M	50 MHR	50	1094	0	0	0	1258
311250.02001138	LOAD & HAUL BURIAL BOXES TO BURIAL	501 M	1 EA	6	150	0	0	0	173
	SUBTOTAL								
	SITENWORK								
	SWP 100.00%			256	5,620	0	0	0	6,463
	OH&P (ON MARKUPS ONLY)			256	5,620				6,463
	TOTAL								
	COST CODE 50102			512	11,240	0	0	0	12,926
	WBS 311250								
	(ESCALATION 42.52 % - CONTINGENCY 30.00 %)								24,166
	TOTAL WBS 311250 BURIAL FEES AND COSTS			512	11,240	0	0	0	12,926
									24,166

** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE OPTION 2B KENROB - ESTIMATE DETAIL BY WBS / COST CODE									
Kaiser Engineers Hanford Westinhouse Hanford Company JOB NO. ERT269 OPT 2B									
PAGE 9 DATE 09/13/91 15:06:41 BY W T SUSIENE									
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	SUB- CONTRACT	EQUIP- MENT	TOTAL DOLLARS
311260	SHIFT DIFFERENTIAL COSTS								
311260.01	GENERAL REQUIREMENTS	501	0	0	0	0	0	0	0
311260.0100000									
311260.0100004	MANHOUR RATE DIFFERENTIAL 439 MHR X .0625 = 27 439 MHR X .125 = 55 27 + 55 = 82 MHR	501	82 MHR	82	2239	0	0	0	2239
SUBTOTAL	GENERAL REQUIREMENTS			82	2,239	0	0	0	2,239
TOTAL	COST CODE 50101 WBS 311260 (ESCALATION 42.52 % - CONTINGENCY 35.00 %)			82	2,239	0	0	0	2,239
311260.01	GENERAL REQUIREMENTS								
311260.0100006	INCREASED FIELD OVERHEAD TO SUPPORT MULTIPLE SHIFT OPERATION	501	1 LS	704	38720	0	0	0	38720
SUBTOTAL	GENERAL REQUIREMENTS			704	38,720	0	0	0	38,720
TOTAL	COST CODE 50101 WBS 311260 (ESCALATION 42.52 % - CONTINGENCY 35.00 %)			704	38,720	0	0	0	38,720
TOTAL WBS 311260	SHIFT DIFFERENTIAL COSTS			786	40,959	0	0	0	40,959

KAISER ENGINEERS HANFORD
WESTINHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 28

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 28
KENROB - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 10
DATE 09/13/91 15:06:42
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
331250	INSTALL HPT EQUIPMENT AND JUMPERS										
331250.15	MECHANICAL										
331250.1500000	***** INSTALL HOT PIPE TRENCH CONCRETE & MACHINE *****	501	0	0	0	0	0	0	0	0	0
331250.1500004	CRANE OPERATOR (1)	501	300 MHR	300	14100	0	0	0	0	0	14100
331250.1500006	EMM OPERATOR (2)	501	560 MHR	560	26320	0	0	0	0	0	26320
331250.1500008	RPT (1)	501	280 MHR	280	12600	0	0	0	0	0	12600
SUBTOTAL	MECHANICAL			1,140		0	0	0	0	0	
					53,020		0		0		53,020
TOTAL	COST CODE 50115 WBS 331250 (ESCALATION 42.52 % - CONTINGENCY 30.00 %)			1,140		0	0	0	0	0	
					53,020		0		0		53,020
TOTAL WBS 331250	INSTALL HPT EQUIPMENT AND JUMPERS			1,140		0	0	0	0	0	
					53,020		0		0		53,020

E-110

WHC-SD-WH-TA-032
Revision 0

** KAISER ENGINEERS HANFORD WESTINHOUSE HANFORD COMPANY JOB NO. ER1269 OPT 2B												PAGE 11 DATE 09/13/91 15:06:43 BY W T SUSIENE			
** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE KERROB - ESTIMATE DETAIL BY UBS / COST CODE															
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS				
331260	SUPPORT CPAF CONSTRUCTION														
331260.01	GENERAL REQUIREMENTS	501	0	0	0	0	0	0	0	0	0				
331260.010000	SUPPORT CPAF CONSTRUCTION														
331260.0100004	PROVIDE CRANE & EMH OPERATOR	501	0 MHR	0	0	0	0	0	0	0	0				
331260.0100006	SUPPORT LABOR TO ASSIST CPAF CONSTRUCTION OPERATIONS - COVERED UNDER UBS 331260	501	329 MHR	329	14805	0	0	0	0	0	14805				
331260.0100008	RPT SUPPORT FOR CPAF ZONE WORK OPERATIONS ENGR AND SUPV (4 MHR PER SHIFT)	501	176 MHR	176	7920	0	0	0	0	0	7920				
SUBTOTAL	GENERAL REQUIREMENTS			505	22,725	0	0	0	0	0	22,725				
TOTAL	COST CODE 50101 UBS 331260 (ESCALATION 42.52 % - CONTINGENCY 30.00 %)			505	22,725	0	0	0	0	0	22,725				
TOTAL UBS 331260 SUPPORT CPAF CONSTRUCTION												0	0	0	22,725

KAISER ENGINEERS HANFORD WESTINGHOUSE HANFORD COMPANY JOB NO. ERT269 OPT 2B		** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE RENEDIATION PROGRAM REDEFINITION STUDY ESTIMATE KENR08 - ESTIMATE DETAIL BY WBS / COST CODE		PAGE 12 DATE 09/13/91 15:06:44 BY W T SUSIENE							
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	OREP / B & I	TOTAL DOLLARS
341210	OPER CONTR PROJ MGMT										
341210.19	PROJECT MANAGEMENT	501	-1 LS	0	0	0	0	-19491	0	0	-19491
341210.1900000	WHC PROJECT MANAGEMENT ESTIMATED AT 2 PER CENT OF PROJECT COST										
SUBTOTAL PROJECT MANAGEMENT											
TOTAL COST CODE 50119											
WBS 341210											
(ESCALATION 42.52 % - CONTINGENCY 30.00 %)											
TOTAL WBS 341210 OPER CONTR PROJ MGMT											
0 0 0 0 0 -19,491 0 0 -19,491											

KAISER ENGINEERS HANFORD		PAGE 13	
WESTINGHOUSE HANFORD COMPANY		DATE 09/13/91 15:06:45	
JOB NO. ERT269 OP1 2B		BY M T SUSTENE	

** KAISER ENGINEERS INTERACTIVE ESTIMATING **			
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION			
STUDY ESTIMATE			
KENROB - ESTIMATE DETAIL BY UBS / COST CODE			

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	HANNOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OHIP / B & I	TOTAL DOLLARS
				3,748	145,557	0	-1,152,645	109	0	12,926	-994,053
REPORT TOTAL											

This page intentionally left blank.

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2C
PAGE 1 OF 7
DATE 09/14/91 08:11:18
BY W T SUSTENE

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE
OPTION 2C
KENR01 - PROJECT COST SUMMARY

COST CODE	DESCRIPTION	ESCALATED TOTAL COST	CONTINGENCY %	TOTAL DOLLARS
000	ENGINEERING	0	0	0
501	BUILDINGS	21,340,000	29	27,510,000
	(ADJUSTED TO MEET DOE \$100.4)	-40,000	30,000	-10,000
	OPTION 2C TOTAL	21,300,000	29	27,500,000
	TOTAL COST OF OPTION 2A	100,700,000	40	135,900,000
	PROJECT TOTAL	122,000,000	41,400,000	163,400,000

TYPE OF ESTIMATE	STUDY	SEPTEMBER 14, 1991	REMARKS: ESTIMATE IS AN ALTERNATE ESTIMATE ESTIMATE DOES NOT STAND ALONE. REFERENCE THE FOLLOWING ESTIMATES:
ARCHITECT	<i>[Signature]</i>		ER1269 OPT 1
ENGINEER	<i>[Signature]</i>		ER1269 OPT 2A
OPERATING CONTRACTOR			ER1269 OPT 2B
(ROUNDED/ADJUSTED TO THE NEAREST " 10,000 / 100,000 " - PERCENTAGES NOT RECALCULATED TO REFLECT ROUNDING)			

KAISER ENGINEERS HAMFORD
WESTINHOUSE HAMFORD COMPANY
JOB NO. ER1269 OPT 2C

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2C
KEHR02 - WORK BREAKDOWN STRUCTURE SUMMARY

PAGE 2 OF 7
DATE 09/14/91 08:11:20
BY W T SUSIENE

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION % TOTAL	SUB TOTAL	CONTINGENCY % TOTAL	TOTAL DOLLARS		
111210	ENGINEERED EQUIPMENT DEFIN DESIGN	-1920	0	-1920	37.71	-724	-2644	35	-925	-3570
	SUBTOTAL 11 DEFINITIVE DESIGN	-1920	0	-1920	37.71	-724	-2644	35	-925	-3570
121210	E/I - ONSITE A-E - PROCUREMENT SUPT	0	0	0	0.00	0	0	0	0	0
121220	E/I - ONSITE A-E - ONSITE INSTALL	0	0	0	0.00	0	0	0	0	0
	SUBTOTAL 12 E/I DURING CONSTRUCTION	0	0	0	0.00	0	0	0	0	0
	SUBTOTAL 1 ENGINEERING	-1920	0	-1920	37.71	-724	-2644	35	-925	-3570
211220	HARDWARE PROCUREMENT	-3370256	0	-3370256	34.45	-1161053	-4531309	35	-1585958	-6117267
	SUBTOTAL 21 ONSITE CONTR PROCUREMENT	-3370256	0	-3370256	34.45	-1161053	-4531309	35	-1585958	-6117267
	SUBTOTAL 2 PROCUREMENT	-3370256	0	-3370256	34.45	-1161053	-4531309	35	-1585958	-6117267
311250	BURIAL FEES AND COSTS	-1189064	0	-1189064	42.52	-505590	-1694654	30	-508396	-2203050
311260	SHIFT DIFFERENTIAL COSTS	-80189	0	-80189	42.52	-34096	-114285	35	-40000	-154285
	SUBTOTAL 31 ONSITE CONSTR CONTR	-1269253	0	-1269253	42.52	-539686	-1808939	30	-548396	-2357335
331220	HOT PIPE TRENCH DECONTAMINATION	14901300	0	14901300	42.52	6336033	21237333	30	6371200	27608533
331230	HOT PIPE TRENCH DEMOLITION	4304425	0	4304425	42.52	1830242	6134667	30	1840400	7975066
331260	SUPPORT CPAF CONSTRUCTION	-72933	0	-72933	42.52	-31011	-103944	30	-31183	-135127
	SUBTOTAL 33 OPER CONTR CONSTRUCTION	19132792	0	19132792	42.52	8135264	27268056	30	8180417	35448472
341210	OPER CONTR PROJ MGMT	289828	0	289828	42.52	123235	413063	30	123919	536982
	SUBTOTAL 34 OPER CONTR PROJ MGMT	289828	0	289828	42.52	123235	413063	30	123919	536982
	SUBTOTAL 3 CONSTRUCTION	18153367	0	18153367	42.52	7718813	25872180	30	7755940	33628119
=====										
PROJECT TOTAL		14,781,191	0	14,781,191	44.36	6,557,036	21,338,227	29	6,169,057	27,507,282

E-116

WMC-SD-WM-TA-032
Revision 0

KAISER ENGINEERS HANFORD
WESTHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2C

KAISER ENGINEERS INTERACTIVE ESTIMATING
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE
KENR03 - ESTIMATE BASIS SHEET

PAGE 3 OF 7
DATE 09/14/91 08:11:18
BY V T SUSIENE

1. DOCUMENTS AND DRAWINGS
=====
- DOCUMENTS: DRAFT, B PLANT PROCESS PIPING REPLACEMENT FEASIBILITY STUDY REPORT BY GARY F. HOWDEN, DATED SEPTEMBER 6, 1991
- DRAWINGS:
2. MATERIAL PRICES
=====
- UNIT COSTS REPRESENT CURRENT PRICES FOR SPECIFIED MATERIAL. VENDOR INFORMATION WAS OBTAINED FOR SELECTED ITEMS AS INDICATED ON THE EQUIPMENT LIST ATTACHED TO ESTIMATE ER1269 OPTION 2A.
3. LABOR RATES
=====
- CURRENT HANFORD BASE RATES AS ISSUED BY KEN (ISSUE # 14, REV. 0, DATED 4-1-91) INCLUDE FRINGE BENEFITS,
LABOR INSURANCE, TAXES AND TRAVEL WHERE APPLICABLE.
4. GENERAL REQUIREMENTS/TECHNICAL SERVICES
=====
- A.) ONSITE CONSTRUCTION FORCES GENERAL REQUIREMENTS AND TECHNICAL SERVICES COSTS ARE INCLUDED AS A COMPOSITE PERCENTAGE BASED ON THE KEN ESTIMATING FACTOR/BILLING SCHEDULE REVISION 12 DATED APRIL, 01, 1991. THE TOTAL COMPOSITE PERCENTAGE APPLIED TO ONSITE CONSTRUCTION FORCES LABOR FOR THIS PROJECT IS 84% FOR SHOP WORK AND 115% FOR FIELD WORK WHICH IS REFLECTED IN THE "OH&P / B & I" COLUMN OF THE ESTIMATE DETAIL.
5. ESCALATION
=====
- ESCALATION CALCULATED BY THE HANFORD MATERIAL & LABOR ESCALATION STUDY - FEBRUARY, 1991. RATES SELECTED ARE BASED UPON A MIDPOINT OF ENGINEERING OF JULY, 1997, PROCUREMENT OF JULY, 1998 AND CONSTRUCTION OF JULY, 1999.
6. ROUNDING - LINE ITEMS:
=====
- U.S. DEPARTMENT OF ENERGY - DOE ORDER 5100.4 PAGE J-2 SUBPARAGRAPH (M). REQUIRES ROUNDING OF A COST ESTIMATE TO \$10,000 FOR ITEM COST AND \$100,000 FOR TOTAL COST. REFERENCE: DOE 5100.4, FIGURE 1-11, DATED 10-31-84.
7. REMARKS
=====
- A) ESTIMATE IS FOR OPTION 2C AS DESCRIBED IN WHC FEASIBILITY STUDY. ESTIMATE IS ESSENTIAL THE SAME AS ESTIMATE ER1269 OPTION 2A EXCEPT THAT INSTEAD OF BLOCKING OFF EXISTING PIPING IN THE HOT PIPE TRENCH WITH NEW SHIELDING BLOCKS, THE EXISTING PIPING IN THE HOT PIPE TRENCH IS TO BE TOTALLY REMOVED. THIS OPTION WOULD NOT REPLACE EXISTING TRENCH COVER BLOCKS AND WOULD INCLUDE DECONTAMINATION OF EXISTING HOT PIPE TRENCH. REFERENCE WHC FEASIBILITY STUDY REPORT FIGURE 5.
- B) THIS ESTIMATE DOES NOT STAND ALONE. IT IS ADDITIVE (DEDUCTIVE) TO ESTIMATE ER1269 OPTION 2A.

PAGE 4 OF 7
DATE 09/14/93 08:11:24
BY M T SUSTENE

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2C
KENR004 - COST CODE ACCOUNT SUMMARY

KAISER ENGINEERS HANFORD
WESTINHOUSE HANFORD COMPANY
JOB NO. ERT269 OPT 2C

WBS DESCRIPTION	ESTIMATE SUBTOTAL	ONSITE INDIRECTS	SUB TOTAL	ESCALATION % TOTAL	SUB TOTAL	CONTINGENCY % TOTAL	TOTAL DOLLARS
000 ENGINEERING							
111210 ENGINEERED EQUIPMENT DEFIN DESIGN	-1920	0	-1920	37.71	-724	35	-925
121210 E/I - ONSITE A-E - PROCUREMENT SUPT	0	0	0	0.00	0	0	0
121220 E/I - ONSITE A-E - ONSITE INSTALL	0	0	0	0.00	0	0	0
TOTAL 000 ENGINEERING	-1920	0	-1920	37.71	-724	35	-925
501 BUILDINGS							
211220 HARDWARE PROCUREMENT	-3370256	0	-3370256	34.45	-1161053	35	-1585958
311250 BURIAL FEES AND COSTS	-1189064	0	-1189064	42.52	-505590	30	-508396
311260 SHIFT DIFFERENTIAL COSTS	-80189	0	-80189	42.52	-34096	35	-40000
331220 HOT PIPE TRENCH DECONTAMINATION	14901300	0	14901300	42.52	6336033	30	6371200
331230 HOT PIPE TRENCH DEMOLITION	4304425	0	4304425	42.52	1830242	30	1840400
331260 SUPPORT CPAF CONSTRUCTION	-72933	0	-72933	42.52	-31011	30	-31183
341210 OPER CONTR PROJ MGMT	289828	0	289828	42.52	123235	30	123919
TOTAL 501 BUILDINGS	1478311	0	1478311	44.36	6557760	29	6169982
PROJECT TOTAL	14,781,191	0	14,781,191	44.36	6,557,036	29	6,169,057
							27,507,282

PAGE 5 OF 7
DATE 09/14/91 08:11:27
BY W T SUSIENE

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE
OPTION 2C
KENROS - ESTIMATE SUMMARY BY CSI DIVISION

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ERT269 OPT 2C

WBS DESCRIPTION	ESTIMATE SUBTOTAL	ON-SITE INDIRECTS	SUB TOTAL	ESCALATION % TOTAL	SUB TOTAL	CONTINGENCY % TOTAL	TOTAL DOLLARS
ENGINEERING							
00 TECHNICAL SERVICES	-1920	0	-1920	37.71	-724	35	-3570
TOTAL ENGINEERING	-1920	0	-1920	37.71	-724	35	-3570
CONSTRUCTION							
01 GENERAL REQUIREMENTS	-153122	0	-153122	42.52	-65107	33	-289412
02 SITEWORK	18016661	0	18016661	42.52	7660685	30	3380549
03 CONCRETE	-3370256	0	-3370256	34.45	-1161053	35	-6117267
19 PROJECT MANAGEMENT	209828	0	209828	42.52	123235	30	536982
TOTAL CONSTRUCTION	14783111	0	14783111	44.36	6557760	29	27510852
PROJECT TOTAL	14,781,191	0	14,781,191	44.36	6,557,036	29	27,507,282

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2C

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2C
KENR06 - CONTINGENCY ANALYSIS BASIS SHEET

PAGE 6 OF 7
DATE 09/14/91 08:11:10
BY W T SUSIENE

REFERENCE: ESTIMATE BASIS SHEET
COST CODE ACCOUNT SUMMARY

PAGE 3 OF 7
PAGE 4 OF 7

THE U.S. DEPARTMENT OF ENERGY - RICHLAND ORDER 5700.3 "COST ESTIMATING, ANALYSIS AND STANDARDIZATION"
DATED 3-27-85, PROVIDES GUIDELINES FOR ESTIMATE CONTINGENCIES. THE GUIDELINE FOR A STUDY ESTIMATE
SHOULD HAVE AN OVERALL RANGE OF 20 TO 50%.

CONTINGENCY IS EVALUATED AT THE THIRD COST CODE LEVEL AND SUMMARIZED AT THE PRIMARY AND SECONDARY COST CODE
LEVEL OF THE DETAILED COST ESTIMATE.

ENGINEERING

ENGINEERING CONTINGENCY IS ASSIGNED AT 35 PER CENT AS NOTED IN ESTIMATE ER1269 OPT 2A AND APPEARS IN THIS
ESTIMATE AS A FUNCTION OF THE ELEMENTS INCLUDED IN THIS OPTION ONLY.

AVERAGE ENGINEERING CONTINGENCY 35%

CONSTRUCTION

AVERAGE CONSTRUCTION CONTINGENCY 29%

CONSTRUCTION CONTINGENCY IS ASSIGNED AT 40 PER CENT AS NOTED IN ESTIMATE ER1269 OPT 2A AND APPEARS IN THIS
ESTIMATE AS A FUNCTION OF THE ELEMENTS INCLUDED IN THIS OPTION ONLY.

AVERAGE PROJECT CONTINGENCY 29%

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2C

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2C
KEHR07 - ONSITE INDIRECT COSTS BY WBS

PAGE 7 OF 7
DATE 09/14/91 08:11:29
BY W T SUSIENE

WBS	DESCRIPTION	ESTIMATE SUBTOTAL	CONTRACT ADMINISTRATION % TOTAL	BID PACK PREP.	OTHER INDIRECTS	TOTAL INDIRECTS
=====	=====	=====	=====	=====	=====	=====
111210	ENGINEERED EQUIPMENT DEFIN DESIGN	-1920	0.00	0	0	0
121210	E/I - ONSITE A-E - PROCUREMENT SUPT	0	0.00	0	0	0
121220	E/I - ONSITE A-E - ONSITE INSTALL	0	0.00	0	0	0
211220	HARDWARE PROCUREMENT	-3370256	0.00	0	0	0
311250	BURIAL FEES AND COSTS	-1189064	0.00	0	0	0
311260	SHIFT DIFFERENTIAL COSTS	-80189	0.00	0	0	0
331220	HOT PIPE TRENCH DECONTAMINATION	14901300	0.00	0	0	0
331230	HOT PIPE TRENCH DEMOLITION	4304425	0.00	0	0	0
331260	SUPPORT CPAF CONSTRUCTION	-72933	0.00	0	0	0
341210	OPER CONTR PROJ MGMT	289828	0.00	0	0	0

PROJECT TOTAL

14,781,191

0

0

0

0

E-121

MHC-SD-MM-TA-032
Revision 0

This page intentionally left blank.

KAISER ENGINEERS HANFORD
WESTINHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2C

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2C
KEHRO8 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 1
DATE 09/14/91 08:11:34
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
111210	ENGINEERED EQUIPMENT DEFIN DESIGN										
111210.00	TECHNICAL SERVICES										
111210.0000000	*****	000	0	0	0	0	0	0	0	0	0
111210.0000004	REVISE ENGINEERING TO ELIMINATE HOT PIPE TRENCH PIT COVER AND SHIELDING BLOCKS	000	-1 LS	-32	-1920	0	0	0	0	0	-1920
SUBTOTAL	TECHNICAL SERVICES			-32	-1,920	0	0	0	0	0	-1,920
TOTAL	COST CODE 00000 WBS 111210 (ESCALATION 37.72 % - CONTINGENCY 35.00 %)			-32	-1,920	0	0	0	0	0	-1,920
TOTAL WBS 111210	ENGINEERED EQUIPMENT DEFIN DESIGN			-32	-1,920	0	0	0	0	0	-1,920

E-123

MHC-SD-MM-TA-032
Revision 0

** KAISER ENGINEERS INTERACTIVE ESTIMATING **												
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION												
STUDY ESTIMATE OPTION 2C												
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE												
PAGE 2												
DATE 09/14/91 08:11:35												
BY W T SUSIENE												
ACCOUNT	DESCRIPTION	COST	QUANTITY	MANHOURS	LABOR	EQUIP	USAGE	MATERIAL	SUB-	EQUIP-	ON&P	TOTAL
NUMBER		CODE							CONTRACT	MENT	/ B & I	DOLLARS
121210	E/I - ONSITE A-E - PROCUREMENT SUPT											
121210.00	TECHNICAL SERVICES	000	0	0	0	0	0	0	0	0	0	0
121210.0000000												
121210.00000004	ENGINEERING AND INSPECTION	000	0	0	0	0	0	0	0	0	0	0
	DURING CONSTRUCTION -											
	ANY CHANGE IN THIS COST IS											
	NEGLECTIBLE - NO COST CHANGE											
SUBTOTAL	TECHNICAL SERVICES			0		0		0	0		0	
TOTAL	COST CODE 00000											
	WBS 121210			0		0		0	0		0	
	(ESCALATION 45.98 % - CONTINGENCY 35.00 %)											
TOTAL WBS 121210	E/I - ONSITE A-E - PROCUREMENT SUPT			0		0		0	0		0	

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2C

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2C
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 3
DATE 09/14/91 08:11:36
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
121220	E/I - ONSITE A-E - ONSITE INSTALL										
121220.00	TECHNICAL SERVICES										
121220.0000000	*****	000	0	0	0	0	0	0	0	0	0
121220.0000004	ENGINEERING AND INSPECTION DURING CONSTRUCTION - ANY CHANGE IN COST IS NEGLECTIBLE & NO COST CHANGE	000	0	0	0	0	0	0	0	0	0
SUBTOTAL	TECHNICAL SERVICES			0	0	0	0	0	0	0	0
TOTAL	COST CODE 00000 WBS 121220 (ESCALATION 54.86 % - CONTINGENCY 35.00 %)			0	0	0	0	0	0	0	0
TOTAL WBS 121220	E/I - ONSITE A-E - ONSITE INSTALL			0	0	0	0	0	0	0	0

E-125

WMC-SD-WM-TA-032
Revision 0

Kaiser Engineers Hanford Westimhouse Hanford Company Job No. ER1269 OPT 2C									
** Kaiser Engineers Interactive Estimating ** Defense Waste Remediation Program Redefinition Study Estimate Kenros - Estimate Detail by WBS / Cost Code									
ACCOUNT NUMBER DESCRIPTION COST CODE QUANTITY MANHOURS LABOR EQUIP USAGE MATERIAL SUB- CONTRACT EQUIP- MENT CH&P / B & I TOTAL DOLLARS									
211220		HARDWARE PROCUREMENT							
211220.03		CONCRETE							
211220.0300000	501		0	0	0	0	0	0	0
211220.0300106	501	HPT COVER BLOCKS - PRECAST 2' THICK W/ HI-DENSITY CONCRETE. BLOCKS APPROX 10' X 11' X 24" OVERALL	-74 EA	0	0	0	0	0	-1480000
211220.0300110	501	HPT SHIELDING BLOCKS 30" THK PRECAST BLOCKS - HI DENSITY CONCRETE. BLOCKS APPROX 10' X 9' X 30" OVERALL	-74 EA	0	0	0	0	0	-1480000
SUBTOTAL CONCRETE									
SALES TAX 7.80 %									
WAREHOUSING 6.06 %									
COST CODE 50103									
WBS 211220									
(ESCALATION 34.45 % - CONTINGENCY 35.00 %)									
TOTAL									
TOTAL WBS 211220 HARDWARE PROCUREMENT									

KAISER ENGINEERS HANFORD
WESTINGHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2C

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2C
KENROB - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 5
DATE 09/14/91 08:11:38
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
311250	BURIAL FEES AND COSTS										
311250.02	SITWORK										
311250.0200000	***** TRANSFER, WRAP AND HAUL COVER BLOCKS TO BURIAL *****	501 M	0	0	0	0	0	0	0	0	0
311250.0200001	.	501 M	0	0	0	0	0	0	0	0	0
311250.0200006	WRAP TRENCH COVER BLOCKS FOR BURIAL 1200SF OF COVER/1100 LF TAPE EACH COVER W/PADDING/DUNNAGE	501 M	-74 EA	-888	-19429	0	-12950	0	0	-22343	-54722
311250.0200007	***** REQUIRES WMC CRANE OPR SUPT .	501 M	0	0	0	0	0	0	0	0	0
311250.0200009	LOAD AND HAUL TRENCH COVER BLOCKS TO HOT BURIAL	501 M	-74 EA	-296	-8140	0	0	0	0	-9361	-17501
311250.0200138	LOAD & HAUL BURIAL BOXES TO BURIAL SITE (WMC DEMOLITION)	501 M	4 EA	24	600	0	0	0	0	690	1290
311250.0200148	STEP-OFF PAD LABOR SUPPORT	501 M	-290 MHR	-290	-6345	0	0	0	0	-7297	-13642
311250.0200200	***** HOT WASTE BURIAL CHARGES *****	501 M	0	0	0	0	0	0	0	0	0
311250.0200211	BURIAL CHARGE FOR TRENCH CVR BLOCKS	501 M	-14985 CF	0	0	0	0	-1028271	0	0	-1028271
311250.0200220	BURIAL CHARGE FOR WMC HOT PIPE DEMOLITION - COVERED UNDER WBS 331230	501 M	0	0	0	0	0	0	0	0	0
SUBTOTAL	SITWORK	(MASK)		-1,450		0	-12,950			-38,311	
	SWP 100.00%			-1450	-33,314				0		-1,112,846
	CONSUMABLES 6.00 %				-33314						-33314
	SALES TAX 7.80 %						-777				-777
	WAREHOUSING 20.00 %						-1071		0		-1071
	OH&P (ON MARKUPS ONLY)						-2745				-2745
										-38311	-38311
TOTAL	COST CODE 50102 WBS 311250			-2,900		0	-17,543	-1,028,271	0	-76,622	-1,189,064

WMC-SD-MH-TA-032
Revision 0

(ESCALATION 42.52 % - CONTINGENCY 30.00 %)

[illegible]

WHC-SD-WM-TA-032
Revision 0

** KAISER ENGINEERS INTERACTIVE ESTIMATING **										
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION										
STUDY ESTIMATE										
KEROB - ESTIMATE DETAIL BY WBS / COST CODE										
PAGE 8										
DATE 09/14/91 08:11:41										
BY W T SUSIENE										
ACCOUNT	DESCRIPTION	COST	QUANTITY	MANHOURS	LABOR	EQUIP	SUB-	EQUIP-	OH&P	TOTAL
NUMBER		CODE				USAGE	CONTRACT	MENT	/ B & I	DOLLARS
331220	HOT PIPE TRENCH DECONTAMINATION									
331220.02	SITWORK	501	0	0	0	0	0	0	0	0
331220.0200000	HOT PIPE TRENCH PIPE DECONTAMINATION									
331220.0200104	CRANE OPERATOR (1) 3-MONTHS PER SECTION X 18 SECTIONS	501	27000 MHR	27000	1269000	0	0	0	0	1269000
331220.0200106	CHEN OPERATOR (5) 3-MONTHS PER SECTION X 18 SECTIONS	501	135000 MHR	135000	6345000	0	0	0	0	6345000
331220.0200108	MAINTENANCE (2.5) 3-MONTHS PER SECTION FOR 18 SECTIONS	501	67500 MHR	67500	3172500	0	0	0	0	3172500
331220.0200110	RPT (1) 3-MONTHS PER SECTION FOR 18 SECTIONS	501	28080 MHR	28080	1263600	0	0	0	0	1263600
331220.0200112	ENGINEER (2) 3-MONTHS PER SECTION FOR 18 SECTIONS	501	54000 MHR	54000	2430000	0	0	0	0	2430000
331220.0200114	PIPEFITTER (1) 1-MONTH PER SECTION FOR 18 SECTIONS	501	9360 MHR	9360	421200	0	0	0	0	421200
SUBTOTAL	SITWORK			320,940		0	0	0	0	14,901,300
TOTAL	COST CODE 50102 WBS 331220 (ESCALATION 42.52 % - CONTINGENCY 30.00 %)			320,940	14,901,300	0	0	0	0	14,901,300
TOTAL WBS 331220	HOT PIPE TRENCH DECONTAMINATION			320,940	14,901,300	0	0	0	0	14,901,300

** KAISER ENGINEERS INTERACTIVE ESTIMATING **											
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION											
STUDY ESTIMATE											
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE											
PAGE 9											
DATE 09/14/91 08:11:42											
BY W T SUSIENE											
ACCOUNT	DESCRIPTION	COST	QUANTITY	MANHOURS	LABOR	EQUIP	MATERIAL	SUB-	EQUIP-	OH&P	TOTAL
NUMBER		CODE				USAGE		CONTRACT	MENT	/ B & I	DOLLARS
331230	HOT PIPE TRENCH DEMOLITION										
331230.02	SITWORK										
331230.0200000	HOT PIPE TRENCH PIPE	501	0	0	0	0	0	0	0	0	0
	DEMOLITION										
331230.0200004	CRANE OPERATOR (1)	501	500 MHR	500	23500	0	0	0	0	0	23500
331230.0200006	CHEN OPERATOR (2)	501	1000 MHR	1000	47000	0	0	0	0	0	47000
331230.0200008	RPT (1)	501	500 MHR	500	22500	0	0	0	0	0	22500
331230.0200010	ENGINEER (1)	501	500 MHR	500	22500	0	0	0	0	0	22500
331230.0200012	SOLID WASTE DISPOSAL	501	1 LS	0	0	0	0	4220000	0	0	4220000
331230.0200014	EQUIPMENT	501	1 LS	0	0	50000	0	0	0	0	50000
331230.0200100	HOT PIPE TRENCH PIPE	501	0	0	0	0	0	0	0	0	0
	JUMPER REMOVAL										
331230.0200104	CRANE OPERATOR (1)	501	-75 MHR	-75	-3525	0	0	0	0	0	-3525
331230.0200108	RPT (1)	501	-75 MHR	-75	-3375	0	0	0	0	0	-3375
331230.0200110	ENGINEER (1)	501	-75 MHR	-75	-3375	0	0	0	0	0	-3375
331230.0200112	SOLID WASTE DISPOSAL	501	-1 LS	0	0	0	0	-63300	0	0	-63300
331230.0200114	EQUIPMENT	501	-1 LS	0	0	-7500	0	0	0	0	-7500
SUBTOTAL	SITWORK			2,275	105,225	42,500	0	4,156,700	0	0	4,304,425
TOTAL	COST CODE 50102			2,275	105,225	42,500	0	4,156,700	0	0	4,304,425
	WBS 331230			2,275	105,225	42,500	0	4,156,700	0	0	4,304,425
	(ESCALATION 42.52 % - CONTINGENCY 30.00 %)										
TOTAL WBS 331230	HOT PIPE TRENCH DEMOLITION			2,275	105,225	42,500	0	4,156,700	0	0	4,304,425

WMC-SD-WM-TA-032
Revision 0

** KAISER ENGINEERS INTERACTIVE ESTIMATING **											
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION											
STUDY ESTIMATE											
KENR08 - ESTIMATE DETAIL BY WBS / COST CODE											
PAGE 10											
DATE 09/14/91 08:11:44											
BY W T SUSIEME											
ACCOUNT	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB-CONTRACT	EQUIP-MENT	ONHP / 8 & 1	TOTAL DOLLARS
331260	SUPPORT CPAF CONSTRUCTION										
331260.01	GENERAL REQUIREMENTS	501	0	0	0	0	0	0	0	0	0
331260.0100000	SUPPORT CPAF CONSTRUCTION										
331260.0100004	PROVIDE CRANE AND EMH OPERATOR SUPPORT LABOR TO ASSIST CPAF CONSTRUCTION	501	-444 MHR	-444	-20868	0	0	0	0	0	-20868
331260.0100006	OPERATIONS: RPT SUPPORT FOR CPAF ZONE WORK	501	-725 MHR	-725	-32625	0	0	0	0	0	-32625
331260.0100008	OPERATIONS ENGR AND SUPV (4 MRS PER SHIFT)	501	-432 MHR	-432	-19440	0	0	0	0	0	-19440
SUBTOTAL GENERAL REQUIREMENTS											
-1,601											
-72,933											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											

KAISER ENGINEERS HANFORD
WESTINHOUSE HANFORD COMPANY
JOB NO. ER1269 OPT 2C

** KAISER ENGINEERS INTERACTIVE ESTIMATING **
DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION
STUDY ESTIMATE OPTION 2C
KEHRO8 - ESTIMATE DETAIL BY WBS / COST CODE

PAGE 11
DATE 09/14/91 08:11:45
BY W T SUSIENE

ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	MATERIAL	SUB- CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
341210	OPER CONTR PROJ MGMT										
341210.19	PROJECT MANAGEMENT										
341210.1900000	WMC PROJECT MANAGEMENT ESTIMATED AT 2 PER CENT OF PROJECT COST	501	1 LS	0	0	0	0	289828	0	0	289828
SUBTOTAL	PROJECT MANAGEMENT			0	0	0	0	289,828	0	0	289,828
TOTAL	COST CODE 50119 WBS 341210 (ESCALATION 42.52 % - CONTINGENCY 30.00 %)			0	0	0	0	289,828	0	0	289,828
TOTAL WBS 341210	OPER CONTR PROJ MGMT			0	0	0	0	289,828	0	0	289,828

E-133

WMC-SD-WM-TA-032
Revision 0

WHC-SD-WM-TA-032
Revision 0

KAISER ENGINEERS HANFORD WESTINGHOUSE HANFORD COMPANY JOB NO. ER1269 OPT 2C		** KAISER ENGINEERS INTERACTIVE ESTIMATING ** DEFENSE WASTE REMEDIATION PROGRAM REDEFINITION STUDY ESTIMATE XEMR00 - ESTIMATE DETAIL BY MBS / COST CODE		PAGE 12 DATE 09/14/91 08:11:46 BY W T SUSTENE						
ACCOUNT NUMBER	DESCRIPTION	COST CODE	QUANTITY	MANHOURS	LABOR	EQUIP USAGE	SUB- MATERIAL CONTRACT	EQUIP- MENT	OH&P / B & I	TOTAL DOLLARS
REPORT TOTAL			317,498	14,784,855	42,500	-3,387,799	3,418,257	0	-76,622	14,781,191

APPENDIX F

AUTHORIZATION TO USE COPYRIGHTED DATA

(See Appendix D)

This page intentionally left blank

WHC-SD-WM-TA-032
Revision 0

Westinghouse Hanford Company P.O. Box 1970 Richland, WA 99352	APPLICATION FOR PERMISSION TO USE YOUR COPYRIGHTED MATERIAL						
To: Cutting Technologies Inc. 2002 Ford Circle, Suite G Milford, Ohio 45150	Date: 7/25/95						
<p>Permission is requested to reproduce the following copyrighted material from:</p> <p>Your sales literature.</p> <p>Selections from text (specify by date of issue, page, paragraph, or illustration; if desired, attach a copy of the material in question):</p> <ol style="list-style-type: none">1. Typical Diamond Cutting Wire graphic with your copyright, our document draft page D1-30.2. Case Study No 4 graphic with your copyright, our document draft page D1-323. Typical Wall Cut graphic with your copyright, our document draft page D1-33 .4. Typical Floor Cut graphic with your copyright, our document draft page D1-34. <p>Copies of the pages from our document are attached for your review.</p> <p>Title of work or project in which this material will be included:</p> <p>These illustrations will, with your permission, be used in a publically issued report entitled, "B Plant Process Piping Replacement Feasibility Study", report number WHC-SD-WM-TA-032, by Westinghouse Hanford Company for the U. S. Department of Energy.</p> <p>Estimated publication date: August, 1995 Author: G. F. Howden</p> <p>Publisher (if applicable):</p> <p>If the copyrighted material is not to be used in a published work, please provide a brief description of how it is to be used:</p>							
A self-addressed stamped envelope is enclosed for your reply.							
<p>Name: Gary F. Howden, Sr. Principal Engr. MSIN: G3-20 Date: 7/25/95 509-372-3809</p> <p>Signature: _____ Westinghouse Hanford Company</p>							
<p>Credit line (if required):</p> <p>_____</p>							
<p>Application approved by:</p> <table><tr><td>Name: <u>Robert Frazier</u></td><td>Date: <u>Aug. 6, 95</u></td></tr><tr><td>Company Name: <u>C.T.I.</u></td><td>Signatory's Position: <u>President</u></td></tr><tr><td>Signature: <u>Robert Frazier</u></td><td>(on behalf of) _____</td></tr></table>		Name: <u>Robert Frazier</u>	Date: <u>Aug. 6, 95</u>	Company Name: <u>C.T.I.</u>	Signatory's Position: <u>President</u>	Signature: <u>Robert Frazier</u>	(on behalf of) _____
Name: <u>Robert Frazier</u>	Date: <u>Aug. 6, 95</u>						
Company Name: <u>C.T.I.</u>	Signatory's Position: <u>President</u>						
Signature: <u>Robert Frazier</u>	(on behalf of) _____						

This page intentionally left blank

WHC-SD-WM-TA-032
Revision 0

Westinghouse Hanford Company
P.O. Box 1970
Richland, WA 99352

APPLICATION FOR PERMISSION TO USE
YOUR COPYRIGHTED MATERIAL

To: Mr. William Coleman
Quest Integrated, Inc.
21414 68th Ave. South
Kent, Washington 98032

Date: August 7, 1995

Permission is requested to reproduce the following copyrighted material from:

~~Research, Inc.~~
Your sales literature provided to Westinghouse Hanford Company by Mr Jim White in 1991, prior to your separation from Flow International. If you have a logo, we would be glad to show it on the graphics with the notation "Previously Flow International, now Quest Integrated, Inc." ~~Research, Inc.~~ QUEST

Selections from text (specify by date of issue, page, paragraph, or illustration; if desired, attach a copy of the material in question):

1. UHP Stem Assembly graphic with your logo, our document draft page D1-21
2. Deep Kerf 3 Axis Motion graphic with your logo, our document draft page D1-22
3. Deep Kerfer System graphic with your logo, our document draft page D1-23
4. Abrasive Jet Concrete Cutting Nozzle Assm. with your logo, our document draft page D1-26.

Copies of these pages are attached for your reference.

Title of work or project in which this material will be included:

These illustrations will, with your permission, be used in a publicly issued report entitled, "B Plant Process Piping Replacement Feasibility Study, report number WHC-SD-WM-TA-032, by Westinghouse Hanford Company, for the U. S. Department of Energy.

Estimated publication date: August, 1995

Author: G. F. Howden

Publisher (if applicable):

If the copyrighted material is not to be used in a published work, please provide a brief description of how it is to be used:

A self-addressed stamped envelope is enclosed for your reply.

Name: Gary F. Howden, Sr. Principal Engr.
509-372-3809

Mail Stop: 63-20 Date: August 7, 1995

Signature: Gary F. Howden Westinghouse Hanford Company

Credit line (if required):

Application approved by:

Name: W. F. Coleman V.P.

Date: _____

Company Name: QUEST

Signatory's Position: _____

Signature: W. F. Coleman

(on behalf of) _____

This page intentionally left blank

WHC-SD-WM-TA-032
Revision 0

Westinghouse Hanford Company
P.O. Box 1970
Richland, WA 99352

APPLICATION FOR PERMISSION TO USE
YOUR COPYRIGHTED MATERIAL

To: Laser Technology Inc.
10624 Ventura Blvd.
North Hollywood, CA 91604

Date: July 25, 1995

Permission is requested to reproduce the following copyrighted material from:

Your sales literature.

Selections from text (specify by date of issue, page, paragraph, or illustration; if desired, attach a copy of the material in question):

1. Large Wire Saw, as shown on attached draft document page D1-31, Fig. 14.
2. Diamond cutting wire data sheet, as shown on attached draft document page D1-29, Fig. 11.

Title of work or project in which this material will be included:

These illustrations will, with your permission, be used in a publically issued report entitled, "B Plant Process Piping Replacement Feasibility Study, report number WHC-SD-WM-TA-032, by Westinghouse Hanford Company for the U. S. Department of Energy.

Estimated publication date: August, 1995

Author: G. F. Howden

Publisher (if applicable):

If the copyrighted material is not to be used in a published work, please provide a brief description of how it is to be used:

A self-addressed stamped envelope is enclosed for your reply.

Name: Gary F. Howden, Sr. Principal Engr. MSIN: G3-20 Date: July 25, 1995
509-372-3809

Signature: Gary F. Howden

Westinghouse Hanford Company

Credit line (if required):

Application approved by:

Name: JOHN B. HOWDEN

Date: 7-26-95

Company Name: LASER TECHNOLOGY INC. LIMITED

Signatory's Position: PRESIDENT

Signature: [Signature]

(on behalf of)

LTW INC., General

This page intentionally left blank