RECEIVED

OCT 07 1994

DISTRIBUTION SHEET

To Distribution	From IPM Project Engineering	Page 1 of 1 OSTI
		Date September 15, 1994
Project Title/Work Order Initial Pretreatment Module, Project W-236B		EDT No. 604340
		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
D. L. Banning	G3-20	X			
S. A. Barker	G3-20	X			
C. S. Cho	G3-20	X			
P. T. Furlong	S7-52	X			
R. R. Gadd	G3-20	X			
J. S. Garfield	H5-49	X			
K. A. Gasper	G3-21	X			
B. K. Horsager	G3-20	X			
G. F. Howden	G3-20	X			
K. B. Sowa (4)	G3-20	X			
J. S. Sparks	G3-20	X			
L. M. Swanson	H5-49	X			
L. D. Swenson	G3-20	X			
R. V. Vaddey	G3-20	X			
DPC-2	G3-20	X			
OSTI (2)	L8-07	X			
Central Files	L8-04	X			

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED *rb*

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

2. To: (Receiving Organization) IPM Project	3. From: (Originating Organization) IPM Project Engineering	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: IPM/TWRS	6. Cog. Engr.: K. B. Sowa	7. Purchase Order No.: N/A
8. Originator Remarks: Prior comments from WHC Project Mgt. and Raytheon/BNFL are accommodated. Approval of Rev. 0 of new SOW for IPM, WHC-SD-W236B-SOW-001, is requested.		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: N/A
11. Receiver Remarks:		12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: August 26, 1994

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 Trans- mittal	Originator Dispo- sition	Receiver Dispo- sition
1	WHC-SD-W236B-SOW-001	ALL	0	STATEMENT OF WORK FOR ARCHITECT-ENGINEER SERVICES, INITIAL PRETREATMENT MODULE	ESQ	1&2		

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	4. Review	1. Approved	4. Reviewed no/comment
		2. Release	5. Post-Review	2. Approved w/comment	5. Reviewed w/comment
		3. Information	6. Dist. (Receipt Acknow. Required)	3. Disapproved w/comment	6. Receipt acknowledged

(G)	(H)	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. KB Sowa	<i>[Signature]</i>	8/18/94		IPM Project Approvals:					
1	1	Cog. Mgr. BK Horsager	<i>[Signature]</i>	9/1/94		Proj. Control & Admin.- DF Mulderis	<i>[Signature]</i>			1	1
1	1	QA: JS Sparks	<i>[Signature]</i>	9/2/94		Program & Tech. Integration - SA Barker	<i>[Signature]</i>			1	1
1	1	SAFETY DL Banning	<i>[Signature]</i>	9/15/94		Permitting & Safety - DL Banning	<i>[Signature]</i>			1	1
1	1	ENV. DL Banning	<i>[Signature]</i>	9/15/94		Contractor Mgmt & Training - LD Swenson	<i>[Signature]</i>			1	1

18. KB Sowa <i>[Signature]</i> 8/18/94 Signature of EDT Originator	19. Authorized Representative for Receiving Organization	20. BK Horsager <i>[Signature]</i> Cognizant Manager Date 9/13/94	21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments
--	--	---	---

RELEASE AUTHORIZATION

Document Number: WHC-SD-W236B-SOW-001, Revision 0

Document Title: Statement of Work for Architect-Engineer Services,
Initial Pretreatment

Release Date: 9/15/94

* * * * *

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

APPROVED FOR PUBLIC RELEASE

* * * * *

WHC Information Release Administration Specialist:

Christine Willingham

C. Willingham

(Signature)

9/15/94

(Date)

SUPPORTING DOCUMENT		1. Total Pages 105
2. Title Statement of Work for Architect-Engineer Services, Initial Pretreatment Module	3. Number WHC-SD-W236B-SOW-001	4. Rev No. 0
5. Key Words Statement of Work, Pretreatment, Architect-Engineer, Conceptual Design, IPM, SOW, A-E, Project W-236B, Raytheon, BNFL, TGW-SVV-063869	6. Author Name: K. B. Sowa Signature Organization/Charge Code 7F421/D8001	
7. Abstract This Statement of Work describes the Architect-Engineer services to be provided by Raytheon/BNFL in providing a conceptual design (Contract TGW-SVV-063869) for the Initial Pretreatment Module, Project W-236B, at the Hanford site, Richland, Washington.		
<p>8. PURPOSE AND USE OF DOCUMENT - This document was prepared for use within the U.S. Department of Energy and its contractors. It is to be used only to perform, direct, or integrate work under U.S. Department of Energy contracts. This document is not approved for public release until reviewed.</p> <p>PATENT STATEMENT - This document is made available in confidence solely for use in performance of work under contracts with the U.S. Department of Energy. This document is not to be published nor its contents otherwise disseminated or used for purposes other than specified above before patent approval for such release or use has been secured, upon request, from the Patent Counsel, U.S. Department of Energy Field Office, Richland, WA.</p> <p>DISCLAIMER - This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. 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. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.</p>		10. RELEASE STAMP
9. Impact Level ESQ		<div style="border: 1px solid black; padding: 5px; text-align: center;"> OFFICIAL RELEASE (23) BY WHC DATE SEP 16 1994 <i>Ita #10</i> </div>

**APPROVED FOR
PUBLIC RELEASE**

*CW
9-15-94*

August 1994

STATEMENT OF WORK FOR ARCHITECT-ENGINEER SERVICES

INITIAL PRETREATMENT MODULE

AUGUST 1994

PREPARED BY THE WESTINGHOUSE HANFORD COMPANY

Approval

R. R. Gadd, Manager
IPM Project
Westinghouse Hanford Company
Richland, Washington

Date

9-7-94

August 1994

This page is intentionally left blank

August 1994

TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	REQUESTED SERVICES	1
1.2	BACKGROUND	2
1.3	LOCATION	5
2	WORK SCOPE	11
2.1	GENERAL	11
2.2	TASK SUMMARIES	13
2.3	SCHEDULE	17
2.4	BASIS OF DESIGN	19
3	PROJECT MANAGEMENT	21
3.1	CONTRACT ADMINISTRATION	21
3.2	TECHNICAL DIRECTION	21
3.3	TECHNICAL DEVELOPMENT	22
3.4	INTEGRATED MANAGEMENT TEAM	22
4	PRELIMINARY INFORMATION	23
5	DESCRIPTION OF REQUIRED A-E SERVICES	25
5.1	CONCEPTUAL DESIGN OBJECTIVES	25
5.2	TASK A-1.2 - CONCEPTUAL DESIGN ACTIVITIES FOR LLW PRETREATMENT	25
5.3	TASK B-1 - PRELIMINARY DESIGN OF IPM (TITLE I, OPTIONAL)	34
5.4	TASK B-2 - DETAILED DESIGN OF IPM (TITLE II, OPTIONAL)	36
5.5	TASK B-3 - ENGINEERING SERVICES DURING CONSTRUCTION	38
5.6	TASK B-4 - INSPECTION SERVICES DURING CONSTRUCTION (TITLE III, OPTIONAL)	40
6	PERFORMANCE OF WORK	41
6.1	PLANNING, GENERAL	41
6.2	PROJECT MANAGEMENT	41
6.3	WORK PLAN	42
6.4	QUALITY ASSURANCE	43
6.5	DESIGN SOFTWARE PLAN	44
7	PROJECT CONTROL REQUIREMENTS	45
7.1	GENERAL	45
7.2	WORK BREAKDOWN STRUCTURE	45
7.3	PLANNING AND BUDGETING	46
7.4	SCHEDULES AND MILESTONE CONTROL	46
7.5	CHANGE CONTROL	47

August 1994

TABLE OF CONTENTS, CONTINUED

8	REPORTS	49
8.1	MONTHLY PERFORMANCE/STATUS REPORTS	49
8.2	MISCELLANEOUS ACTIVITY REPORTS	50
8.3	CONCEPTUAL DESIGN REPORT	50
9	MEETINGS	51
9.1	MEETING MINUTES	51
9.2	KICK-OFF MEETING	51
9.3	MONTHLY REVIEW MEETINGS	51
9.4	DESIGN REVIEW MEETINGS	52
9.5	COORDINATION	52
10	DOCUMENTS	53
10.1	DOCUMENT TYPES	53
10.2	DESCRIPTION	53
10.3	GENERAL DATA	53
10.4	DOCUMENT CONTROL	54
10.5	DOCUMENT IDENTIFICATION AND FORMAT	54
10.6	DOCUMENT APPROVAL	57
10.7	DOCUMENT TRANSMITTAL	57
10.8	STATUS LISTING	57
10.9	RECORD FILES AND OBJECTIVE EVIDENCE	58
10.10	DESIGN END ITEMS	59
11	REFERENCES	63
11.1	PROJECT BASELINE DOCUMENTS	63
11.2	PROJECT BACKGROUND DOCUMENTS	63
11.3	SUPPORTING REFERENCES	64
12	ACRONYMS	66
	APPENDIX A - PROJECT SUMMARY WORK BREAKDOWN STRUCTURE	A-1
	APPENDIX B - TANK WASTE REMEDIATION SYSTEM WORK BREAKDOWN STRUCTURE DICTIONARY	B-1

August 1994

TABLE OF CONTENTS, CONTINUEDFigures and Tables

Figure 1	Pretreatment Block Diagram	6
Figure 2	Location of the 200 East Area at the Hanford Site	7
Figure 3	Proposed Location of the IPM Relative to the 200 East Area . .	9
Table I -	Milestone Schedule for Task A-3	17
Table II -	Target Dates for Options (Preliminary Information Only) . . .	18
Table III -	Task B-3 Required Data	39
Table IV -	Task B-4 Required Data	39
Table V -	Task A-3, Conceptual Design End Items	59
Table VI -	Tasks B-1 and B-2 - IPM Title I and Title II Designs (Optional)	61
Table VII -	Task B-3, Engineering Services During Construction (Optional)	62
Table VIII -	Task B-4, Inspection Services During Construction (Title III, Optional)	62

August 1994

This page is intentionally left blank.

August 1994

STATEMENT OF WORK FOR ARCHITECT ENGINEER SERVICES
for the
INITIAL PRETREATMENT MODULE

1 INTRODUCTION

1.1 REQUESTED SERVICES

The Westinghouse Hanford Company, Richland, Washington, (WHC) requires the services of an Architect-Engineer (A-E) for the purpose of designing a new radiochemical process facility referred to as the Initial Pretreatment Module¹ (IPM). The IPM Project will be designed and constructed for an initial phase of waste pretreatment, which will be for the removal of cesium from supernatant wastes to produce a Low Level Waste (LLW) stream to a vitrification (borosilicate glass) facility. The design shall also accommodate side streams of High Level Waste (HLW) fractions that will be directed to suitable, existing storage tanks where, according to the Functions and Requirements (F&R) for the IPM Project, "The high-activity waste fraction (primarily cesium) will be recombined with an additional high-activity waste fraction generated from pretreatment of the tank waste sludges and solids. This combined high-activity waste fraction will be immobilized as glass and disposed in a geological repository".

The pretreatment of the tank waste sludges and solids, the treatment² of high-activity side streams from IPM to meet HLW waste form requirements for immobilization, and the immobilization of LLW and HLW are outside the scope of this project.

The IPM may consist of one or more processes, depending upon trade study determinations of the need for additional removal of radionuclides, beyond cesium, from the supernatant wastes. The IPM project will be located at the Hanford Site near Richland, Washington.

¹ The term "module" is not intended to prescribe a particular facility architecture, process configuration or process deployment concept; these features will be determined by appropriate trade or engineering studies in support of the conceptual design and shall be consistent with the requirements of the F&R.

² Except for chemical buffering that may be required for corrosion protection prior to follow-on HLW processing.

August 1994

Architect-Engineer services for conceptual design of the IPM project are described in this SOW. This SOW also continues to outline other, optional services for the IPM such as; preliminary and detailed design, engineering services during construction, and inspection services during construction³. These optional services may be performed by the A-E at a later date, at the discretion of WHC, and will be described in more detail either in separate SOWs, or by revisions to this SOW, when authorized.

1.2 BACKGROUND

1.2.1 Prior Statement of Work, TWP-92-002

Prior Statement of Work TWP-92-002 was initiated by the Department of Energy, Richland Operations (RL) in April 1993 to obtain architect-engineering services to begin conceptual design of the IPM. The initial purpose of the IPM project was to destroy or modify underground storage tank waste constituents that posed safety concerns. In addition, based upon cost and schedule considerations, the IPM project was to consider pretreatment processes for separating waste radionuclide constituents into low-level waste fractions to meet grout waste form requirements. Side streams of high-level waste fractions were to be routed to storage for future pretreatment for vitrification.

Coincident with the initial phase of the IPM conceptual design evolving programmatic needs began to emerge, resulting in *Hanford Facility Agreement and Consent Order* or Tri-Party Agreement (TPA) discussions that began in late CY 1993. These discussions culminated in agreements in January 1994 (Ecology et al. 1994). In response to the evolving changes in programmatic requirements the initial conceptual design work for IPM was halted at the 30% complete stage in November, 1993 to allow additional systems engineering analyses by WHC and trade studies by the A-E to proceed. The pretreatment trade studies by the A-E during this period were consistent with design study services requested in TWP-92-002, and were in accordance with WHC technical direction.

One product of the A-E's design study effort between December 1993 and February 1994 was the production of a Conceptual Design Report (CDR) for a small Cesium Demonstration Unit (CDU) to demonstrate deployability of modular concepts for the IPM facility.

Also, prior to completion of the 30% CDR, responsibility for administration of the A-E contract was transferred by RL to WHC in July, 1993.

³ Throughout the text of this SOW, the term "Inspection Services During Construction" may be used interchangeably with the term "Title III", as defined in DOE Order 4700.1.

August 1994

1.2.2 Current Statement of Work, WHC-SD-W236B-SOW-001

A new Functions and Requirements (F&R) document (WHC-SD-W2236B-FRD-002) for the first phase of pretreatment assigned to IPM has been prepared by WHC in response to the evolving programmatic needs. The destruction of waste constituents for the resolution of tank safety issues is no longer the primary function of the IPM project but will be retained for contingency purposes. Accordingly, the previous 30% conceptual design work for IPM will not be restarted. Instead, pretreatment of supernatant streams to prepare waste fractions for LLW vitrification will be the new focus of the first phase of the IPM project. The conceptual design shall include those facilities, processes and lag storage capacities needed to accommodate and direct side streams of HLW to other facilities for recombining with HLW sludges and solids as mentioned in Section 1.1. This SOW authorizes A-E services for the conceptual design based on an F&R (WHC, 1994, Section 11.1) and additional studies as directed by WHC.

Other follow-on A-E tasks for the IPM project such as preliminary design, detailed design, engineering and inspection services during construction are listed as options.

1.2.3 Summary of Changes From Previous Statement of Work

This WHC-approved SOW replaces RL-approved SOW number TWP-92-002 in its entirety. The principal changes are summarized as follows:

- (1) Conceptual design for the IPM Project is to begin October 1, 1994. The initial 30% conceptual design report (CDR), which was produced in accordance with SOW number TWP-92-002 and issued in November, 1993, is to be retained for purposes of technical resource and project background information only. Resumption of conceptual design work, based on the F&R (WHC, 1994), is scheduled to start in October, 1994.
- (2) The production of a CDR for the CDU, which was completed by the A-E in February, 1994 is to be retained for purposes of technical resource and project background information only; further design work on the CDU will be at the direction of the WHC Buyer's Contract Specialist (CS).
- (3) In order to bring this document under WHC's configuration control procedures, the SOW document number is changed from RL number TWP-92-002 to WHC number WHC-SD-W236B-SOW-001; contractual changes to the A-E's scope of work or activation of optional A-E services described herein will be noted by revision to this SOW number. As

August 1994

before, letters of instruction (LOIs) will continue to supplement the SOW for specific tasks requested of the A-E.

- (4) Sections describing WHC's responsibilities are updated to reflect transfer of A-E design contract administration duties from RL to WHC, which was effective in July 1993.
- (5) A new F&R, WHC-SD-W236B-FRD-002, "Functions and Requirements, Project W-236B, Initial Pretreatment Module" has been prepared as the baseline for the IPM Project, pretreatment for LLW vitrification. This F&R supersedes the prior draft Functions and Operational Requirements (F&OR), WHC-SD-W236B-FDC-001 as the programmatic and technical baseline for the IPM Project.
- (6) The requirement for Conceptual Design Criteria (CDC) is canceled. The F&R and Project Design Criteria (PDC) will constitute the project technical baselines.
- (7) Milestone descriptions and schedules related to A-E deliverables are updated to support the latest programmatic needs for pretreatment. These programmatic needs require the production of a CDR for the IPM, which is a facility for the preparation of LLW for vitrification.
- (8) Quality Assurance requirements in Section 6.4 are updated to reference the requirements defined in 10 CFR 830, "Nuclear Safety Management", Code of Federal Regulations, in lieu of previous references to DOE Order 5700.6C.
- (9) The design of Hot Test Facilities for solid/liquid separations and cesium ion exchange processes has been identified as possible additional work that may be included by the CS at a later date.

August 1994

Figure 1 shows a preliminary block diagram⁴ with IPM functions identified. This block diagram will be updated by WHC following associated trade-off studies and pretreatment strategy determinations. It will be finalized by WHC at the conclusion of conceptual design for the IPM.

1.3 LOCATION

The IPM facility will be located adjacent to the 200-East Area, approximately 30 miles northwest of Richland, Washington, on the federal reservation commonly known as the Hanford Site. Figure 2 illustrates the general location of the 200-East Area relative to the Hanford Site. Figure 3 illustrates one location under consideration for the IPM relative to the 200-East Area. The exact location is currently under evaluation and will be determined at a later date.

⁴ This SOW is an administrative document; figures, schematics, plant locations and layouts, etc., are included for preliminary information only. Baseline information for IPM configurations shall be found in the latest issues of the F&R, PDC or other approved technical criteria.

Figure 1 Pretreatment Block Diagram

August 1994

Figure 2 Location of the 200 East Area at the Hanford Site

Hanford Site Department of Energy

Best Hanford Map
B&W

August 1994

This page is intentionally left blank.

Figure 3 Proposed Location of the IPM Relative to the 200 East Area

August 1994

This page is intentionally left blank.

August 1994

2 WORK SCOPE

2.1 GENERAL

The A-E shall perform conceptual designs of facilities and processes that will provide a pretreated waste stream to LLW vitrification (Borosilicate Glass) by others. The IPM conceptual design shall be in accordance with the WHC-approved F&R. Specific processes to be addressed in the conceptual design of IPM are outlined in Figure 1. These processes may be revised, or other processes added, via revision of the F&R document.

As seen in Figure 1, the conceptual design of IPM shall include:

- (1) Solid/Liquid separation and filtration processes to prepare incoming waste streams for downstream supernatant pretreatment processes.
- (2) Processes for the removal of cesium with assessments of processes for the removal of other radionuclides.
- (3) Evaporators will be considered for concentration of supernatant prior to cesium ion exchange, and concentration of LLW prior to vitrification.
- (4) Facility and utility designs to accommodate the above processes and provide interfacing tie-ins to the TWRS retrieval, waste handling, storage and immobilization infrastructure.

Trade studies by the A-E will also be necessary for support of the IPM conceptual design effort. These trade studies will be described in LOIs for two categories of study: (A) those required to support finalization of the F&R documentation necessary for the start of conceptual design, and (B) those required for on-going support of the conceptual design effort.

Start of conceptual design by October, 1994 requires RL concurrence. Category (A) studies shall be completed in time to support incorporation of trade studies into the revised F&R. The timing of Category (B) trade studies shall be consistent with the needs of the conceptual design effort but should be sufficiently complete by the 60% stage of conceptual design to allow assemblage of the conceptual design report (CDR).

A brief listing of the required and optional A-E services for the INITIAL PRETREATMENT MODULE is as follows:

2.1.1 Initial Services

August 1994

- Task A-1.0 Initial Pretreatment Module, Conceptual Design
- Task A-1.1 Cesium Demonstration Unit, Conceptual Design
- Task A-1.2 Initial Pretreatment Module, Low Level Waste (LLW) Pretreatment, Conceptual Design
- Task A-1.3 Advanced Conceptual Design Report
- Task A-1.4 Design of Hot Test Facilities for Solid/Liquid Separations and Cesium Ion Exchange processes

For all tasks authorized by WHC the A-E shall be responsible for the professional quality, technical accuracy, and coordination of the design, drawings, specifications, estimates, schedules, and other services furnished under this contract. The tasks will include reports, schedules, estimates, and other special services as described within this, or subsequent Statement of Work (SOW) documents and as directed by contract with WHC. All design media prepared shall become the property of the U.S. Department of Energy (DOE).

2.1.2 Other Options

The following are other possible options applicable to future A-E services for design and construction phases of LLW Pretreatment facilities for the IPM.

- Task B-1. Preliminary Design (Title I)
- Task B-2. Detailed Design (Title II)
- Task B-3. Engineering Services During Construction
- Task B-4. Inspection Services During Construction (Title III)

August 1994

2.2 TASK SUMMARIES

The required and optional tasks for the IPM Project are summarized as follows:

2.2.1 Required Task Summaries

Conceptual Design (CD) encompasses those efforts that: develop a project technical scope; assure project feasibility and attainable performance levels; develop reliable cost estimates and realistic schedules; provide a complete description of the project for DOE and congressional consideration; and refine project criteria and design parameters for all engineering disciplines. The CD will culminate in a report (CDR), which will include completed conceptual design drawings, sketches, outline specifications, calculations, project schedules, project cost estimates, and BA/BO schedules. The A-E shall also provide, with WHC's input and assistance, the PDC (See Section 5.2.11) that establishes the IPM technical baseline when combined with the F&R document.

2.2.1.1 Task A-1.0 Initial Pretreatment Module Conceptual Design. Refer to RL's TWP-92-002 for a summary of this task (originally Task A-1). This task was completed to the 30% stage with issuance of a review report, E/B-SD-W236B-RPT-001-Rev 0A (Draft) in November, 1993. Additional work on this task is canceled and is replaced by Task A-1.2, below.

2.2.1.2 Task A-1.1 Cesium Demonstration Unit, Conceptual Design. Refer to LOI (WHC 1992) for a summary of this task. This task was authorized by an LOI in December 1993 consistent with the requirements of TWP-92-002 and was completed by the A-E in February of 1994 with responses to questions and validation support ongoing through June 1994 (Ref: E/B-SD-W236B-RPT-008, Rev. 00, dated June 3, 1994). Identifier "Task A-1.1" is assigned for reference purposes.

2.2.1.3 Task A-1.2 IPM Conceptual Design for LLW Pretreatment. Task A-1.2 will provide for the conceptual design of the IPM LLW Pretreatment facility based on the F&R. This project will provide for the pretreatment of supernatants, by removal of cesium, to provide feed to the LLW vitrification facility. As seen in Figure 1, the baseline IPM processes include solid liquid separation to clarify supernatant streams for pretreatment, cesium removal, and concentration of LLW by evaporation. The conceptual design shall also be based on the following additional assumptions:

- (1) Out-of-tank sludge washing, if required, will be performed by others.
- (2) For solid/liquid separation requirements the worst case feed shall be assumed, i.e., that in-tank, or out-of-tank sludge washing by others may result in feeds to pretreatment that range from supernates to

August 1994

slurries. Therefore, gross and polishing separations of solids shall be included in the IPM to maintain ion exchange throughput performance.

The range of particulate size, pH, gross loading of solids, and other waste characteristics to be assumed will be confirmed by WHC in a separate LOI to the A-E.

(3) Provision for caustic recycle and evaporator overheads recycle shall be included.

(4) Lag storage needs for receipt or export of waste shall be addressed in the CDR.

(5) The conceptual design shall include provision of space and/or capability/flexibility for process inclusion or tie-in for additional pretreatment functions as listed in 2.2.1.3(6), below.

(6) Although removal of cesium is one of the prime objectives of the technical baseline from the Tri-Party agreement, removal of other radionuclides shall also be included as facility options in the CDR. The CDR shall provide discussion, scoping sketches, and order-of-magnitude cost estimate and schedule impacts for various pretreatment options in a manner that facilitates subsequent WHC isolation and study of these options. These pretreatment options shall incorporate the best available technologies and shall include:

(a) Strontium Removal

(b) Technetium Removal

(c) TRU Removal (except uranium)

(d) Complexant Destruction as may be required to enable the above options.

2.2.1.4 Task A-1.3 Advanced Conceptual Design Report. If authorized, an advanced conceptual design would be performed prior to Title I in accordance with an LOI or by revision to this SOW. The purpose of the advanced conceptual design would be to provide further resolution, if necessary, of issues identified in the CDR and/or accommodation of additional input from ongoing technology development efforts, applied engineering, and/or trade studies.

August 1994

2.2.1.5 Task A-1.4 Design of Hot Test Facilities To provide testing support for follow-on definitive designs of solid/liquid separations and ion exchange processes, the CS may direct the inclusion of additional work for designs for the construction of hot test facilities or modification of existing facilities. These hot test facility designs would include:

(a) A hot test facility, or existing facility modification, shall be designed for testing the solid/liquid separations (gross separations plus polishing) technologies at flow rates that will provide reliable modeling and scale-up data for follow-on definitive designs. The facility will use actual tank waste and have provision for waste and product sampling. The design flow rate shall be determined based on modeling and scale-up determinations by the A-E and technology discussions with WHC.

(b) Other selected facility modifications will be required for hot testing of cesium ion exchange processes. The facility modifications will allow hot testing of an approximate 1000-liter quantity of representative liquid waste, as described in 2.2.1.3(2) above, through a test bed of solid/liquid separations processes and 1-liter cesium ion exchange column. The test facility may also require other processes for conditioning the waste (e.g. sludge washing, solid/liquid separations) prior to the ion exchange processes.

Additional requirements and identification of needed facility modification design support required for hot testing will be made by WHC by March 31, 1995.

For further discussion of pretreatment strategies refer to Appendix B, which includes a June 9, 1994 Tank Waste Remediation System Work Breakdown Structure Dictionary.

Necessary to the start of Task A-1.2 are preconceptual trade studies by the A-E (Category A) needed to support finalization of the F&R. Additional trade studies (Category B) will be needed from the A-E for support of the evolving conceptual design and to provide updates to the F&R. Technical direction for these trade studies will be provided by separate LOIs from WHC to the A-E, or by revision to this SOW.

August 1994

2.2.2 Optional Task Summaries

2.2.2.1 Tasks B-1 and B-2, Title I and Title II Designs for the IPM.

Title I is the beginning of the final design process. It continues the design effort utilizing the PDC and the selected conceptual design as a basis for project development. Title I design develops topographical and subsurface data and determines the requirements and criteria that will govern the Title II Design. Tasks include preparation of preliminary planning and engineering studies, preliminary drawings and outline specifications, piping and instrument diagrams (P&IDs), life-cycle cost analysis, preliminary cost estimates, scheduling refinements for project completion. Title I design provides identification of long lead procurement items and analysis of risks associated with continued project development.

Title II design continues the development of the project based on the approved baseline preliminary design. Title II Design includes preparation of final working drawings, specifications, cost estimates, and coordination with all parties that might affect the project.

2.2.2.2 Task B-3 - Engineering Services During Construction. These tasks for the IPM include: engineering support to be performed during construction, such as review of construction contractor submittals or proposals; providing fair cost estimates; engineering assistance in resolution of construction problems and nonconformances; etc.

2.2.2.3 Task B-4 - Inspection Services During Construction (Title III). Inspection Services for the IPM consist primarily of providing 'as-built' documentation, estimating services, independent government acceptance inspection of construction, daily inspection reports, inspectors' logs, nonconformance reports, materials testing services, and as-built drawings.

August 1994

2.3 SCHEDULE FOR TASK A-1.2

The revised CD authorized by this SOW is targeted to be in progress by October, 1994 and is to be completed by March, 1996 in time for full project validation by April, 1996. Particular CDR schedule milestones are indicated in Table I, below.

Table I - Milestone Schedule for Task A-3

Tasks	Date
Submit CD ⁵ Work Plans	30 days after authorization to proceed
Complete Category (A) Trade Studies (F&R definition support; Specifics by LOI direction)	09/30/94
Start Category B Trade Studies	10/01/94
Begin conceptual design ⁶	10/01/94
IPM Conceptual design 30% review submittal. Begin 1st draft of Preliminary Hazards Report (HAZOP).	02/28/95
Conceptual design 60% design drawing review and Category (B) Trade Studies complete.	08/31/95
Draft CDR text to WHC for review.	12/01/95
CDR 90% complete, issue for WHC final review and approval; HAZOP complete.	01/31/96
Issue final CDR ⁷ for RL approval	02/29/96
Title I Work Plan Submittal	04/01/96

⁵ CD = Conceptual Design

⁶ Subject to RL concurrence

⁷ CDR = Conceptual Design Report

August 1994

Table II - Target Dates for Options (Preliminary Information Only)

Task	Date
Initiate Title I design	10/1/96 ⁸
Complete Title I design	3/31/98
Initiate Title II design	3/31/98
Complete Title II design	10/31/99
Initiate construction	11/1998 ⁹
Initiate engineering during construction	11/1998
Initiate inspection during construction	11/1998
Complete construction	12/2003 ¹⁰
Start hot operations	12/2004 ¹¹

⁸ TPA Milestone M-50-01-T01 is 12/1996

⁹ Ref: TPA Milestone M-50-01

¹⁰ Ref: TPA Milestone M-50-02-T01

¹¹ Ref: TPA Milestone M-50-02 to start removal of cesium

August 1994

2.4 BASIS OF DESIGN

2.4.1 Conceptual Design Bases

The A-E shall develop a conceptual design that shall meet the requirements specified in the F&R document, WHC-SD-W236B-FRD-002, Rev. 0 and subsequent approved revisions.

2.4.2 Title I and Title II Design Bases

Title I and Title II designs, when authorized, shall comply with the latest revision of the WHC-approved PDC, the WHC and RL-approved F&R, and the cost and schedule baselines established in the WHC approved CDR, which may also be approved by RL or its designee (DOE Order 4700.1). The PDC, which is developed during conceptual design and approved after final issuance of the CDR, establishes the project technical baseline along with the F&R. The PDC supersedes any previous criteria and remains in effect for the remainder of the project. Configuration control of the PDC will be maintained via change control procedures.

2.4.3 Generation of Design Bases

The RL has directed (RL, March 18, 1994) WHC to utilize the Tank Waste Remediation System (TWRS) Systems Engineering Management Plan (SEMP) as guidance in development of project level F&Rs as well as other technical baseline documents; these other technical documents will no longer include a Conceptual Design Criteria (CDC). The SEMP identifies design configuration baseline documents such as:

- Design Requirements Document¹²
- F&R
- Interface Control Documents
- Design Descriptions and Drawings

¹² WHC has determined that the latest issue of the PDC (Section 11.1) shall be in lieu of the Design Requirements Document listed above.

August 1994

This page is intentionally left blank.

August 1994

3 PROJECT MANAGEMENT

3.1 CONTRACT ADMINISTRATION

The Manager, U.S. Department of Energy-Richland Field Office (DOE-RL), has overall responsibility for the IPM Project. Over-sight of project activities will be provided by the Director of the DOE-RL Tank Waste Projects Division (TWP). The administration of the A-E contract will be provided by the WHC IPM Project organization. Contract administration at WHC will be supported by a contract specialist reporting to the IPM Project Manager.

3.2 TECHNICAL DIRECTION

The WHC IPM Project organization has responsibility for the technical direction of the A-E activities. In addition to responsibilities described elsewhere in this document, WHC will coordinate and ensure information exchange between appropriate multi-participant engineering, technology, construction, maintenance, and operations elements. The WHC IPM Project organization will ensure the A-E's services are consistent with the requirements of this SOW. Where required for construction or testing, WHC will procure and coordinate contracts for Government Furnished Equipment (GFE).

August 1994

3.3 TECHNICAL DEVELOPMENT

Applied technology activities required to support the IPM will be carried out by the DOE-RL's R&D contractor (Pacific Northwest Laboratories, PNL) or by specific DOE National Laboratories. These Laboratories may also perform peer reviews as requested by DOE-RL. The WHC IPM Project organization will provide appropriate coordination and integration of all applied technology development or peer review activities related to the IPM project.

3.4 INTEGRATED MANAGEMENT TEAM

The DOE-RL and WHC foster an integrated management team (IMT) approach in conducting its business at Hanford. A step that promotes the IMT concept is multi-participant co-location. In order to accommodate co-location of project participants for integration into the design effort, the A-E shall initially furnish 55 office spaces¹³ at its Tri-Cities, WA. location, until directed otherwise in the terms and conditions of the contract for A-E services. These spaces will be occupied by WHC and DOE-RL staff elements assigned to the IPM project. These spaces shall have adequate lighting, HVAC, and telephone and HLAN computer hookup capability.

¹³ The cost of rent and maintenance, or any changes to the required number of office spaces, will be in addition to the cost proposal and will be negotiated separately.

August 1994

4 PRELIMINARY INFORMATION

A generic list of information items needed to perform CD of the IPM, and optional Title I/Title II designs, is shown below. These items will have been provided by the DOE-RL Contracting Officer (CO) for Task A-1.0 or by the CS for other tasks. The applicable version of the design criteria documents shall be established by the CS. Updated listings of information items will be established in each Statement of Work revision prepared for the Title I/Title II designs and other A-E services.

- (1) Functions and Requirements (F&R)
- (2) Conceptual Design Criteria (CDC)¹⁴
- (3) Project Design Criteria (PDC)¹⁵
- (4) Pre-Conceptual Design Report (PCDR) (KEH 1992)
- (5) Statement of Work (TWP-92-002 superseded by WHC-SD-W236B-SOW-001)
- (6) Wage and Escalation Rates
- (7) Latest Data, Test Results, Studies, or Reports for pretreatment processes.
- (8) Conceptual Design Plan (CDP)
- (9) Applicable DOE Orders, Plans, and Manuals
- (10) Applicable Hanford Plant Standard Design Criteria
- (11) Latest Applicable Regulatory Documentation
- (12) Applicable Safety/Hazards Analysis
- (13) Safety Class Determination Criteria
- (14) Site Evaluation Report
- (15) Project Summary Work Breakdown Structure (PSWBS)
- (16) Justification of Mission Need (JMN)
- (17) Project Plan (PP)
- (18) Draft (DOE-RL) Project Management Plan (PMP)
- (19) Letters of Instruction (LOIs)

¹⁴ Previously provided but now discontinued

¹⁵ As updated during conceptual design and issued with CDR

August 1994

This page is intentionally left blank

August 1994

5 DESCRIPTION OF REQUIRED A-E SERVICES

5.1 CONCEPTUAL DESIGN OBJECTIVES

Principal objectives of the CD will be as follows:

- (1) To allow the A-E to review and become familiar with the preliminary information provided by DOE-RL and WHC, as described in Section 4 (Preliminary Information) and identify areas where further definition or modification is required to reduce project uncertainties.
- (2) To accomplish the major formative stage of the project, which advances proposed IPM concepts from previous and ongoing engineering studies to a level sufficient enough to down-select to a final concept that will undergo additional refinements in design, cost, schedule, and a reduction of uncertainties.
- (3) To formally establish the project's initial baseline cost and schedule as documented in a Conceptual Design Report, and to support the development of a technical baseline as defined in the F&R and PDC.
- (4) To assist WHC in its preparation of preliminary safety and environmental evaluations of the selected concepts.

5.2 TASK A-1.2 - CONCEPTUAL DESIGN ACTIVITIES FOR LLW PRETREATMENT

Activities of the A-E include, but are not limited to, the items listed below. Items completed by the A-E under the prior SOW, TWP-92-002, shall be reviewed against the requirements of this replacement SOW and shall be updated for applicability where necessary.

5.2.1 Criteria Review

Review the F&R and preliminary information provided for the IPM Project and prepare a report describing the A-E's understanding of the F&R and identify any discrepancies or areas requiring further clarification. The report shall be submitted within 20 calendar days of receipt of authorization to proceed.

August 1994

5.2.2 Work Planning

Prepare a CDR work plan in accordance with Section 6.1 that addresses how the A-E will perform the CD to support the full project validation schedule described in Section 2.3 (Schedule). The work plan shall be based on the WBS (see Section 7.2, Work Breakdown Structure) and shall include a list of all deliverables to be completed at the 30% and 60% design completion milestone dates. Submit the work plan for the WHC's approval.

5.2.3 Conceptual Design Report

Prepare a Conceptual Design Report (CDR) and establish the project cost estimate and schedule. The Budget Authorized/Budget Obligated (BA/BO) schedules, estimators work sheets, vendor quotations, and bases for the estimate for each item shall be included. The schedules shall include an overall project milestone schedule backed up by network type critical path method (CPM) schedules. The arrangement and format of the CDR shall be determined by the A-E with the concurrence of the WHC IPM Project organization. The minimum requirements for a CDR are provided in RLIP 4700.1A.

5.2.4 Intermediate CDR Reviews

Prepare CDR review packages at the 30% and 60% stages of completion. As a minimum, the 30% and 60% review packages shall include:

- (1) An overview of top level project activities and results.
- (2) A description of any systems engineering analysis performed in support of the CD.
- (3) A summary of engineering and design activities performed to date on process and facility designs.
- (4) Copies of the latest governing PDC
- (5) Engineering reports
- (6) Preliminary System Design Descriptions (conceptual level of detail)
- (7) Process Flowsheets and Diagrams
- (8) General Arrangements and Facility concepts

August 1994

- (9) Project Cost Estimates and Schedules; provide Order-of-Magnitude trend analyses of any changes to the cost and schedule data that may have occurred since the last review.
- (10) At each design review meeting the A-E shall:
 - (a) summarize the milestones accomplished and the budgets expended to date and present a forecast of the remainder of the CD effort;
 - (b) identify the project open items resolved and any new open items identified;
 - (c) at the 30% design review, summarize the work performed to date in expanding the systems engineering analysis presented in the F&R;
 - (d) at the 60% design review, summarize the work performed to date in defining the system level functions, requirements, interfaces and designs; also, summarize the results of the preliminary hazards analysis;
 - (e) at the 90% design review, summarize the project schedules and cost estimates; also, summarize the results of the preliminary safety evaluation.

5.2.5 Resolution of Open Items.

Extend design of facility features, plant arrangements, and process equipment where the preliminary conceptual design identified open items or basic problems that have not been resolved, or where clearer definition is required for preliminary design. The A-E shall include in the work plan the level of technical detail that shall be provided in plant arrangements, electrical one-lines, flow diagrams, and other relevant depictions.

5.2.6 Identify Advance Procurement Items.

Complete identification of advance procurement items and preparation of outline procurement specifications.

5.2.7 Prepare Topical Reports.

Prepare topical reports to document technical findings and/or describe significant design tradeoff studies and recommendations.

August 1994

The A-E shall identify in the work plan what this effort shall address. Perform shielding studies and calculations, seismic studies, heat load studies and calculations, and other studies/calculations identified to be significant to the safe and efficient operation and maintenance of the IPM. The purpose and type of reports will be identified in LOIs or other direction given by WHC to the A-E for specific studies.

5.2.8 Design Review Presentations

Assemble design review documentation and assist in presentation of the design to reviewers as defined in 9.4 (DESIGN REVIEW MEETINGS)

5.2.9 System Design Descriptions

Initiate System Design Descriptions (SDDs).

5.2.10 Technical Direction.

The WHC will provide updated process requirements and equipment concepts based on data from other ongoing studies and development work. This input shall be reviewed, evaluated, and incorporated, if applicable and/or directed, as it becomes available. The A-E shall participate in other ongoing studies as requested.

5.2.11 Project Design Criteria.

With technical and programmatic support and assistance from the WHC IPM Project organization develop the PDC which, when approved by WHC, will establish the project's technical baseline. The PDC shall identify the applicable sections of upper tier criteria standards (e.g. DOE 6430.1A) that are not currently found in the F&R document. The PDC shall also expand the systems engineering analysis presented in the F&R in sufficient detail to identify the functions, requirements, interfaces, and design criteria for plant structures, systems, and major components.

5.2.12 Design Compliance.

Ensure the CDR complies with the F&R and any WHC-approved changes via the WHC CSor Buyer's Technical Representative (BTR, reporting to the WHC Manager, IPM Project). All documents submitted for approval or acceptance by WHC (See Section 10.10) and concurrence by DOE-RL, shall include the A-E's certification that the design complies with the IPM base documents for the CD effort. Unless requested otherwise, approvals or acceptances by WHC will

August 1994

precede approvals by DOE-RL. The coordination of requests to DOE-RL for reviews or approvals will be the responsibility of the BTR.

5.2.13 Facility Site Selection.

Review previous site selection studies and assessments and provide an updated assessment of the site selection report (also, see Figure 3) consistent with the facility location concepts from the Facility Configuration Study (FCS), WHC-SD-WM-ES-295, (to be issued).

5.2.14 Safety Support.

Provide support to WHC in the development of a Preliminary Safety Evaluation (PSE). The PSE will be provided by WHC to the A-E for incorporation in the CDR. Specific requirements will be provided by WHC. Include in the CD work plans the following activities:

- (1) **Preliminary Hazards Assessment.** Provide draft Preliminary Hazards Assessments (PHAs) of each of the IPM design concepts in allowable time (see schedule, Section 2.3) to support selection of the preferred design. The WHC will participate in the planning and execution of the studies. The PHAs pertaining to the selected design option will be further developed by WHC and incorporated into the PSE.
- (2) **Safety Criteria.** Provide a summary level report which specifies the safety related design criteria applicable to the IPM and describes in general how the design will meet these criteria.
- (3) **Safety Planning.** Provide technical assistance in updating the Safety Management Plan, WHC-SD-W236B-HSP-001, and developing the PSAR Preparation Plan.
- (4) **Safety Reviews.** Provide technical review of the PSE.

5.2.15 Master Schedule.

Prepare a time-phased logic network project master schedule supported by detailed sub-network schedules covering all phases of the project (i.e., design, permits, bid package preparation and bid periods, construction phases, as-built). Schedules shall identify the critical path and the construction packages and be consistent with the PSWBS and CWBS. Prepare a project summary schedule and a project milestone schedule in bar chart form based on information developed in the logic network schedules. Time scales shall be appropriate for the level of detail presented.

August 1994

5.2.16 Procurement Schedules

Analyze the delivery schedules for IPM process system components. Prepare a list of equipment, lead time for design, fabrication, and delivery of which requires advance procurement action to support the construction schedule.

5.2.17 Project Cost Estimate

Prepare a project cost estimate at the CWBS level, based on material takeoffs and vendor quotations. The estimate shall use rates included in approved Hanford Site construction estimate factors. The BA/BO schedule, estimator work sheets, vendor quotations and basis of the estimate for each item shall be included. The A-E shall provide IPM total estimated cost and total project cost data as may be requested by WHC throughout the course of the initial contract and any subsequent contracts, or contract modifications, for optional services. The cost estimate data shall be electronically stored and disseminated using the Hanford Interactive Estimating System or an approved equal in accordance with the code of accounts and other classifications concurred by WHC. Electronic traceability to design media shall be maintained and be available to WHC. The estimate shall be prepared in accordance with the applicable DOE orders and other requirements as specified by WHC.

5.2.18 Life Cycle Cost Analysis

Provide a life cycle cost analysis on systems or proposed facilities as necessary and agreed to with WHC.

5.2.19 Risk Assessment

Perform a formal Risk Assessment of the project that addresses the cost, schedule, and technical risks associated with the chosen concept.

5.2.20 Contract Reviews

As requested, consult with and advise WHC concerning any questions that may arise in connection with the A-E services described within the contract.

August 1994

5.2.21 Drawings and Specifications List

Appropriate to the level of detail for each stage of design, the A-E shall develop and maintain a list containing each drawing and specification required for construction of the project. The listing shall include the drawing or specification number, title, scheduled and actual start and completion dates, revision number, status information, responsible engineer, procurement or construction package to which each applies, and the procurement or construction package to receive the drawing or specification for reference. The list shall be prepared on an electronic medium that is compatible with IBM Personal Computer (DOS)-based computer equipment.

5.2.22 Shielding Calculations

The Shielding Methodology draft report (E/B-SD-W236B-RPT-006-REV 0A) previously prepared for the IPM Project shall be finalized (numeric revision status) and issued with the CDR.

5.2.23 Development Support

Identify and request from WHC, any development or demonstration testing requirements necessary to generate input data for scheduled design activity. Perform Test Facility design/s as directed by WHC (see Section 2.2.1.5..(b)).

5.2.24 Environmental and Permitting Planning

Provide assistance to WHC in development of information for environmental and permitting planning.

5.2.25 Oversight Review Support

Provide support for DOE-HQ (yearly) budget validation, independent reviews, audits and surveillances, and Independent Cost Estimate (ICE) reviews as required.

5.2.26 National Laboratory Interfaces

In conjunction with WHC, the A-E will directly interface with DOE national labs as appropriate for application or incorporation of technology developments.

August 1994

5.2.27 Special Studies

Participate in Special Study tasks, technical services, presentations, discussions and meetings required on an "as needed" basis to support IPM design and development. The studies may begin before, or during, conceptual design but will be expected to continue in various forms during follow-on design phases.

5.2.28 Trade Studies

Perform trade studies (e.g. EBASCO/BNFL 1994) to provide technical support for the systems engineering analysis of LLW pretreatment processes and facilities, and corresponding handling of HLW side streams, as authorized by WHC Procurement. The WHC will order each trade study by providing a letter of instruction for the services expected, schedule and milestone dates as necessary, and a funding limitation. The WHC may direct performance and the A-E may submit a proposal for each trade study as contemplated for changes under the "changes" clause of the contract. Trade studies will be performed prior to, and during, conceptual design as outlined in Section 2.1. Examples of trade studies include:

- Evaluation of proposed waste treatment and disposal technologies, and the preparation of design requirements. (For example, participate in determination of need for organic complexant destruction. Prepare down-selection criteria for organic destruction, etc.)
- Formulation of design recommendations, implementation of recommendations, and cost/benefit and liabilities analyses.

5.2.29 Study Briefings and Presentations

Preparation of, and participation in, briefings and formal presentations related to the progress or outcome of special studies.

5.2.30 Functions and Requirements

Provide assistance in the preparation of Functions and Requirements and supplementary design requirements.

August 1994

5.2.31 Pretreatment Strategy

Participate as a team member in developing a program acceptable strategy for IPM with the objective of further optimization of the IPM design. As a minimum, the participation will include:

- (1) **Pretreatment Processes** Participate in assessment of principal processes essential to IPM operation, and scoping of process facilities, features, and interfaces.
- (2) **Pretreatment Interfaces** Participate in functional scoping of IPM interfaces with other facilities for final disposition of the waste in grout or borosilicate glass waste forms.
- (3) **Pretreatment Study Reports** Assist in preparation of study reports including text, sketches, and visual aids.
- (4) **Process Selection** Where more than one alternative exists for a specific process (e.g. solid/liquid separation, evaporator configurations, ion exchange media, etc.) assist in comparisons of proposed process versus alternative process/es to determine respective advantages and disadvantages and provide data for down-selection to a single process or configuration.
- (5) **Cost Reviews** Assist in cost-benefit/trade-off studies.
- (6) **Future Pretreatment** Assist in scoping, cost and schedule analyses for follow-on pretreatment technologies.

5.2.32 Safety Class Assessment Assess safety class system implication on process facilities.

5.2.33 Site Familiarization Gain familiarization with Hanford Site process, operation and safety practices and prepare report summarizing potential IPM implications.

5.2.34 Briefings Provide assistance with briefings and formal presentations as requested by WHC and DOE-RL. The estimated frequency of these presentations is two per month. Assistance shall include generation of briefing material (narratives, cost data, and graphics), participation in portions of the briefing, and responding to actions (via agreement/commitment documentation and meeting minutes) for which the A-E is made responsible.

5.2.35 Technology Assessments Provide an analysis evaluating IPM processes against current state of the art. The analysis shall also outline

August 1994

the specific research and development, mock-up, and testing that will be required to ensure correct operability of the equipment/systems.

5.2.36 Project Planning Support As requested, provide input and assistance to WHC for development of miscellaneous budget and project planning documentation and associated reviews such as; the Multi Year Work Plan (MYWP), Activity Data Sheets (ADS) and Multi-Year Program Plan (MYPP).

5.2.37 Interface Control Documents Provide assistance in the preparation of Interface Control Documents (ICDs) at the project level and prepare ICDs at the system level.

5.3 TASK B-1 - PRELIMINARY DESIGN OF IPM (TITLE I, OPTIONAL)

It is anticipated that an advanced conceptual design effort (ACDR, Task A-1.3) will be required to bridge between completion of the conceptual design and start of Title I design. If Title I design is authorized it will be based on the completed CDR, plus possible additional data from the ACDR (Section 2.2.1.4) and will be further described by revision to this SOW. Refer to Table I for the schedule for completion of the IPM CDR and ACDR. Table II contains the preliminary target dates for completion of Task B-1.

Title I Design will be performed in order to fix or freeze the IPM project scope by investigating alternative design directions identified in the conceptual phase and by further refinement of selected concepts. This phase of the design will utilize the CD and baseline criteria that have been prepared for the project as a reference. As a minimum, the following items are to be included in the Title I design for the IPM project.

- (1) **Work Plan Update** Review and if necessary, revise, the work plan for preliminary design that was prepared at the conceptual design phase.
- (2) **Site Evaluation** Conduct, or arrange for by subcontract, all necessary test borings and other required subsurface investigations to define soil bearing capacity, percolation rate, and soil resistivity. Field surveys will be performed by the Hanford Site Engineer/Constructor (E/C) unless otherwise directed.
- (3) **Studies** Perform tradeoff studies, including evaluation of alternative design approaches.
- (4) **Criteria Update** Refine the PDC and quality levels for systems and components in greater detail to be applied to the follow-on Title II Design.
- (5) **Design Detail** Expand CDR concepts in greater detail and provide additional drawings, or develop new drawings based on new concepts.

August 1994

- (6) **Outline Specifications for Construction and Procurement** Develop outline specifications for construction, plus specifications for procurement.
- (7) **Safety and Environmental Analysis** Provide additional analysis of health, safety, environmental protection, and associated program aspects.
- (8) **Procurement and Construction Logistics** Develop preliminary estimates of construction labor, equipment, and material quantities and identify long-lead procurement or other potential labor or material supply problems.
- (9) **Cost and Schedule Data** Update the project cost estimates and project schedules developed during CD and review methods of construction performance at the completion of Preliminary Design.
- (10) **Energy Conservation Report** Prepare an Energy Conservation Report in accordance with DOE Order 6430.1A.
- (11) **Utility and Services Requirements** Provide preliminary estimates of utility and services requirements in coordination with WHC and utility companies.
- (12) **Piping and Instrument Diagrams** Prepare P&IDs.
- (13) **Safety Support** Provide safety or engineering analyses in support of WHC's preparation of a Preliminary Safety Analysis Report (PSAR). Preliminary safety analyses for the IPM will be performed concurrently with Title I and Title II design and will culminate in a Preliminary Safety Analysis Report (PSAR). The purpose of the PSAR is to provide sufficient safety analyses to support approval to begin construction. For the IPM, it is possible that two construction phases will be required (early site work and final construction) in which case two PSARs (or a phased PSAR) will have to be prepared. Analyses may include Failure Modes and Effects Analyses for selected systems or subsystems (e.g. DOD, 1980).

The A-E shall prepare selected chapters of the Preliminary Safety Analysis Report (PSAR) in compliance with the DOE Order 5480.23, DOE Order for Nuclear Safety Analysis Reports.
- (14) **Work Planning** Prepare a work plan for the follow-on Title II Design.
- (15) **Risk Assessment** Update the formal Risk Assessment (Section 5.2.19) in light of continuing resolutions to uncertainties performed during Title I.

August 1994

(16) **Hazards and Operability Review Report** Prepare a HAZOP document based on the PHAs prepared during CD (Section 5.2.14..(1)).

(17) **Phased PSAR** Assist WHC in the preparation of a PSAR for an initial phase (if necessary) of construction related to site preparation.

(18) **Title I Report** Prepare a Title I design summary as described in DOE 4700.1

(19) **Permitting Support** Engineering reports and supporting documentation will be needed to expedite the RCRA Part B permit for the design and construction. The A-E shall provide assistance in the preparation of the permit by preparing Chapters 2.0, Facility Description and 4.0, Process Information for the Part B Permit (WAC 173-303).

(20) **National Environmental Policy Act Documentation** Provide data and information to support NEPA documentation preparation.

(21) **System Design Descriptions** Continue development of SDD's.

(22) **Interface Control Drawings** The A-E shall prepare or update ICDs required to integrate the IPM facility with existing site conditions. The A-E shall indicate in the design work plan the schedule for interface information required from WHC.

5.4 TASK B-2 - DETAILED DESIGN OF IPM (TITLE II, OPTIONAL)

If authorized Title II design will complete the design phase of the IPM project and will provide the design media that can be used for the construction phase. Table II contains the preliminary target dates for completion of Task B-2. The principal activities during Title II include:

(1) **Resolve Issues from Title I** Restudy and redesign work resulting from issues carried over from the preliminary design.

(2) **Prepare Detailed Design** Develop final (working) drawings and specifications for procurement and construction.

(3) **Final Cost Estimate** Develop final costs for procurement, site materials, construction, labor, equipment, inspection and testing. These shall include identification of methods of performance and identification of construction packages.

(4) **Safety and Environmental Support** Provide support for analyses of health, safety, environmental, and other project aspects. Perform

August 1994

engineering analyses in support of WHC's preparation of the FSAR for the final phase of construction.

(5) **Risk Assessment** Update the final Risk Assessment document (Section 5.2.19).

(6) **Hazards and Operability Review Report** Update the formal HAZOP document in light of final resolutions to issues.

(7) **Inspection Plan** Prepare a Field Inspection Plan for Title III activities. Update test plan.

(8) **Title II Report** Complete a Title II design report.

(9) **Special Studies** Complete special study tasks, technical services, presentations, discussions and meetings on an "as needed" basis to support IPM final design, procurement and construction.

(10) **Design Review Resolution** The A-E shall prepare, on an electronic data base, a list of all design review comments, and any open items (generated during earlier engineering studies, design stages, or earlier design reviews) for which resolution was deferred to later design stages. The A-E shall monitor and report monthly, or as requested, the status for all comments until they are satisfactorily incorporated into the design or otherwise resolved. The data base shall also include other documented concerns WHC may have.

August 1994

5.5 TASK B-3 - ENGINEERING SERVICES DURING CONSTRUCTION (OPTIONAL)

The IPM will be constructed under lump sum contract agreements with the WHC. Coordination of all site work will be accomplished by the construction manager (TBD). The A-E shall support the construction manager and provide the following engineering services during construction. Additional and/or revised requirements will be described in a separate SOW to be provided in advance of construction.

- (1) **Required Data** Submit information shown in Table III.
- (2) **Vendor Submittals** Check and approve certified vendor information (e.g., all shop drawings and data, maintenance and operating manuals) submitted by construction contractors to assure conformity with the approved design. Assemble certified vendor information files for record documents in accordance with Section 10 (Documents).
- (3) **Engineering Support** Provide engineering review and disposition, to include estimate of cost and schedule impact, of all design field changes and nonconformance reports that may arise during construction, including consultation services by the A-E at the site or other designated location.
- (4) **Fair Cost Estimates** Prepare fair cost estimates for construction bid packages and assist the WHC in post-bid evaluation of construction bids. Prepare estimates for contract modifications as required; evaluate proposals submitted by the construction contractor for such modifications and make recommendations to the CS for use in renegotiating.
- (5) **Inquiries** Consult with and advise WHC when requested concerning any questions that may arise in connection with A-E services described in the contract for A-E services.

August 1994

Table III - Task B-3 Required Data

Document	Submit	Copies	For
Fair cost evaluation ¹⁶ of construction bid	To support bid opening	3	Information
Submittal review--vendor information	Within 15 d (working)	5 + 2 (rep)	Review
Engineering Change Notices (ECNs)	Within 10 d (working)	Original	Approval*

Table IV - Task B-4 Required Data

Document	Submit	Copies	For
Nonconformance reports	Within 5 days (working)	Original	Approval*
Inspection reports	Daily	5	Information
As-Built drawings	120 days-(calendar) following completion of construction	Mylars & CADD Files	Acceptance

rep = reproducible

* Approval authority is based on the change control procedure.

¹⁶ A fair cost evaluation will also involve preparation of a Government Cost Estimate for reconciliation with bids on the selected portion/s of construction; see DOE/MA-0063 Vol. 6.

August 1994

5.6 TASK B-4 - INSPECTION SERVICES DURING CONSTRUCTION (TITLE III, OPTIONAL)

The A-E shall perform field acceptance inspections, on behalf of WHC, which shall include all, or part of following elements. Additional and/or revised requirements will be described in a separate SOW to be provided in advance of construction.

- (1) **Required Data** Information to be submitted is shown on Table IV.
- (2) **Inspection Services** Inspect construction to assure that workmanship, material, and equipment comply with the approved drawings and specifications. Prepare daily inspection reports covering activities at the construction site with emphasis on problem areas, rejected work, changes, and outstanding action items. Prepare punchlists of remaining work and perform final inspection of contractor's work for certification of construction completion. Provide documentation to support acceptance of construction in accordance with the approved inspection plan.
- (3) **Construction Testing Support** Make or procure such field or laboratory tests of construction workmanship, materials, and equipment as may be required.
- (4) **As-Built Documentation** As-built all record drawings and specifications defining the facility as constructed, including critical reference dimension drawings for mountings and clearances for replacement equipment.
- (5) **Acceptance Testing** Witness Acceptance Test Procedures (ATP) and provide engineering disposition of discrepancies noted during testing.
- (6) **Inquiries** Consult with and advise the WHC, as requested, on any questions arising in connection with the A-E services described within this contract.

August 1994

6 PERFORMANCE OF WORK

6.1 PLANNING, GENERAL

For each task or combination of tasks (see Section 5), authorized by WHC, work shall be performed according to plans which the A-E shall prepare and submit for concurrence or approval. Progress and adherence to the plans shall be documented in activity reports as defined in Section 8 (Reports).

Work planning shall address at least the following areas: management, technical, configuration control, schedule, quality assurance, safety, systems engineering, project controls, and document control. The last two areas are covered in other sections of this SOW.

For CD the following plans shall be prepared or, if existing from prior IPM Project work, shall be updated and submitted as required by the A-E's procedures (e.g., QAPP) in order to be current with program requirements, applicable codes, standards, DOE Orders, and with changes in the IPM mission, goals or directions.

- (1) Project Management Plan
- (2) Work Plan
- (3) Quality Assurance Program Plan
- (4) Project Control Plan (Section 7.1)
- (5) Document Control Plan (Section 10.4)
- (6) Design Software Plan (Section 6.5)

6.2 PROJECT MANAGEMENT PLAN

A project management plan shall be prepared by the A-E consistent with the DOE-RL Project Management Plan (PMP) for the Multi-Function Waste Remediation Facility (MWRF) and submitted to WHC for concurrence. This plan shall thoroughly describe the management approach, methodologies, practices, and implementing procedures for the initial conceptual design and for the optional services described in this SOW. It shall clearly delineate and support project management interface requirements between the A-E, WHC, and DOE-RL. This project management plan shall be updated and maintained in accordance with the A-E's internal procedures. In support of the PMP the A-E's Systems Engineering Management and Configuration Management Plans shall also be updated based on the TWRS Systems Engineering Management Plan (DOE-RL, 1994).

August 1994

6.3 WORK PLAN

The objective, approach, and organizational structure intended for use in accomplishing the requested tasks shall be presented in the A-E's Work Plan as updated for each design task (Section 2.1.1). The work to be done for each activity and the method of accomplishment shall be described by WBS. Preliminary method of performance (i.e. performance specification versus definitive design for construction) shall be identified by package or discipline in the proposals, as well as the work plan. In addition, provide the estimated number of conceptual design drawings and specifications for each discipline. The work plan shall provide the following:

6.3.1 Task A-1.2 Work Plan

Identify the objective, approach, organizational structure, and lead individuals assigned. Describe the work to be performed for each element. List specific documents and types of drawings to be produced.

6.3.2 Deliverables

The A-E shall define a list of deliverables for each task authorized. The list shall highlight specific 30% and 60% design completion deliverables (also, see Section 5.2.4 for content of CDR packages for review).

6.3.3 Schedule

A schedule shall be prepared showing the sequence of planned tasks, constraints and interdependence for all activities and milestones for each A-E service. Project milestone control is described in Section 7.4. The weighted percent of work associated with each activity shall be identified. A graphical forecast of total progress shall be shown. The schedule shall be updated monthly to show progress and current schedule. This shall include a comparison of the percent actual against the percent scheduled complete to date, identification of actual or forecast variances from the critical path, and corrective actions to be taken for negative variances.

August 1994

Original milestone dates shall be retained to provide a reference of performance. The schedule section of the A-E's Work Plan shall provide the following:

- (1) **Schedule Type** Provide a network, time phased, resource loaded, logic-based schedule of all tasks consistent with approved A-E procedures.
- (2) **Manpower Input** Provide manpower estimates by discipline and work breakdown structure (WBS).
- (3) **Performance Measurement** Provide a time-phased performance measurement baseline by Contractor Work Breakdown Structure (CWBS).

6.4 QUALITY ASSURANCE PROGRAM PLAN

The A-E shall establish and implement a comprehensive Quality Assurance Program founded on the requirements defined in the American Society of Mechanical Engineers (ASME) NQA-1-1989, Quality Assurance Requirements for Nuclear Facilities (ASME 1989 with addenda 1a-1989, 1b-1991, and 1c-1992); and shall establish a Quality Assurance Program Plan (QAPP) that adheres to the applicable QA requirements of 10 CFR 830, "Nuclear Safety Management, Subpart A, General Provisions", Section 830.120, "Quality Assurance Requirements", Code of Federal Regulations.

Initially, the program shall encompass those QA elements applicable to the design effort. Other QA elements of the program will be added for follow-on services such as construction support and inspection when options for these services are exercised.

August 1994

6.4.1 Quality Assurance Accessibility

The A-E shall provide access to all documents, files, and work stations for purposes of audit or surveillance, by WHC, RL, or their agents, of ongoing activities. The A-E shall provide support, as requested, for audits or surveillances to be conducted by other project participants. The A-E shall, upon request from WHC, submit project implementing procedures for review and concurrence.

6.4.2 Corrective Action

The A-E shall be responsive to deficiencies identified by the Department of Energy (DOE) or WHC, via Quality Assurance, Corrective Action Reports (CAR), Nonconformance Reports (NCR), Audit/Surveillance/Management Assessment Reports, Stop Work Orders, or Reviews/Evaluations. The A-E shall provide input data (i.e., NCR, CAR, Audit Findings, Unsatisfactory Surveillance) and develop a project quality trend program which identifies conditions adverse to quality.

6.5 DESIGN SOFTWARE PLAN

A design software plan shall be prepared by the A-E in accordance with ASME NQA-2-1989, Part 2.7, *Quality Assurance Requirements of Computer Software for Nuclear Facility Applications*. The plan shall be applied for all design software, whether developed in-house, licensed or procured from a commercial vendor, obtained from another organization, or otherwise acquired and used in IPM quality related applications related to design, analysis, evaluation, and assessment of IPM structures, systems, and components.

August 1994

7 PROJECT CONTROL REQUIREMENTS

7.1 GENERAL

The A-E shall prepare and submit for WHC approval a Project Control Plan which describes the management control system for organizing, planning, scheduling, budgeting, authorizing, accounting, controlling and estimating the scope of work.

It shall be the responsibility of the A-E to ensure that the design, procurement and construction costs remain within the baseline Total Estimated Cost (TEC) and schedules established for IPM. Design concepts proposed by the A-E shall be verified as achievable within the project baselines. DOE-RL and WHC shall be advised, in writing, or verbally with follow-on correspondence and an explanation provided, if at anytime the current working estimate exceeds the original baseline cost estimate as amended by approved change requests.

7.2 WORK BREAKDOWN STRUCTURE

The project control plan shall include the Contractor Work Breakdown Structure (CWBS) for all work to be accomplished. All planning and performance measurement shall be structured on the approved CWBS which includes the following criteria and requirements:

- (1) Be compatible with and support the Project Summary Work Breakdown Structure (PSWBS).¹⁷
- (2) Provide a CWBS dictionary description for each element.

¹⁷ A draft copy of the PSWBS is seen in Attachment A. An updated version will be provided by WHC to the A/E prior to start of Conceptual Design.

August 1994

7.3 PLANNING AND BUDGETING

A time phased performance measurement budget baseline (PMB) (man hours and dollars) shall be prepared by the A-E and included in the project control plan. The PMB shall be:

- (1) Consistent with directed work scope, the work plan, WBS, etc.
- (2) Structured by CWBS Level.
- (3) Maintained through change control (A-E and project procedures) and shall be updated periodically.

NOTE: Timetable for incorporation of approved changes into the A-E's budget baseline shall be the first reporting period after change approval.

- (4) At the lowest level, and shall be consistent with and roll-up to the CWBS reporting level baseline (one baseline).
- (5) Prepared to show budgeted cost of work scheduled (BCWS) spreads at the lowest level of the CWBS, including the earned value methodology to be used. The A-E shall delineate the method in the A-E work plan.

All A-E detailed budget information (man hours and dollars) below the CWBS level shall be available for review by WHC and DOE as required.

7.4 SCHEDULES AND MILESTONE CONTROL

The A-E shall prepare, submit, and maintain critical path automated logic network schedules for all activities that are compatible with the CWBS. Schedules shall meet the following criteria:

August 1994

7.4.1 Schedules

Schedules shall be:

- (1) Consistent with the identified work scope, PMB (Budget Baseline), work plan, WBS, etc.
- (2) Statused monthly using a bar-chart format for presentation purposes.
- (3) Supported by lower level activity and task plan schedules (as required) to manage the work that will roll up to give status on logic network schedules.

7.4.2 Milestones

The A-E and WHC will develop, and the A-E will status monthly, a list of control milestones to meet the following criteria:

- (1) Milestones will be subject to change control in accordance with approved procedures (Section 7.5) and the terms and conditions of the contract for A-E services.
- (2) Milestones shall include activity completion dates, client review dates, etc. as selected from the CD work plan.

7.5 CHANGE CONTROL

Any deviation from established baselines is considered a change. Change control shall be imposed throughout the life of the project, including the A-E's effort. All changes to established baselines must be defined, justified, and approved in accordance with the approved project change control procedure TWRS-PIP-2.2, WHC Manual WHC-IP-0944. The A-E shall implement a system to control the initiation, evaluation, coordination, approval, and implementation of all changes to the project cost, schedule, or technical baselines. The system shall control documentation of each change in an accurate and timely manner and shall maintain traceability to the preceding documentation. Procedures required to implement the system shall be included in the A-E's project management procedures manual. The A-E shall submit the change control procedures with the Project Control Plan for WHC acceptance.

August 1994

This page is intentionally left blank.

August 1994

8 REPORTS

8.1 MONTHLY PERFORMANCE/STATUS REPORTS

Beginning with Conceptual Design, the A-E shall provide monthly activity status reports. This report shall be submitted on or before the 15th working day of each month (for the previous month) and shall be formatted as mutually agreed to with the WHC BTR. Consistent with the reporting needs of each phase of design, the following information shall be considered for inclusion:

- (1) Project Manager's narrative highlights and status assessment for each CWBS element including activities planned for the next month.
- (2) Issues/Concerns (cost, schedule, technical), recommended resolution, and progress towards resolution.
- (3) Agreements and/or commitments for problem or technical issues resolution.
- (4) Complete DOE "cost performance report" formats 1 and 3 and variance analysis (reference: DOE Order 1332.1A) at the CWBS level.

NOTE: Variance analysis shall be on the current month reporting period, plus cumulative-to-date, and shall include:

- (a) Cause, effect and corrective action
 - (b) Variance analysis shall be prepared at the CWBS Level with explanation lower as required to adequately address problems (offsetting variances, etc.).
 - (c) Variance analysis thresholds (current month and cumulative date) shall be as agreed to between the WHC and the A-E.
- (5) Status reports of critical path logic network schedules and a forecast of schedule impacts including a log of control milestones status with a six month forecast of upcoming milestones.
 - (6) Staffing status including planned and actual staff.

August 1994

8.2 MISCELLANEOUS ACTIVITY REPORTS

Miscellaneous activity reports include:

- (1) Weekly Reports on Critical Issues. Identification of an issue as "critical" shall be by mutual agreement between the A-E and WHC. Examples of critical issues include those that would require prioritization for resolution by the A-E in order to avoid adverse affects on meeting cost, schedule, or technical criteria.
- (2) Topical Reports, as requested.

8.3 CONCEPTUAL DESIGN REPORT

The CDR for the IPM shall consist of a summary of activities performed during the conceptual design effort and shall comply with the minimum requirements of DOE Order 4700.1. The CDR contents shall be mutually agreed to between the A-E and WHC and, when complete, shall be submitted for WHC approval. The WHC approved CDR, which may also be approved by RL or its designee, will form the project baseline (cost, schedule, and technical) supporting KD-1.

August 1994

9 MEETINGS

9.1 MEETING MINUTES

The A-E will be responsible for issuing meeting minutes within ten days of the meetings described as follows.

9.2 KICK-OFF MEETING

A kick-off meeting will be held after the award of contract at the Hanford Site. These meetings will focus on a discussion of the project scope and a review of the construction site. Pertinent documents will be distributed and discussed. The participants in the meeting will include DOE-RL, WHC, and the A-E as a minimum. The purpose of these meetings is to provide the A-E with additional information as required to accomplish the design task.

9.3 MONTHLY REVIEW MEETINGS

Monthly meetings shall be held at the A-E's office, or other location mutually agreeable between the A-E and WHC, to review progress of the A-E's work for the previous month. During these meetings, the A-E shall present project technical, cost, and schedule status, identify existing or anticipated problem areas (including impacts), and report on progress toward resolution of problems. The A-E shall issue the meeting agenda 5 working days before the meeting and shall prepare and distribute the meeting minutes within 10 working days after the meeting. Minutes shall emphasize agreements, commitments, and planned actions. The specific content for review meetings will be determined by mutual agreement between the A-E and WHC.

Additionally, the A-E shall support the IPM project monthly Management Review Meeting held for RL to review the progress of the previous month's period for all project participant's work scope areas.

August 1994

9.4 DESIGN REVIEW MEETINGS

Design Review (DR) meetings shall be held to assure that the design objectives are being achieved. The design reviews shall be indicated on the activity schedule and shall require the concurrence of WHC. The DR's will be held at the site selected by the A-E, with the concurrence of WHC. Design reviews will normally be held at approximately the 30%, 60% and final, or 90% stages of Conceptual design or as mutually agreed to between WHC and the A-E. See Section 5.2.4 for the content of conceptual design review packages.

9.5 COORDINATION

Coordination meetings will be held as required between the DOE-RL/WHC and the A-E to review project business. These meetings will be informal and can be called by any of the parties. These meetings will be held primarily at the A-E's office. Agreements and commitments must be signed, implementing necessary changes or corrective actions within assigned responsibility and authority. The agreements and commitments are not a medium for scope, cost, schedule, or baseline changes.

August 1994

10 DOCUMENTS

10.1 DOCUMENT TYPES

Record documents and contract documents will be generated during the course of the design.

10.2 DESCRIPTION

Record documents are those design end-item documents required by this Statement of Work and are identified in 10.10 (Design End Items). Record documents include drawings, specifications, and supporting documents (SD numbered). Supporting documents are released and controlled within WHC's document control system in accordance with WHC-CM-6-1, Standard Engineering Practices, EP-1.12.

Contract documents are those documents implementing the contract and include the contract, and all requirements, references, and other related documents.

10.3 GENERAL DATA

All data prepared for drawings, reports and other documentation shall utilize the Metric system (RL, 1994) for weights and measures unless formal waiver is issued by RL to WHC. The implementation of the metric system shall be deferred by the A-E until the start of (optional) Title I design to allow for updating data and computer design systems.

10.3.1 Computer-Aided Design and Drafting

All drawings shall be provided by computer-aided design and drafting (CADD). Any exceptions shall be identified and submitted for approval. Implementation of CADD on the project shall contain the following items.

(1) **General Requirements** All drawings shall be prepared with commercially available software capable of three-dimension depiction and shall be in compliance with the latest revision of the Hanford Plant Standards, Standard Design Criteria, SDC-1.3.

(2) **Construction Drawings** The A/E shall include in its proposal the approach for producing construction drawings on electronic media. The approach shall not only optimize detail design costs, but also must consider the cost benefits during construction and operation.

August 1994

(3) **Software Compatibility** Provide design media on CADD files, as requested, for use by DOE-RL, WHC, or other contractors at the Hanford Site. At completion of final (Title II) design, the design media shall be compatible for up-loading to CADD/Database software that is currently being used by the on-site Engineer Constructor (Kaiser Engineers Hanford) and is planned by WHC for use during construction and follow-on operation of the IPM. The A-E will be notified by WHC before the start of Title II design regarding the type of CADD/Database software that is planned for construction and operation. For the operating phase of the IPM the electronic design media will be integrated with database systems used for retrieval of CVI data on specific equipment, maintenance logs, configuration management, and other operations support functions.

10.3.2 Other Documents

All documents prepared by the A-E shall produce a legible image from microfilm at 50% blow-back size of the original document.

All documents, except drawings, shall be 8 1/2 by 11 in. or 11-in. run.

Full size drawings shall be 28 by 40 in. and reduced size drawings shall be 14 by 20 inches. Drawings or sketches included in topical reports shall be no larger than 11 by 17 inches. Drawing sizes other than those listed may be accepted on a mutually agreed basis.

Record documents shall be prepared on the A-E's standard forms. These forms shall be listed in the status listing defined in 10.8 (Status Listing).

Mylars for drawings shall be furnished by the A-E pending approval of WHC.

10.4 DOCUMENT CONTROL

Preparation, identification, approval, transmittal, and final disposition of new and revised record documents shall conform to the A-E's established procedures or special instructions.

Use of contract documents shall be controlled in accordance with the A-E's established procedures or special instructions.

Oral communications having an impact on the work shall be confirmed in writing by the A-E at the earliest opportunity.

10.5 DOCUMENT IDENTIFICATION AND FORMAT

August 1994

10.5.1 Numbering System

The A-E is required to use the Hanford Site numbering system (Ref: HPSDCM) for all documents (drawings and specifications), mechanical equipment, piping, electrical systems, etc. The numbering system as well as drawing numbers will be provided by WHC.

10.5.2 Traceability

A drawing traceability list (Ref: HPSDCM) shall be included near the title block to provide an auditable trail forward and backward between existing drawings and new revised drawings.

Each drawing shall include a list of reference drawings to define interfaces.

August 1994

10.5.3 Format

Each record document shall show:

- (1) Project and contract identification.
 - (a) Initial Pretreatment Module (IPM)
 - (b) Project number: W-236B
 - (c) Contract number: TVW-SVV-063869 (DE-AC06-93RL12472)¹⁸
- (2) Originating firm's name.
- (3) End item document title.
- (4) WBS number (when applicable).
- (5) Document level of approval.
- (6) Document identification number (on each page).
- (7) Document descriptive title.
- (8) Revision or addendum number or letter (on each page with revised portion of page indicated).
- (9) Issue or revision date (released documents only).
- (10) Authorized use stamp (e.g. draft, for approval, approved for construction, proprietary information, etc.).
- (11) Total number of pages and number of each page (e.g. page 1 of 4)
- (12) Table of contents or attachments (as needed).
- (13) Approval signature and title of responsible person in originating firm (released documents only).

¹⁸ Documents satisfactorily completed under RL Contract 93-RL-12472, prior to the A/E contract turnover from DOE-RL to WHC, will be acceptable without revision of identifier numbers.

August 1994

10.6 DOCUMENT APPROVAL

All design drawings submitted for comment or review by DOE-RL and WHC shall first be reviewed by the A-E's QA and drafting checker personnel prior to submittal. Design drawings, reports, and documents submitted for WHC acceptance or approval shall first be complete and approved by the A-E.

Documents submitted in compliance with earlier work on this contract shall be reviewed for applicability to current work scope and, if necessary, shall be updated and resubmitted for acceptance/approval or information, as applicable.

Acceptance by WHC is the act of reviewing an activity or document and acknowledging that it may be used for the purpose intended at that time. Acceptance does not assure that future changes will not be required, and does not convey or imply approval of or assumption of responsibility for the activity or document. The originator remains fully responsible for all aspects of the activity or document, for fulfilling all specifications, and for any other obligation or liability otherwise arising under a specification, agreement, or contract.

10.7 DOCUMENT TRANSMITTAL

Unless otherwise agreed upon, transmittal of record documents shall include 20 copies. For documents larger than 8 1/2 by 11 in., full-size, photo-quality reproduces shall be included. Transmittal of record documents produced electronically shall include a copy of the tape identified by directory and data set file names in addition to the hard copies. Transmittals shall be documented on a suitable, sequentially numbered form containing a standard document identification number, distribution, and space for reviewers to note the disposition of listed attachments in accordance with the A-E document transmittal procedure.

10.8 STATUS LISTING

The A-E shall prepare an index to show the status of end item documents. The index shall be updated at least monthly and shall be maintained for the duration of the applicable contract activity (e.g. CD, Title I, Title II, etc.). An information copy of the index shall be transmitted to WHC on a monthly basis. For each document, the index shall identify the effective issue and the applicable control information listed as follows:

- (1) End item number and title
- (2) Level of approval obtained
- (3) Document identification number.

August 1994

- (4) Document descriptive title.
- (5) Latest revision number.
- (6) Status (e.g., in checking, approved with comment, etc.).
- (7) Transmittal number.

NOTE: Drawings listed on a separate drawing control list are not required on this listing.

10.9 RECORD FILES AND OBJECTIVE EVIDENCE

Record files with current and prior revisions shall be maintained for record documents in accordance with the A-E's approved QA plan. At the conclusion of the design and construction phase, WHC will advise the A-E of their disposition. The A-E shall keep redundant copies of data needed to meet code or legal requirements.

Objective evidence is test material and unreduced data supporting record documents. Objective evidence includes, but is not limited to, material samples used in examinations and tests, instrument records, radiographs, and photographs.

Unless needed for evaluation of a nonconformance or other special use, objective evidence will not be distributed. A "record only" transmittal should be issued with the objective evidence listed in the document index and retained with the record files.

August 1994

10.10 DESIGN END ITEMS

The following tables show deliverable design end items, responsibility and approval levels, and schedule information related to each of the tasks defined in Section 5.

Table V - Task A-3, Conceptual Design End Items					NOTE ¹⁹
<u>ITEM</u>	<u>Ref:</u>	<u>A-E</u>	<u>WHC</u>	<u>DOE</u> <u>/RL</u>	<u>SCHEDULE</u>
Criteria review report	5.2.1	P/A	R/Ac	R	Within 20 calendar days after notice to proceed (ANTP)
Work Plans	5.2.2 5.2.14	P/A	R/Ac	R/I	Within 30 calendar days ANTP
Project Management Plan	6.2	P/A	R/Ac	R/I	Within 60 calendar days ANTP
Quality Assurance Program Plan	6.4	P/A	R/Ac	R/I	Within 60 calendar days ANTP
Project Control Plan	7.1	P/A	R/Ac	R/I	Within 60 calendar days ANTP
Document Control Plan	6.1	P/A	R/Ac	R/I	Within 60 calendar days ANTP
CDR Drawings	2.2.1.3	P/R	R	R	30% & 60% of CD
Project Estimate and Schedule	2.2.1.3	P/R	R	R	90% CD, AWP

¹⁹ P=PREPARE, A=APPROVAL, Ac=ACCEPTANCE, I=INFORMATION, R=REVIEW, RFC=RELEASE FOR CONSTRUCTION, AWP=IN ACCORDANCE WITH THE APPROVED WORK PLAN

August 1994

Table V, Continued

<u>ITEM</u>	<u>Ref:</u>	<u>A-E</u>	<u>WHC</u>	<u>DOE</u> <u>/RL</u>	<u>SCHEDULE</u>
Final CDR	5.2.3	P/A	R/A	A	AWP
Final Project Estimate	5.2.3 5.2.17	P/A	R/A	A	AWP
Final Project Schedule	5.2.3 5.2.15	P/A	R/A	A	AWP
Review Assessment of Site Selection Study	5.2.13	P/A	R/Ac	R/I	30% CD
Outline Procurement Specification	5.2.6	P/A	R/Ac	R/I	With CDR
Topical Reports, Special or Trade Studies	5.2.7	P/A	R	R	As Required
Life Cycle Cost Analysis	5.2.18	P/A	R/Ac	R/I	With CDR
Formal Risk Assessment	5.2.19	P/A	R/Ac	R/I	With CDR
Drawings & Specification List	5.2.21	P/A	R/Ac	R/I	With CDR
Shielding Calculation Methods	5.2.22	P/A	R/Ac	I	30% CD
Identification of Development and Testing Needs	5.2.23	P/A	R/Ac	R	As Required
Design Software Plan	6.5	P/A	R/Ac	R/I	With Work Plan

August 1994

Table VI - Tasks B-1 and B-2 - IPM Title I and Title II Designs (Optional)

<u>ITEM</u>	<u>A-E</u>	<u>WHC</u>	<u>DOE /RL</u>	<u>SCHEDULE</u>
Work Plans	P/A	R/Ac	R/I	Prior to each design effort
Title I Design Report	P/A	R/Ac	R/I	AWP
Title I Cost Estimate	P/A	R	R	AWP
Title II Cost Estimate	P/A	R	R	AWP
Updated Construction Schedule	P/A	R/Ac	R	AWP
Interface Control Drawings	P/A	R/A	I	AWP
Design Calculations	P/A	I	I	AWP
Technical Reports	P/A	R	I	AWP
Construction and Procurement Specifications	P/A	R/RFC	R/C	60% review & Final
Final Design Media	P/A	R/RFC	R/C	60% review & Final
Final Construction Cost Estimate (where applicable)	P/A	R/Ac	I	AWP
QA Program Plan Update	P/A	Ac	R	AWP
Design Reports after Design Completion	P/A	R/Ac	R/I	3 Months

August 1994

Table VII - Task B-3, Engineering Services During Construction (Optional)

<u>ITEM</u>	<u>A-E</u>	<u>WHC</u>	<u>DOE</u> <u>/RL</u>	<u>SCHEDULE</u>
Submittal Reviews	A	Ac	R	As Needed
Engineering Change Notice	P/A	P/A	P/A	As Needed
Nonconformance Reports	P/A	R/A	R/A	As Needed

Table VIII - Task B-4, Inspection Services During Construction (Title III, Optional)

<u>ITEM</u>	<u>A-E</u>	<u>WHC</u>	<u>DOE</u> <u>/RL</u>	<u>SCHEDULE</u>
As-Built Drawings	P/A	R		AWP
Critical Reference Dimension Drawings	P/A	A		As Needed
Inspector's Log	P/A	I	I	As Needed
Official Acceptance of Construction ²⁰	A	P/A	A	AWP

²⁰ Ref: RLIP 4700.1A, Attachment X-1

August 1994

11 REFERENCES

11.1 PROJECT BASELINE DOCUMENTS

WHC, 1994, *Functions and Requirements Project W-236B, Initial Pretreatment Module*, WHC-SD-W236B-FRD-002, Revision 0.

EBASCO/BNFL, 1994, *Initial Pretreatment Module, Project Design Criteria*, E/B-SD-W236B-PDC as amended.

DOE, 1989, *General Design Criteria, DOE Order 6430.1A*, U.S. Department of Energy, Washington, D.C..

11.2 PROJECT BACKGROUND DOCUMENTS

KEH, 1993, *Engineering Report, Initial Pretreatment Module, Project W-236B*, WHC-SD-W236B-ER-001, Rev 0

WHC, 1993, *Project 94L-EWW-236B, Initial Pretreatment Module, Hot Test Facility Conceptual Design Criteria*, WHC-SD-W236B-CDC-002, Rev 0 (Draft, WHC-Approved) September 1993.

EBASCO/BNFL, 1993, *Initial Pretreatment Module Review Report, 30% Conceptual Design*, E/B-SD-W236B-RPT-001-Rev 0A, November 1993.

KEH, 1992, *Engineering Study for the Initial Pretreatment Module, Project W-236B*, WHC-SD-W236B-ES-001, Rev. 0, October 1992.

WHC, 1993, *Functional and Operational Requirements for the Initial Pretreatment Module (IPM) Project W-236B*, WHC-SD-W236B-FDC-001, Draft February 1993, to be superseded by "Functions and Requirements" document WHC-SD-W236B-FRD-002 in Section 11.1, above.

WHC, 1994, *Functions and Requirements for the Cesium Demonstration Unit*, WHC-SD-W236B-FRD-001 (Draft, WHC-Approved), March 1994.

EBASCO/BNFL, 1994, *Initial Pretreatment Module, Conceptual Design Report, Cesium Demonstration Unit, 100% Conceptual Design*, E/B-SD-W236B-RPT-008-Rev 0B, March 1994.

August 1994

11.3 SUPPORTING REFERENCES

- DOD, 1980, *Procedure for Performing Failure Modes, Effects & Criticality Analyses*, MIL-STD-1629A, Department of Defense, Washington, D.C., November 1980.
- 10 CFR 830 "Nuclear Safety Management, Subpart A, General Provisions", Section 830.120, "Quality Assurance Requirements" *Code of Federal Regulations*, as amended.
- 40 CFR 1508.13 "Finding of no significant impact." *Code of Federal Regulations*, as amended.
- WAC 173-303, *Dangerous Waste Regulations*, Washington Administrative Code, Olympia, Washington.
- Ecology, EPA, and DOE, 1994, *Hanford Federal Facility Agreement and Consent Order*, Fourth Amendment, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.
- DOE-RL, 1994, *Tank Waste Remediation System, Systems Engineering Management Plan*, DOE/RL-93-0106, Annex 2, March 1994 (Draft)
- DOE-RL, 1994, Letter, John D. Wagoner to Contractors, Richland, Washington, *Hanford Metric Implementation Plan Endorsement*, 94-PMD-133, June 24, 1994
- DOE, 1992, *Nuclear Safety Analysis Reports*, DOE Order 5480.23, U.S. Department of Energy, Washington, D.C..
- DOE, 1985, *Uniform Reporting System*, DOE Order 1332.1A, U.S. Department of Energy, Washington, D.C..
- DOE-RL, 1991, *Project Management System*, RLIP 4700.1A, U.S. Department of Energy-Richland Operations Office, Richland, Washington.
- DOE, 1987, *Project Management System*, DOE Order 4700.1, U.S. Department of Energy, Washington, D.C..
- WHC-IP-0944, "Baseline Change Control, TWRS-PIP-2.2", *Tank Waste Remediation System, Projects Integrating Procedures*, Westinghouse Hanford Company, Richland, Washington.

August 1994

EBASCO/BNFL, 1994, "Initial Pretreatment Module, Cesium Demonstration Unit",
Hazards and Operability Review Report, E/B-SD-W236B-RPT-010, Rev. 0C,
May 16, 1994.

HPSCDM, "Preparation and Control of Engineering and Fabrication Drawings,
SDC-1.3, *Hanford Plant Standards, Design Criteria*

EBASCO/BNFL, *Conceptual Design Trade Off Study and Development Schedule*,
IPM-PD-94-045, February 2, 1994.

WHC, 1993, *Letter of Instruction - Conceptual Design of Cesium Demonstration
Unit*, 7F420-93-009, December 6, 1993.

EPA, *Resource Conservation Recovery Act (RCRA)*, Environmental Protection
Agency, as amended.

WHC, 1994, *Review Comment Record (RCR)*, W-236B CDR 100%, March 24, 1994

August 1994

12 ACRONYMS

A-E	Architect-Engineer
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ATP	Acceptance Test Procedure
BA/BO	Budget Authorized/Budget Obligated
BTR	Buyer's Technical Representative
CADD	Computer-aided design and drafting
CD	Conceptual Design
CDC	Conceptual Design Criteria
CDU	Cesium Demonstration Unit
CPM	Critical Path Method
CPU	Compact Processing Unit
CS	Buyer's Contract Specialist
CSI	Construction Specifications Institute
CWBS	Contractor Work Breakdown Structure
DOE	U.S. Department of Energy, Headquarters
E/C	Engineering/Constructor Contractor
F&R	Functions and Requirements
FAT	Factory Acceptance Test
FMEA	Failure Modes Effects Analyses
FSAR	Final Safety Analysis Report
GCC	General Construction Contractor
GFE	Government-Furnished Equipment
HAZOP	Hazards and Operability Review Report
HTF	Hot Test Facility
ICD	Interface Control Drawing
IPM	Initial Pretreatment Module
MW	Mixed Waste
P&ID	Piping and Instrument Diagram
PCDR	Pre-Conceptual Design Report
PDC	Project Design Criteria
PMB	Performance Measurement Baseline
POP	Period Of Performance
PSAR	Preliminary Safety Analysis Report
PSE	Preliminary Safety Evaluation
PSWBS	Project Summary Work Breakdown Structure
QA	Quality Assurance
R&D	Research & Development
RAM	Reliability, Availability, and Maintainability
RL	Richland Field Office, U.S. Department of Energy
SDD	System Design Description
SOW	Statement of work
TEC	Total Estimated Cost
TPC	Total Project Cost
WBS	Work Breakdown Structure

August 1994

APPENDIX A - PROJECT SUMMARY WORK BREAKDOWN STRUCTURE

(DRAFT)

August 1994

This page is intentionally left blank

August 1994

IPM PSWBS

August 1994

This page is intentionally left blank

August 1994

APPENDIX B - TANK WASTE REMEDIATION SYSTEM WORK BREAKDOWN STRUCTURE
DICTIONARY

JUNE 9, 1994

August 1994

This page is intentionally left blank.

August 1994

Tank Waste Remediation System Work Breakdown Structure
Dictionary.

1. PROGRAM TITLE/PARTICIPANT 1.1.1 TWRS Program 1.1.1.3 Process Tank Waste/WHC/PNL	2. DATE PREPARED June 9, 1994	3. IDENTIFICATION NUMBER DE-ACO6-87RL10930
4. WBS ELEMENT CODE/LEVEL 1.1.1.3.01/IV	5. WBS ELEMENT TITLE Waste Pretreatment	
6. WBS INDEX LINE NO. 66	7. CURRENT REV NO. 1	8.EFFECTIVE REVISION DATE June 13, 1994
9. APPROVED CHANGES N/A	10. ADS/TDD NUMBER 1220-0	
11. SYSTEM ENGINEERING ARCHITECTURE REFERENCE NUMBER 4.2.2 Process Waste, 4.2.2.1 Pretreat Waste, 4.2.2.1.1 Pretreat Sludges/Solids, 4.2.2.1.2 Pretreat Supernatants	12. ADS/TDD BUDGET AND REPORTING NUMBER EW3130010	

13. ELEMENT DESCRIPTION

A. COST CONTENT

Resource category	Resource Name	1994 unescalated)
M0	MANAGERS	82,197
E0	ENGINEERS	129,528
S0	SCIENTISTS	16,349
P0	ADMINISTRATION & OTHER PROFESSIONAL OCCUPATIONS	27,669
T0	TECHNICIANS	127,153
C0	CRAFTS	102,168
R0	OPERATORS	228,961
L0	LABORERS	57,038
G0	GENERAL ADMINISTRATION/SECRETARIAL/CLERK	127,460
W7	EXEMPT	0
W8	NON-EXEMPT	0
W9	BARGAINING UNIT	7,142
23	WHC ADMINISTRATION MATERIALS	169,025
10	PROCUREMENT MATERIALS	505,147
3R	KEH	3,438
3D	PNL	96,349
21	CONTRACTS NOT KEH/PNL	
5X	ASSESSMENTS	52,598
3X	DOE/NATIONAL LABS	8,595
Z	CANDIDATE OR VALIDATED PROJECTS	987,469

PRETREAT-1

August 1994

TOTAL COST	
------------	--

B. TECHNICAL BASES

The functional products of Waste Pretreatment are pretreated supernatants and pretreated sludges/solids which meet the feed specifications of the low-level waste (LLW) and high-level waste (HLW) vitrification facilities, respectively. This program element is scheduled for completion in March 2022, six years and nine months ahead of the scheduled date of December 2028, contained in the Fourth Amendment of the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement). Early completion of Waste Pretreatment is driven by the schedule needs of the Waste Retrieval program element to retrieve all single-shell tanks (SSTs) by September 2018 (M-45-05). Additional double-shell tank (DST) space would be needed to accumulate retrieved SST waste for the period between completion of waste retrieval and completion of waste pretreatment if the Tri-Party Agreement schedule of December 2028 were used. After the supernatants and sludges/solids have been pretreated, the respective facilities will be cleaned out and placed in a shutdown mode in preparation for decommissioning. The standard for cleanup of the facilities for decommissioning will be established by the Environmental Restoration Program. Initial standards for pretreatment of supernatants and sludges/solids will be provided as preliminary feed specifications for the LLW and HLW vitrification facilities by the end of fiscal year 1994. Since a definitive feed specification is not available to meet the requirements of a low-shielded LLW vitrification facility and LLW disposal, the program element is proceeding at high risk in the near-term. The risk to HLW pretreatment is the uncertainty of the processing requirements to achieve a "reasonable" volume of HLW. The foregoing risks are increased due to the lack of sufficient characterization data on tank waste. Actions are being taken to reduce the risk by accelerating laboratory and bench-scale testing using actual waste and providing a hot pilot-scale testing capability for testing unit operations. The results of hot testing will be fed into trade studies to assist in validating the technical baseline assumed.

With respect to pretreated sludges/solids, two approaches bound the possible methods for separation of Hanford tank waste into low-activity and high-activity fractions for disposal. These approaches are minimum separations (in-tank sludge washing and enhanced sludge washing), which is the planning technical baseline selected, and minimum HLW/transuranic (TRU) volume (advanced sludge separations), which is an alternative. The selection of a waste separation approach is influenced requirements for deep geologic disposal of HLW and disposal of LLW. Geologic repository volume limitations have not been established. Therefore, uncertainty exists as to the acceptability of either approach for separation of tank waste. The planning baseline of minimum separations will be validated by laboratory and bench-scale testing using actual waste, parametric studies, and trade studies. An evaluation of the decision on whether advanced sludge separation processes are required to further minimize HLW/TRU volume is expected to be completed in March 1998 (TPA M-50-03). No risk to the cost or schedule baselines will be experienced if it is decided that minimum separations will result in a reasonable HLW/TRU volume. Significant risk to both the cost and schedule baseline would result from a decision to pursue advanced separations to minimize HLW/TRU volume.

With respect to pretreated supernatants, two approaches have been identified for removal of radionuclides from supernatant streams. These approaches are removal of cesium only, which is the planning technical baseline in the Tri-Party Agreement, and removal of other radionuclides, which is the alternative. The selection of a radionuclide removal approach is influenced by the design of the LLW vitrification facility and the requirements set forth in the performance assessment for disposal of LLW which are currently being prepared. The design concept of a low-shielded LLW vitrification facility influences the degree of cesium and strontium removal that must be achieved in the LLW pretreatment facility. The performance assessment for disposal of LLW influences the degree of technetium and TRU removal that must be achieved in the LLW pretreatment facility. If it is determined that strontium and/or TRU removal is needed, the plan for retrieval of tank waste can be adjusted to first retrieve and process waste requiring cesium removal only, while deferring retrieval of waste requiring strontium and/or TRU removal. This will provide additional time to develop and incorporate strontium and/or TRU removal processes into the LLW pretreatment facility. On the other hand, if technetium removal is required, it must be accomplished at the start of supernatant pretreatment because double-shell slurry feed (DSSF), the first waste to be pretreated, contains higher levels of technetium than wastes to be processed later. The tanks containing DSSF must be retrieved and processed first to free up DST space for storing/blending retrieved SST waste prior to pretreatment and for storing/blending pretreated supernatants prior to vitrification in the LLW vitrification facility. The risk to the technical baseline associated with strontium

PRETREAT-2

August 1994

and/or TRU removal involves cost risk only. It is anticipated that the baseline schedule could be achieved because only a portion of the waste would require strontium and/or TRU removal. The risk to the technical baseline associated with technetium removal is a risk to both cost and schedule since this would require modifications to the LLW pretreatment facility and delay startup.

There are additional uncertainties that may result in technical, cost, or schedule risk. These include:

- Regulatory "creep," which may add requirements to the design, construction and operation of pretreatment facilities
- Ability of the Tank Farm infrastructure to support the numerous waste transfer and processing activities to support tank cleanup (e. g., retrieval, LLW pretreatment, HLW pretreatment, LLW vitrification, HLW vitrification, liquid evaporation, liquid effluent treatment and disposal, etc.).
- Maintaining design basis total operating efficiency (TOE) due to technical and conduct of operations issues
- Lack of sufficient tank space and/or waste transfer capability to blend waste feed to pretreatment facilities and vitrification facilities
- The possible need for one or more additional LLW forms to handle potential problems with the disposal of some chemicals in the pretreated supernatant
- Disposal of large quantities of radioactive solid waste and ion-exchange resins

The Waste Pretreatment Program Element is part of the Level III WBS element, Process Tank Waste, and is comprised of six Level V activities:

- 1.1.1.3.01.01, Technical Planning and Integration
- 1.1.1.3.01.02, Technology Development and Applied Engineering
- 1.1.1.3.01.03, Facility Operations
- 1.1.1.3.01.04, Systems Definition
- 1.1.1.3.01.05, W-236B Pretreatment Facility
- 1.1.1.3.01.06, High Level Waste Pretreatment

Goals and objectives:

Waste pretreatment will be required to partition HLW and TRU wastes stored in DSTs and SSTs. Product streams from waste pretreatment provide feed for LLW and HLW immobilization facilities. Waste pretreatment will develop required technologies, operate pretreatment facilities, and provide and operate hot test facilities for pretreatment technology development as well as provide feed materials for HLW vitrification waste form qualification.

Major end-item deliverables:

- Design, construction and operation of LLW pretreatment facilities (Modules 1 and 2) and pretreatment of supernatants to provide feed to the LLW vitrification facility.
- Operation of in-tank processes to pretreat sludges/solids to provide feed to the HLW vitrification facility.
- Design, construction and operation of HLW pretreatment facility to process sludges/solids requiring additional pretreatment to meet HLW vitrification feed specifications and/or to further reduce the volume of HLW.

PRETREAT-3

August 1994

- Evaluation of enhanced sludge washing.
- Complete pretreatment processing of Hanford tank waste (TPA M-50-00), clean out and shut down pretreatment facilities, and turn over facilities to the Environmental Restoration Program for decontamination and decommissioning (D & D).

Acceptance criteria:

- Pretreated supernatants will meet the feed specifications of the LLW vitrification facility and the processing schedule requirements of Waste Retrieval and LLW vitrification.
- Pretreated sludges/solids will meet the feed specifications of the HLW vitrification facility and the processing schedule requirements of Waste Retrieval and HLW vitrification.

Waste types generated:

- Off gas: Yes
- Effluents: Yes
- Solid waste: Yes

C. STATEMENT OF WORK

Activities leading to the completion of pretreatment processing of Hanford tank waste include the processing of the waste from the 149 SSTs, 28 DSTs, new DSTs, and liquid radioactive waste generated during tank cleanup operations.

Required activities over lifetime

Pretreatment processing includes operation of the facilities described below. The functions executing the work include National Laboratories needed that develop processes used in the facilities; process and system engineers who establish the functions and requirements, develop process flowsheets, and prepare process specifications; Architect Engineer(s) who design and inspect facilities to be constructed; construction contractor(s) who construct facilities; and operations, maintenance, and engineering staff who operate, clean out and shut down the facilities for turnover to the Environmental Restoration Program for D & D.

- LLW Pretreatment Facility Module 1. This facility will be operated for approximately 16 years months (December 2004 to March 2021) to remove cesium and strontium from tank waste. The resulting liquid LLW will be blended and stored to feed the LLW vitrification facility scheduled to initiate hot operations in June 2005 (TPA M-60-05). The liquid HLW separated from tank waste in the LLW pretreatment facility will be blended and stored to feed the HLW vitrification facility scheduled to initiate hot operations in December 2009 (TPA M-51-03). After completion of waste pretreatment the facility will be cleaned out and placed in a shutdown mode over a period of 12 months during which it will be prepared for decommissioning. At the end of this activity the facility will be turned over to the Environmental Restoration Program for decommissioning in approximately March 2022.

PRETREAT-4

August 1994

- **LLW Pretreatment Facility Module 2.** This facility will be operated for approximately 14 years (December 2005 to June 2020) to provide an increased processing capability. Module 2 will include additional separations capability to remove strontium and TRU from complex waste as well as technetium removal, if required, for disposal of LLW. The resulting liquid LLW and HLW streams will be handled as described for Module 1. Facility cleanout and shut down will be handled as described above for Module 1, except turnover to the Environmental Restoration Program for decommissioning will occur approximately June 2021.
- **In-Tank Processing.** Preparations for in-tank processing are currently planned for September 1997 to October 1998. In-tank processing will be operated for approximately 21 years (November 1998 to June 2020). In-tank processing deals with separating the insoluble solids (containing most of the radionuclides) from the liquids (containing most of the cesium and other soluble compounds) using the existing and future underground waste tanks and Tank Farms infrastructure. The resulting pretreated solids will be blended and stored to feed the HLW vitrification facility, and the liquid LLW, including water used to wash the solids, and will be fed to the LLW pretreatment facilities (Modules 1 and 2) for removal of cesium and other radionuclides. Cleanout and turnover of the Tank Farm facilities to the Environmental Restoration Program is the responsibility of other program elements, Waste Pretreatment and Tank Farms Operations and Maintenance.
- **HLW Pretreatment Facility.** This facility will be operated for approximately 12 years (June 2008 to June 2020) to provide additional capability to pretreat HLW waste, if required. The resulting liquid LLW and HLW streams will be handled as described for the LLW pretreatment facility (Module 1). After completion of HLW waste pretreatment, the facility will be cleaned out and placed in a shutdown mode over a period of 12 months during which it will be prepared for decommissioning. At the end of this activity the facility will be turned over to the Environmental Restoration Program for decommissioning in June 2021.

Interfaces:

#	From This WBS To	Item Provided
2	Low Level Waste (1.1.1.3.02)	Product stream from LLW Pretreatment
3	High Level Waste (1.1.1.3.03)	Product stream from HLW Pretreatment
	To This WBS From	Item Provided
1	Waste Tank Retrieval (1.1.1.2.05)	Tank waste for pretreatment
2	Characterization (1.1.1.2.04)	Sample data characterization for all Hanford tanks

Technologies to be assessed:

Technologies are being assessed to validate planning assumptions used to select technical baselines for the functional products, pretreated sludges/solids and pretreated supernatants. The main avenues used for assessing technologies are laboratory- and bench-scale testing of various technology options followed by pilot-scale testing of selected unit operations. Testing will be accomplished using both waste simulants and actual waste.

PRETREAT-5

August 1994

- Pretreated Sludges/Solids. Two approaches for pretreating sludges/solids are being investigated; minimum separations (sludge washing and enhanced sludge washing) and minimum HLW/TRU volume (advanced sludge separations). With respect to minimum separation, which is the planning baseline, the following technologies are being assessed in order of importance.

- Washing HLW/TRU solids
- Enhanced sludge washing (alkaline leach)
- Removing organics from sludge

With respect to minimum HLW/TRU volume, which is the alternative to the baseline, the following technologies are being assessed in order of importance, but not the level for the planning baseline above.

- Acid leach of sludge
- Acid dissolution of sludge
- Reconstitution of sludge
- Removing HLW and TRU from acidic solutions

- Pretreated Supernatants. Two approaches for pretreating supernatants are being investigated: removal of cesium only and removal of cesium plus other radionuclides (strontium, technetium, TRU, etc.). With respect to cesium removal, which is the planning baseline, the following technologies are being investigated in order of importance.

- Cesium ion-exchange
- Separation HLW solids from liquids

With respect to other radionuclides, which is the alternative to the baseline, the following technologies are being assessed in order of importance, but not to the level for the planning baseline above.

- Removal of technetium from alkaline solutions
- Removing strontium and TRU from alkaline solutions

Other technologies which may merit assessment are recycling chemicals and decontaminating chemicals. If trade studies indicate a potential for cost savings, funding will be pursued for these technologies.

Options to be considered:

Major areas of the program where options have been identified are processing, facility configuration, and processing strategy.

- Processing. Options for processing to provide pretreated supernatants and pretreated sludges/solids as feed to the LLW and HLW vitrification facilities, respectively, are discussed below.

With respect to pretreatment of supernatants, the processing options being considered are listed below. All options include separation of solids from supernatant. Options for strontium and TRU removal may require removal of organics from the supernatant as well.

- Cesium removal (planning baseline)
- Cesium and strontium removal
- Cesium and technetium removal
- Cesium, technetium and strontium removal.

August 1994

With respect to pretreatment of sludges/solids, the processing options being considered are listed below. All options to the planning baseline include sludge washing and enhanced sludge washing (caustic leach) as a precursor. These options may require removal of organics from the sludge as well.

- Sludge washing (planning baseline)
 - Enhanced sludge washing (planning baseline)
 - Acid leach of sludge
 - Reconstitution of sludge
 - Acid dissolution of sludge
 - Removal of radionuclides from acid solutions
- Facility Configurations. The optional facility configurations being considered are documented in the draft Facility Configuration Evaluation, Phase 1 Study trade study. The options are listed below.
 - Combined LLW pretreatment and LLW vitrification (includes two cases: modules in a centralized configuration and a centralized location)
 - Combined LLW pretreatment and HLW vitrification
 - Combined LLW pretreatment, LLW vitrification and HLW vitrification
 - Standalone LLW pretreatment (includes three cases: modules in a centralized configuration; a centralized location; and dispersed modules)
 - Processing Strategies. Optional processing strategies being considered include:
 - Number of LLW feed blends
 - Number of HLW feed blends
 - Water recycle

D. OTHER LEGAL DRIVERS AND ORDER REQUIREMENTS

Refer to DOE/RL-92-60, Rev 1, 31 March 1994, Tank Waste Remediation System Functions and Requirements:

- Section 2, item V, paragraph B, table F4.2.2.1
- Section 3, item VIII, paragraph C, table A4.2.2.1
- Page 2-155, table F4.2.2.

August 1994

This page is intentionally left blank.

August 1994

**Tank Waste Remediation System Work Breakdown Structure
Dictionary.**

1. PROGRAM TITLE/PARTICIPANT 1.1.1 TWRS Program 1.1.1.3 Process Tank Waste 1.1.1.3.01 Waste Pretreatment/WHC	2. DATE PREPARED June 9, 1994	3. IDENTIFICATION NUMBER DE-AC06-87RL10930
4. WBS ELEMENT CODE/LEVEL 1.1.1.3.01.05/Level V	5. WBS ELEMENT TITLE W-236B Pretreatment Facility (IPM)	
6. WBS INDEX LINE NO. 70	7. CURRENT REV NO. 0	8. EFFECTIVE REVISION DATE June 13, 1994
9. APPROVED CHANGES N/A	10. ADS/TDD NUMBER 1280-D-AB	
11. SYSTEM ENGINEERING ARCHITECTURE REFERENCE NUMBER 4.2.2.1	12. ADS/TDD BUDGET AND REPORTING NUMBER EW3130010	

13. ELEMENT DESCRIPTION

A. COST CONTENT

RESOURCE		FY 1994 (\$000)
CO	CRAFTS	
EO	ENGINEERS	4,055
GO	GENERAL ADMIN	94
LO	LABORERS	
MO	MANAGERS	1,686
PO	ADMIN & PROF OCCUP	
RO	OPERATORS	
SO	SCIENTISTS	
TO	TECHNICIANS	
W9	BARGAINING UNITS	
10	PROCURED MATERIALS	59,535
21	CONTRACTS not PNL/KEH	13,708
23	WHC ADMIN MATERIALS	1,086
3D	PNL	390
3R	KAISER (A&E)	
3X	DOE NATIONAL LABS	3,220
4C	MATERIAL PROC. RATE	10,050
5X	ASSESSMENTS	69

August 1994

7D	G & A	14,439
7E	CSP	7,793
ZZ	CANDIDATE PROJECTS	784,997
	TOTAL	\$ 901,122

B. TECHNICAL BASES

The product of the W-236B, the Low-Level Waste (LLW) Pretreatment Facility Modules I and II, is a processing facility(ies) for pretreating supernatants/liquids to meet the feed specifications of the LLW vitrification facility and to produce a sidestream containing more concentrated radionuclides for blending and ultimate disposal with HLW materials in the HLW Vitrification facility. Construction of the LLW Pretreatment Facility Mod I is scheduled for completion in December 2003 with completion of preparations for startup scheduled for December 2004. The standards for turning the facility over to operations for hot startup (TPA M-50-02) by December 2004 include Key Decision 4, Approval to Commence Operation/Production per DOE Order 4700.1; DOE standard 3006-93, Planning and Conduct of Operational Readiness Reviews; DOE Order 5480.31, Startup and Restart of Nuclear Facilities; and requirements for receiving operating licenses and permits from regulatory agencies. A second LLW Pretreatment Facility (Mod II) may be constructed to provide additional processing capability for liquid treatment and may also provide additional processing functions, as identified later in the TWRS program.

Two approaches have been identified for removal of radionuclides from supernatant streams. These approaches are removal of cesium only, which is the planning technical baseline in the Tri-Party Agreement, and removal of other radionuclides which is the alternative. The selection of a radionuclide removal approach is influenced by the design of the LLW vitrification facility and the requirements set forth in the performance assessment for disposal of LLW which is currently being prepared. The design concept of a low-shielded LLW vitrification facility influences the degree of cesium and strontium removal that must be achieved in the LLW pretreatment facility. The performance assessment for disposal of LLW influences the degree of technetium and TRU removal that must be achieved in the LLW pretreatment facility. If it is determined that strontium and/or TRU removal is needed, the plan for retrieval of tank waste can be adjusted to first retrieve and process waste requiring cesium removal only, while deferring retrieval of waste requiring strontium and/or TRU removal. This will provide additional time to develop and incorporate strontium and/or TRU removal process(es) into the LLW pretreatment facility. On the other hand, technetium removal, if required, must be accomplished at the start of supernatant pretreatment since double-shell slurry feed (DSSF), the first waste to be pretreated, contains higher levels of technetium than

August 1994

wastes to be processed later. The tanks containing DSSF must be retrieved and processed first to free up DST space for storing and blending retrieved SST waste prior to pretreatment and for storing and blending pretreated liquids prior to vitrification in the LLW vitrification facility. The risk to the technical baseline associated with strontium and/or TRU removal is a cost risk since it is anticipated that the baseline schedule could be achieved because only a portion of the waste would require strontium and/or TRU removal. The risk to the technical baseline associated with technetium removal is a risk to both the cost and schedule baselines since this would require modification to the LLW pretreatment facility and delay startup.

In addition to the above mentioned risks to the LLW pretreatment facility the following discussion describes additional concerns that have been identified for the project.

- Characterization information is needed to identify the range of tank compositions. This information is needed to determine the range of conditions for operation of processes. This poses a risk to both cost and schedule in that the selected process design may be inadequate to process a particular stream at an acceptable rate with acceptable separation factors. This risk will be managed by providing a more conservative conceptual design and by working with the characterization program to try and determine the full range of tank compositions.
- Access to hot waste samples for design input in a timely fashion has been identified as another risk for the project. In order to obtain certain process design information, some testing with actual tank waste must be performed. There is a schedule risk to the project in obtaining these samples in that pretreatment priorities are competing with other TWRS priorities for a limited sampling capability. This will impact the project design schedule. In addition, if it is determined that the various TWRS end functions are required to fund the sampling activities, current resources are not included in the multi-year planning schedules. To mitigate this issue, the project is working to develop its data requirements and inputting that information into the characterization DQO requirements. Also, project sampling requirements will be forwarded to the pretreatment program for inclusion into the sampling schedule.
- Certain infrastructure requirements have been identified (i.e., electrical power, transfer piping, and process water) that are expected to be provided by other TWRS projects. At this time, projects are not underway to support the development of the needed infrastructure. Risks to the project involve both cost and schedule. Currently the project does not include funding for the required infrastructure, and TWRS planning does not

August 1994

included the resources for the expected projects. Due to the limited funding for TWRS over the next several years, as these projects are identified and funded, competition for existing resources may cause a reallocation of project funds. A reallocation of funds and/or untimely completion of needed infrastructure can cause significant project schedule delays.

- LLW pretreatment product criteria have not been set. This creates a project risk in cost and schedule. Currently, the project is assuming a conservative position on cesium removal requirements. This will allow the project to move forth, although at a higher project cost, and meet all listed milestones. However, strontium, TRU, and technetium processing requirements are being evaluated and as trade studies are completed a determination will be made to the expected processing capability requirements for the LLW pretreatment facility. Cost impacts will be experienced if processing capabilities are added and then are determined to be unnecessary. Cost and schedule impacts will be experienced if processing capabilities are not included, but are determined to be necessary at a future date. The final performance assessment for the LLW waste form is not currently expected until the project is in Title II design. Currently, the project is conducting trade studies to further define the risk to the project. In addition, the LLW vitrification program will release a preliminary performance assessment during the conceptual design phase of the project. The results of this performance assessment will weigh heavily in selection of process capabilities for the project.
- Interfaces between the LLW pretreatment facility and other TWRS programs and projects have not been completely identified. Current schedules are not detailed enough to completely identify the required interfaces. For example, process streams that will require pretreatment from LLW and HLW vitrification processes are not identified. However based on the Savannah River Defense Waste Processing Facility (DWPF), it has been determined that these streams will be significant in quantity and impact. The lack of identified interfaces may cause a delay in schedule due to insufficient information to support process capacity determination. In order to reduce this risk, planning efforts will be conducted during FY94 to identify the required interfaces and to include them within the integrated TWRS schedules. In addition, an interface control system will be put in place to make sure that satisfactory and timely progress is made on the interface issues.
- Technical requirements for process design are not complete. Identified needs indicate that cold and/or hot

August 1994

testing facilities at appropriate scales are not available on the Hanford Site. This can result in cost and schedule risks. Costs risks involve insufficient resources to provide adequate testing facilities (currently not specified). Schedule risks involve delays in project design due to insufficient design information. The risks are being addressed through ongoing evaluations of project and program testing needs and strategy. Another risk to the project schedule is the ability to obtain necessary permits to perform the testing in a timely fashion. It is expected that the ongoing hot testing evaluation will provide information to allow the permitting activities to proceed.

- The availability of project funds is being controlled externally. The current TWRS funding process as defined in the ADS process locks projects into inflexible funding profiles. Current outyear projections are based on a preliminary engineering estimate. As more definitive cost estimates are available, it is uncertain that TWRS constraints will allow for sufficient project funding. In addition, project contingency is very limited constraining the project's ability to deal with emerging issues.

- Goals and objectives:

The primary goal of this activity is to provide processing capability for pretreatment tank supernatants and process liquids from the HLW pretreatment facility, the HLW vitrification facility, and the LLW vitrification facility to meet the feed specifications of the LLW vitrification facility. A secondary goal is to provide a processing capability for pretreating supernatants/liquids which will minimize the amount of HLW byproduct produced while producing a product stream that meets the LLW vitrification feed specifications. The objective is to provide a facility with the required capability to support LLW vitrification facility I feed volume requirements by December 2004. A secondary objective is to provide additional capabilities to pretreat liquid streams created by sludge/solids processing for LLW vitrification disposal prior to January 2008.

- Associated Systems Engineering functions:

- This program activity performs the functions and requirements element "Pretreat Supernatants" (4.2.2.1.2).
- This program activity is supported by the functions and requirements elements "Store Waste" (4.2.1.1), "Characterize Waste" (4.2.1.2), "Retrieve Waste" (4.2.1.3), "Manage System Generated Waste and Excess

August 1994

Facilities" (4.2.3), and "Pretreat Sludges/Solids" (4.2.2.1.1).

- Major end-item deliverables:
 - Design, construction and startup of LLW pretreatment facilities (Modules I and II) for the pretreatment of supernatants and other process liquids generated by the tank waste retrieval, HLW pretreatment, LLW vitrification, and HLW vitrification facilities.
 - All appropriate nuclear facility licenses, environmental, and operating permits for the LLW pretreatment facilities.
- Acceptance criteria:
 - Key Decision 4, Approval to Commence Operation/ Production per DOE Order 4700.1
 - DOE standard 3006-93, Planning and Conduct of Operational Readiness Reviews
 - DOE Order 5480.31, Startup and Restart of Nuclear Facilities
 - Receipt of appropriate nuclear facility licenses and permits.
 - Pretreated supernatants and other liquids will meet the feed specifications of the LLW vitrification facility and the processing schedule requirements of Waste Retrieval and LLW vitrification.
- Waste types generated:
 - Off gas: Yes
 - Effluents: Yes
 - Solid waste: Yes

C. STATEMENT OF WORK

Activities leading to the completion of pretreatment processing of Hanford tank waste supernatants include the processing of the waste from the 149 SSTs, 28 DSTs, new DSTs and liquid radioactive waste generated during tank cleanup operations.

- Required activities over lifetime (identify function executing work)

The LLW pretreatment facility activity is responsible for the design, procurement, construction, and startup of the facility. The Hanford Maintenance and Operating Contractor (WHC) is

August 1994

responsible for the project management and engineering activities; the Architect Engineer(s) (Ebasco/BNFL) is responsible for design and inspection of facilities to be constructed; the construction contractor(s) is responsible to construct facilities; and the Hanford Maintenance and Operating Contractor (WHC) is responsible for the startup and readiness preparation for the facility.

This WBS activity is responsible for the design construction and startup of the following facilities. The functions of the delivered facilities are briefly outlined and performance timeframes are described below.

- LLW Pretreatment Facility Module 1. This facility will be operated for 16 years and 3 months (December 2004 to March 2021) to remove cesium and strontium from tank waste. The resulting liquid LLW will be blended and stored to feed the LLW vitrification facility scheduled to initiate hot operations in June 2005 (TPA M-60-05). The liquid HLW separated from tank waste in the LLW pre-treatment facility will be blended and stored to feed the HLW vitrification facility scheduled to initiate hot operations in December 2009 (TPA M-51-03). After completion of waste pretreatment the facility will be cleaned out and placed in a shut down mode over a period of 12 months in preparation for decommissioning. At the end of this activity the facility will be turned over to the Environmental Restoration Program for decommissioning in March 2022.
- LLW Pretreatment Facility Module 2. This facility will be operated for 14 years and 6 months (December 2005 to June 2020) to provide an increased processing capability. Module 2 will include additional separations capability to remove strontium and TRU from complexed waste as well as technetium removal, if required for disposal of LLW. The resulting liquid LLW and HLW streams will be handled as described above for Module 1. Facility clean out and shut down will be handled as described above for Module 1 except turn over to the Environmental Restoration Program for decommissioning will be in June 2021.

The following scheduled activities have been identified to support this activity. The following activities are duplicated for LLW pretreatment facilities, modules I and II.

- Conduct Project Engineering & Management--WHC
- Perform Applied Technology Testing--WHC, PNL, other national laboratories
- Prepare Conceptual Design (CDR)--A-E: Ebasco/BNFL
- Prepare Preliminary Safety Evaluation (PSE)--WHC
- Prepare Other Permitting--WHC

August 1994

- Prepare Advanced Conceptual Design (ACDR)--A-E: Ebasco/BNFL
 - Prepare National Environmental Protection Act (NEPA) documentation--WHC
 - Prepare Other Permits--WHC
 - Prepare Title I Design--A-E:Ebasco/BNFL
 - Prepare Preliminary Safety Analysis Report (PSAR)--WHC
 - Prepare Title II Design--A-E: Ebasco/BNFL
 - Construct LLW Pretreatment Facilities--Construction Contractor (to be determined)
 - Prepare Final Safety Analysis Report (FSAR)--WHC
 - LLW Pretreatment Facilities Preparation for Startup Phase I & II--WHC
 - Design, fabricate, and install Pretreatment Hot Testing Capability (e.g. CDU/CPU)--WHC, A-E: Ebasco/BNFL, Construction Contractor (to be determined)
- Interfaces (products and tie codes):

#	From This WBS To	Item Provided
1	Characterization	Process supernatants characterization requirements.
2	LLW Vitrification Facility	Expected compositions, flowrates, and processing schedule for LLW pretreated liquids.
3	Blend High Activity Streams	Expected compositions, flowrates, and processing schedule for separated HLW streams.
	To This WBS From	Item Provided
1	Technology Develop. and Applied Engineering (1.1.1.3.01.02)	Cesium resin technology.
2	Same as above.	Separation technology for other radionuclides.
3	System Definition (1.1.1.3.01.04)	Functions & requirements for LLW pretreatment facility.
4	Same as above.	Pretreatment flowsheet.
5	Same as above.	Select organic destruction option for LLW pretreatment facility.
6	Same as above.	Select facility option for LLW pretreatment facility.

August 1994

	To This WBS From	Item Provided
7	Same as above.	Functions & requirements for hot test facility.
8	Same as above.	Basis for incorporating organic destruction for safe storage in LLW facility design.
9	Characterization	Updated data for LLW pretreatment facility CDR.
10	Same as above	Various liquid and solid samples as needed for hot testing in support of applied engineering activities.
11	LLW Vitrification Facility	Initial LLW immobilization feed specification.
12	Same as above	Updated LLW immobilization feed specification.
13	Same as above	Characteristics and volume of LLW plant generated streams.
14	HLW Vitrification Facility	Characteristics and volume of HLW plant generated streams.

- Technologies to be assessed:

Technologies are being assessed to develop engineering design data to provide a basis for process and equipment selection and sizing for the LLW pretreatment facility. The main avenues to be used for developing applied engineering data are laboratory, bench-scale, and pilot-scale testing of selected unit operations and/or processes. Testing will be accomplished using both waste simulants and actual waste depending on the technical or training need of the project.

- Pretreated Supernatants. Two approaches for pretreating supernatants are being investigated; removal of cesium only and removal of cesium plus other radionuclides (strontium, technetium, TRU, etc.). With respect to cesium removal, which is the planning baseline, the following technologies will be tested to provide engineering design data and operation verification.

- Cesium ion-exchange
 - Separation HLW solids from liquids

With respect to other radionuclides, which is the alternative to the baseline, the following technologies

August 1994

are being assessed as required to meet product specification for LLW waste immobilization.

- Removal of technetium from alkaline solutions
- Removing strontium and TRU from alkaline solutions

Other technologies which may require testing to determine engineering design parameters involve recycling and decontaminating chemicals. If trade studies indicate a potential for cost savings, these process will be included in the project scope and will require engineering design information development.

• Options to be considered:

Major areas of the program where options have been identified are processing, facility configuration, and processing strategy.

- Processing. With respect to pretreatment of supernatants the processing options being considered are listed below. All options include separation of solids from supernatant and concentration of various liquid streams by evaporation as defined by future engineering trade studies in conjunction with the TWRS material logistics studies. Options for strontium and TRU removal may require destruction or removal of organic complexants from the supernatant as well.
 - Cesium removal (planning baseline)
 - Cesium and strontium removal
 - Cesium and technetium removal
 - Cesium, technetium and strontium removal.

With respect to pretreatment of sludges/solids the processing options being considered are listed below. These options are being evaluated by project W-236B to determine the probable composition and flowrates of streams that may be added to tank supernatants. These streams are expected to have a large impact on the throughput of the LLW pretreatment facility. All options to the planning baseline include sludge washing and enhanced sludge washing (caustic leach) as a precursor.

- Sludge washing (planning baseline)
 - Enhanced sludge washing (planning baseline)
 - Other leaching of sludge
- Facility Configurations. The optional facility configurations being considered are documented in the draft Facility Configuration Evaluation, Phase 1 Study trade study. The options are listed below.
 - Combined LLW pretreatment and LLW vitrification

August 1994

(includes two subcases: modules in a centralized configuration and centralized facility)

- Combined LLW pretreatment and HLW vitrification
 - Combined LLW pretreatment, LLW vitrification and HLW vitrification
 - Stand alone LLW pretreatment (includes three subcases: modules in a centralized configuration; centralized facility; and, dispersed modules)
- Processing Strategies. Optional processing strategies being considered are listed below.
 - Number of LLW feed blends
 - Water recycle

D. OTHER LEGAL DRIVERS AND ORDER REQUIREMENTS

- Hanford Federal Facility Agreement and Consent Order, Tri-Party Agreement (TPA) Fourth Amendment, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington, January, 1994, Milestones M-50-00.
- DOE, 1988 "Final Environmental Impact Statement for the Disposal of Hanford Defense High-Level, Transuranic and Tank Waste, Hanford Site, Richland, Washington, Record of Decision," Federal Register V 53(7.2) pp 12449-12453, U.S. Department of Energy, Washington D.C.

August 1994

This page is intentionally left blank.

August 1994

**Tank Waste Remediation System Work Breakdown Structure
Dictionary.**

1. PROGRAM TITLE/PARTICIPANT 1.1.1 TWRS Program 1.1.1.3 Process Tank Waste 1.1.1.3.01 Waste Pretreatment/WHC	2. DATE PREPARED June 9, 1994	3. IDENTIFICATION NUMBER DE-AC06-87RL10930
4. WBS ELEMENT CODE/LEVEL 1.1.1.3.01.06/Level V	5. WBS ELEMENT TITLE High Level Waste Pretreatment	
6. WBS INDEX LINE NO. 71	7. CURRENT REV NO. 0	8.EFFECTIVE REVISION DATE June 13, 1994
9. APPROVED CHANGES N/A	10. ADS/TDD NUMBER 1220-0-AF	
11. SYSTEM ENGINEERING ARCHITECTURE REFERENCE NUMBER 4.2.2.1	12. ADS/TDD BUDGET AND REPORTING NUMBER EW3130010	

13. ELEMENT DESCRIPTION

A. COST CONTENT

RESOURCE		FY 1994 (\$000)
CO	CRAFTS	
EO	ENGINEERS	1,515
GO	GENERAL ADMIN	
LO	LABORERS	
MO	MANAGERS	625
PO	ADMIN & PROF OCCUP	
RO	OPERATORS	
SO	SCIENTISTS	
TO	TECHNICIANS	
W9	BARGAINING UNITS	
10	PROCURED MATERIALS	
21	CONTRACTS not PNL/KEH	
23	WHC ADMIN MATERIALS	398
30	PNL	
3R	KAISER (A&E)	
3X	DOE NATIONAL LABS	
4C	MATERIAL PROC. RATE	
5X	ASSESSMENTS	

August 1994

7D	G & A	429
7E	CSP	218
ZZ	CANDIDATE PROJECTS	148,775
	TOTAL	\$ 151,960

B. TECHNICAL BASES

The product of High-Level Waste (HLW) Pretreatment is a processing facility for pretreating sludges/solids to meet the feed specifications of the HLW vitrification facility. Construction of the HLW pretreatment facility is scheduled for completion in May 2007 and completion of preparations for startup is scheduled for completion in May 2008. The standards for turning the facility over to operations for hot startup (TPA M-50-04) by June 2008 include Key Decision 4, Approval to Commence Operation/Production per DOE Order 4700.1; DOE Standard 3006-93, Planning and Conduct of Operational Readiness Reviews; DOE Order 5480.31, Startup and Restart of Nuclear Facilities; and requirements for receiving operating licenses and permits from regulatory agencies.

- Goals and objectives:

The primary goal is to provide a processing capability for pretreating selected sludges/solids to meet the feed specifications of the HLW vitrification facility. The secondary goal is to provide a processing capability for pretreating sludges/solids to reduce the volume of HLW produced. The objective is to provide a facility with the required capability by May 2008.

- Associated Systems Engineering functions:
 - This program activity performs the function and requirement element "Pretreat Sludges/Solids" (4.2.2.1.1).
 - This program activity is supported by the function and requirement elements "Pretreat Supernatants" (4.2.2.1.2), "Store Waste" (4.2.1.1), "Characterize Waste" (4.2.1.2), "Retrieve Waste" (4.2.1.3), and "Manage System Generated Waste and Excess Facilities" (4.2.3.).
- Major end-item deliverables:
 - Design, construction and startup preparations for the HLW pretreatment facility.

August 1994

- Acceptance criteria:
 - Key Decision 4, Approval to Commence Operation/Production per DOE Order 4700.1, Project Management System.
 - DOE Standard 3006-93, Planning and Conduct of Operational Readiness Reviews.
 - DOE Order 5480.31, Startup and Restart of Nuclear Facilities.
 - Receipt of appropriate nuclear facility licenses and permits.
- Waste types generated:
 - Off gas: Yes
 - Effluents: Yes
 - Solid waste: Yes
- C. STATEMENT OF WORK
 - Required activities over lifetime/(identify function executing work)
 - Prepare Conceptual Design (CDR) for HLW Pretreatment Facility (A-E: Ebasco/BNFL)
 - Prepare Advanced Conceptual Design (ACDR) for HLW Pretreatment Facility (A-E: Ebasco/BNFL)
 - Prepare Title I Design for HLW Pretreatment Facility (A-E)
 - Prepare Title II Design for HLW Pretreatment Facility (A-E)
 - Prepare PSE for HLW Pretreatment Facility (WHC)
 - Prepare PSAR for HLW Pretreatment Facility (WHC)
 - Prepare FSAR for HLW Pretreatment Facility (WHC)
 - Prepare Other Permitting for HLW Pretreatment Facility (WHC)
 - Construct HLW Pretreatment Facility (Construction Contractor)
 - Prepare for HLW Pretreatment Facility Startup (WHC)
 - Interfaces (products and tie codes):

August 1994

#	From This WBS To	Item Provided
1	Systems Definition (1.1.1.3.01.04)	Input to technical options for organic destruction LLW/HLW
2	High Level Waste (1.1.1.0.03)	Input to Title I HLW Vitrification Facility
	Tech. Integ. & Planning (1.1.1.3.01.03)	Input to HLW Pretreatment Facility operations
	To This WBS From	
	AB	Input to TWRS EIS

- Technologies to be assessed:
 - Acid leaching of sludges/solids
 - Removing organics from sludge
 - Chemical reconstitution of sludge
 - Chemical recycle of caustic

- Options to be considered:
Major areas where possible options have been identified are processing and facility configuration.
 - Processing. The processing options for the HLW pretreatment facility are listed below.
 - Acid leaching of selected sludge types to reduce volume of HLW produced
 - Removal of organics in some sludge types to meet HLW feed specifications
 - Chemical reconstitution (acidification and neutralization) of some sludge types to reduce the volume of HLW produced
 - Recycle caustic to reduce the amount of sodium in the feed to the LLW vitrification facility
 - Facility Configuration. The optional facility configurations are listed below.
 - Combined LLW pretreatment and HLW pretreatment
 - Combined LLW pretreatment, HLW pretreatment and HLW vitrification
 - Stand alone facility

D. OTHER LEGAL DRIVERS AND ORDER REQUIREMENTS

Refer to DOE/RL-92-60, Rev 1, March 31, 1994, "TWRS Functions and Requirements"

August 1994

This page is intentionally left blank.