S

ENGINEERING CHANGE NOTICE

1. ECN 650557

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental []	CE Graves, Project W-532, R3-83, 376-5235	[] Yes [X] No	03/23/01
Direct Revision [X]	6. Project Title/No./Work Order No.	7. Bldg./Sys./Fac. No.	8. Approval Designator
Change ECN []	RPP/WFD/SST Closure	Tank Farms	ESQ
Temporary []	9. Document Numbers Changed by this ECN (includes sheet no. and rev.)	10. Related ECN No(s).	11. Related PO No.
Standby []	RPP-5566, Rev. 0	NA	NA
Supersedure []			
Cancel/Void []			

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

13a. Description of Change

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

Complete revision of document.

14a. Justification (mark one)	14b. Justification Details
Criteria Change [X] Design Improvement [] Environmental [] Facility Deactivation [] As-Found [] Facilitate Const. [] Const. Error/Omission [] Design Error/Omission []	The functions and requirements of the Cold Test, Training, and Mockup Facility have been revised to reflect the current mission of the facility.

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

See Distribution Sheet

RELEASE STAMP

DATE: MAR 29 2001
STA: 4
HANFORD RELEASE
ID. 2

A-7900-013-2 (10/97)

A-7900-013-1

ENGINEERING CHANGE NOTICE	Page 2 of 2	1. ECN 650557

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

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

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]	None	[X]
Environmental Permit	[]	Inventory Adjustment Request	[]	_____	[]

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

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

21. Approvals

	Signature		Date		Signature	Date
Design Auth. ~~RL Schlosser~~	T.C. MACKEY	R3-83	3/28/01	Design Agent		
Cog. Eng. CE Graves	CE Graves	R3-83	3/22/01	PE		
Cog. Mgr. GW McLellan		R3-47	3/28/01	QA		
QA JF Bores		R2-82	3/28/01	Safety		
Safety LJ Marquardt		S7-07	3/29/01	Design		
Environ. PC Miller		R1-51	3/29/01	Environ.		
Other				Other		
HH Ziada		R3-83	3-28-01			
Program D.L Parker		R2-50	3/29/01			

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

A-7900-013-3 (10/97)

DISTRIBUTION SHEET

To:	From:	Page 1 of 1
Distribution	Plant Support Engineering	Date 03/23/01
Project Title/Work Order:		EDT No. ---
RPP-5566, Rev. 1, *Cold Test, Training, and Mockup Facility Functions and Requirements*		ECN No. 650557

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
JR Bellomy III	R3-83	X	Hardcopy		
JF Bores	R2-82	X			
JW Brothers	K9-20	X			
JW Cammann	T4-08	X			
TJ Conrads	R3-73	X			
C. Defigh-Price	T4-08	X			
GT Frater	T4-08	X			
CE Graves	R3-73	X			
CE Grenard	R3-73	X			
AD Hjellum	R3-47	X			
RR Janecke	R2-86	X			
DP Kerwick	H6-07	X			
WA Kitchen	S7-61	X			
RG Lee	T4-07	X			
MW Leonard	R2-36	X			
TC Mackey	R3-83	X			
LJ Marquardt	S7-07	X			
GW McLellan	R3-47	X			
PC Miller	R1-51	X			
DL Parker	R2-50	X			
SH Rifaey	T4-07	X			
RL Schlosser	R3-83	X			
DH Shuford	R3-83	X			
RR Thompson	T4-08	X			
WT Thompson	S7-90	X			
CM Welch	R2-38	X			
RC Wilson	T4-08	X			
HH Ziada	R3-83	X			

Cold Test, Training, and Mockup Facility Functions and Requirements

C.E. Graves
Numatec Hanford Corporation
Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-99RL-14047

EDT/ECN: 650557 UC: 721
Org Code: 7N700 Charge Code: 110409
B&R Code: Total Pages: 23

Key Words: functions and requirements, CTTM, double-shell tank, single-shell tank, cold test facility, mockup, waste feed delivery

Abstract:

This functions and requirements document establishes the functional, performance, design, and interface requirements for the Cold Test, Training, and Mockup (CTTM) Facility. The CTTM facility will provide a test bed for full-scale testing of tank waste retrieval, transfer, and sampling hardware to be procured by the Single-Shell Tank Closure Project and the Double-Shell Tank Waste Feed Delivery Project.

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

Printed in the United States of America. To obtain copies of this document, contact: Document Control Services, P.O. Box 950, Mailstop H6-08, Richland WA 99352, Phone (509) 372-2420; Fax (509) 376-4989.

3/29/01
Release Approval Date

DATE: HANFORD RELEASE
STA: 4 ID. 2
MAR 29 2001
Release Stamp

APPROVED FOR PUBLIC RELEASE

RECORD OF REVISION	(1) Document Number RPP-5566	Page 1

(2) Title
Cold Test, Training, and Mockup Facility Functions and Requirements

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
0	Initial release of document per EDT #625313.	JR Bellomy	DB Smet
1 RS	Complete document revision per ECN #650557.	CE Graves	GW McLellan 3/28/01

RPP-5566 Rev. 1

COLD TEST, TRAINING, AND MOCKUP FACILITY FUNCTIONS AND REQUIREMENTS

March 2001

CH2M HILL Hanford Group, Inc.

Richland, Washington

CONTENTS

1.0 SCOPE 1
1.1 IDENTIFICATION 1
1.2 CTTM FACILITY OVERVIEW 1
1.2.1 Relationship to the Tank Farm System Mission 1
1.2.2 CTTM Facility Purpose 2
1.3 DOCUMENT OVERVIEW 3

2.0 APPLICABLE DOCUMENTS 3
2.1 GOVERNMENT DOCUMENTS 3
2.2 NON-GOVERNMENT DOCUMENTS 4

3.0 FACILITY FUNCTIONS AND REQUIREMENTS 5
3.1 CTTM FACILITY DESCRIPTION 5
3.2 CHARACTERISTICS 6
3.2.1 Performance Characteristics 6
3.2.1.1 Receive Waste Simulants In-Tank 6
3.2.1.2 Contain Waste Simulants 7
3.2.1.3 Store/Dispose Waste Simulants 7
3.2.1.4 Support On/In-tank Test Equipment 8
3.2.1.5 Monitor Tank for Waste Simulant Leaks 8
3.2.1.6 Respond to Waste Simulant Leaks 8
3.2.1.7 Distribute 480 Vac Power 8
3.2.1.8 Distribute 240(or 208)/120 Vac Power 8
3.2.1.9 Light CTTM Facility 8
3.2.1.10 Distribute Water 9
3.2.1.11 Accommodate CTTM Facility and User Personnel 9
3.2.1.12 Inspect CTTM Facility for Suitability 9
3.2.1.13 Weather Protection of Equipment 9
3.2.2 External Interface Requirements 9
3.2.3 Physical Characteristics 9
3.2.4 Facility Quality Factors 13
3.2.5 Environmental Conditions 13
3.2.5.1 Natural Environments 13
3.2.5.2 Induced Environments 13
3.2.6 Flexibility and Expansion 14
3.2.6.1 Additional Tank 14
3.3 DESIGN AND CONSTRUCTION 15
3.3.1 Materials, Processes, and Parts 16
3.3.2 Electromagnetic Radiation 16
3.3.3 Safety 16
3.3.4 Security 16

4.0 NOTES 17
4.1 ASSUMPTIONS 17
4.2 ACRONYMS AND ABBREVIATIONS 17
4.3 DEFINITIONS 17
4.4 REFERENCES 18

FIGURES

Figure 1. Artist's Rendering of Below-Grade CTTM Tank. 6

Figure 2. Artist's Rendering of Freestanding CTTM Tank. 7

Figure 3. Schematic of DST Pump Installation at CTTM Facility. 10

Figure 4. Schematic of SST Waste Retrieval Equipment Installation at CTTM Facility. 11

Figure 5. Schematic of SST Fluidic Mixer Installation at CTTM Facility. 11

Figure 6. Secondary Superstructure Schematic. 12

Figure 7. Static Load Schematic for the CTTM Facility. 15

TABLES

Table 1. Government Documents 4

Table 2. Non-Government Documents. 4

Table 3. Hanford Environmental Conditions. 13

Table 4. Waste Simulant Composition 14

1.0 SCOPE

1.1 IDENTIFICATION

This functions and requirements (F&R) document establishes the functional, performance, design, and interface requirements for the Cold Test, Training, and Mockup Facility, which will herein be referred to as the facility or the CTTM facility. The CTTM facility will provide a test bed for full-scale testing of tank waste retrieval, transfer, and sampling hardware to be procured by the Single-Shell Tank (SST) Closure Project and the Double-Shell Tank (DST) Waste Feed Delivery (WFD) Project. Tests will be performed in simulated tank and tank waste conditions that are non-radioactive and non-hazardous. In addition to testing, the CTTM facility will allow procedure validation, personnel training, and conducting off-normal and recovery activities. Tests at the CTTM facility will be conducted in accordance with the "Testing Practices Requirements" procedure for the River Protection Project (RPP) (see HNF-IP-0842, Volume IV, Section 4.28). The purpose of this F&R document is to communicate the technical requirements for the design and construction of the CTTM facility.

1.2 CTTM FACILITY OVERVIEW

1.2.1 Relationship to the Tank Farm System Mission

Retrieval of tank waste materials (supernatant, salt cake, and sludge) from double-shell and single-shell tanks will require demonstration of new technologies and innovative operations to support the effective, on-time delivery of waste feed to the Waste Treatment Plant (WTP) and cleanout of the tanks in accordance with the Tri-Party Agreement, *Hanford Federal Facility Agreement and Consent Order* (Ecology 1996). Significant near-term SST Closure Project and DST WFD Project testing activities requiring a cold test facility include:

SST Closure Project[1]

- Tank 241-C-104 Mobile Retrieval System testing
- Tank 241-S-102 Fluidic Mixer testing
- Tank 241-S-112 Low-Volume-Density Gradient method testing

DST WFD Project

- Mixer Pump waste mobilization and solids suspension testing
- Transfer Pump testing
- Tank Waste Sampling System testing

[1] Note: TPA Milestones M-45-03F, M-45-05A and M-45-03C require that retrieval technologies for tanks 241-C-104, 241-S-102 and 241-S-112 improve on the baseline established by past-practice sluicing. The retrieval technology to be applied in each tank is called out in RPP-7087, *Single-Shell Tank Retrieval Sequence: Fiscal Year 2000 Update.*

Supporting Both Projects

- In-tank Leak Detection, Monitoring, and Mitigation System testing
- Instrumentation, Monitoring and Control System testing (e.g., for process control)
- Construction; mock-up; and structure, system, and component deployment testing
- Transfer system pluggage testing
- Demonstrations for Stakeholders
- Readiness Assessments and Operational Readiness Review activities
- Demonstration of in-tank equipment decontamination capability
- Waste retrieval operations personnel training.

Other, longer-term uses of the cold test facility may include "run-in" tests of new transfer and mixer pumps during WFD. Acquisition of a CTTM capability per RPP-7502, *Acquisition Strategy for Cold Test, Training and Mock-up Facilities* and this F&R document will accommodate the near-term needs and provide the ability to expand/upgrade the facility to accommodate the envisioned long term uses.

1.2.2 CTTM Facility Purpose

The overall purpose of the CTTM facility is to accommodate the testing needs of both the SST Closure and DST WFD Projects, as described above. To fulfill these needs, the CTTM facility capabilities must include:

- Testing of DST mixer and transfer pumps on a variety of waste simulants at various locations within a simulated tank to allow evaluation of pump intake and discharge design criteria and determination of optimum pump placement within the tank.
- Testing of an in-line sampling system while mixing to provide sample data for assessing the performance of the mixer pumps as well as the operation and performance of the sampling system and calibration data for monitoring and control instrumentation.
- Testing for cost-effective improvements to monitoring and control instrumentation (These systems may include density measuring devices, mass flow meters, cameras, suspended solids profilers, and immersible pump winch systems).
- Testing to allow for SST retrieval system effectiveness and mining strategy optimization in a full-scale on-tank configuration so that retrieval support system testing (e.g., mobile retrieval system hose management) is also accomplished.
- Testing to allow identification of optimum power control mechanisms, proper monitoring instrumentation, and identification of critical spare parts.
- Testing of ancillary equipment (instrument trees, air lift circulators, etc.) and probes to determine retrieval and pumping effects on other in-tank equipment.
- Testing of equipment handling processes under non-radioactive, cold mock-up conditions to develop, validate and optimize staging, installation, operation, maintenance, and removal procedures; train personnel to minimize personnel risks and exposure to as low as reasonably achievable guidelines and to minimize potential damage to the equipment before hot installation in actual waste tanks. (The ability to install several pumps and

stage equipment will ensure adequate scheduling of pump run-in activities to meet WFD requirements to the WTP.)

Given the needed capabilities and versatility, the CTTM facility should be a simple yet robust test bed on which several separate, diverse tests can be hosted over many years —fiscal year (FY) 2002 through FY 2032 (see HNF-SD-WM-SP-012, *Tank Waste Remediation System Operation and Utilization Plan*, Table 5.3-1).

As a starting point for the functional analysis performed for the CTTM facility, the applicable DST and SST system functions were gleaned from DST System and SST System functional analyses documented in HNF-5136, *Functional Analysis for Double-Shell Tank Subsystems*, and HNF-2826, *Single-Shell Tank System Functional Analysis*. Functional analysis for tank specific SST waste retrieval systems [e.g., RPP-6525, *Functions and Requirements for the Tank 241-C-104 Waste Retrieval System (Project W-523)*] were also considered for the functional analysis documented herein.

The CTTM facility-specific functions derived for the purposes of specifying the requirements of the CTTM facility are defined in Section 3.2.1. Note that the functions defined in Section 3.2.1 are focused on satisfying the near term need of testing the SST and DST retrieval systems' performance in a non-radiological, non-hazardous simulated tank environment. Ancillary CTTM facility functions associated with pump run-in tests, maintenance training, etc. will be acquired in the future, as an upgrade to the facility specified herein.

1.3 DOCUMENT OVERVIEW

This functions and requirements document is formatted in accordance with the guidance found in HNF-IP-0842, Volume IV, Section 3.2, Attachment B. Sections of the specified format not applicable to the CTTM facility functions and requirements were removed.

2.0 APPLICABLE DOCUMENTS

Design requirements applicable to the CTTM facility come from government and non-government source documents and various codes and standards. Each document (of the exact revision identified) in this section is invoked by one or more requirements of this F&R and represents a part of this F&R to the extent specified.

2.1 GOVERNMENT DOCUMENTS

U.S. Department of Energy (DOE) orders and regulatory documents, including those promulgated by the Federal Government and Washington State, constitute a part of this F&R to the extent specified herein. The regulatory documents that form a part of this F&R are listed in Table 1.

Table 1. Government Documents.

Document Number	Title
29 CFR 1910, 1999	"Occupational Safety and Health Standards," *Code of Federal Regulations*, as amended.
29 CFR 1926, 2000	"Safety and Health Regulations for Construction," *Code of Federal Regulations*, as amended.
WSDOT M 22-01, 1999	*Design Manual*, Washington State Department of Transportation, Olympia, Washington.

2.2 NON-GOVERNMENT DOCUMENTS

National codes, standards, and the Hanford Site documents listed in Table 2 constitute a part of this F&R to the extent specified herein.

Table 2. Non-Government Documents.

Document Number	Title
AISC ASD, 1989	*Manual of Steel Construction – Allowable Stress Design*, American Institute of Steel Construction, Chicago, Illinois.
IEEE 142, 1991	*Recommended Practice for Grounding of Industrial and Commercial Power Systems*, Institute of Electrical and Electronics Engineers, Piscataway, New Jersey.
HNF-IP-0-842, Vol. IV, Section 3.14, Rev. 0, 2001	*RPP Administration*, "Engineering Design and Evaluation," CH2M HILL Hanford Group, Inc., Richland, Washington.
The IESNA Lighting Handbook, 9th Ed., 2000	*The IESNA Lighting Handbook*, Illumination Engineering Society of North America, New York, New York.
NFPA 13, 2000	*Standard for the Installation of Sprinkler Systems*, National Fire Protection Association, Quincy, Massachusetts.
NFPA 24, 1995	*Installation of Private Fire Service Mains and Their Appurtenances*, National Fire Protection Association, Quincy, Massachusetts.
NFPA 70, 1999	*National Electrical Code*, National Fire Protection Association, Quincy, Massachusetts.
NFPA 72, 1999	*National Fire Alarm Code*, National Fire Protection Association, Quincy, Massachusetts.
NFPA 101, 2000	*Life Safety Code*, National Fire Protection Association, Quincy, Massachusetts.
UBC, 1997	*Uniform Building Code*, International Conference of Building Officials, Whittier, California.

3.0 FACILITY FUNCTIONS AND REQUIREMENTS

3.1 CTTM FACILITY DESCRIPTION

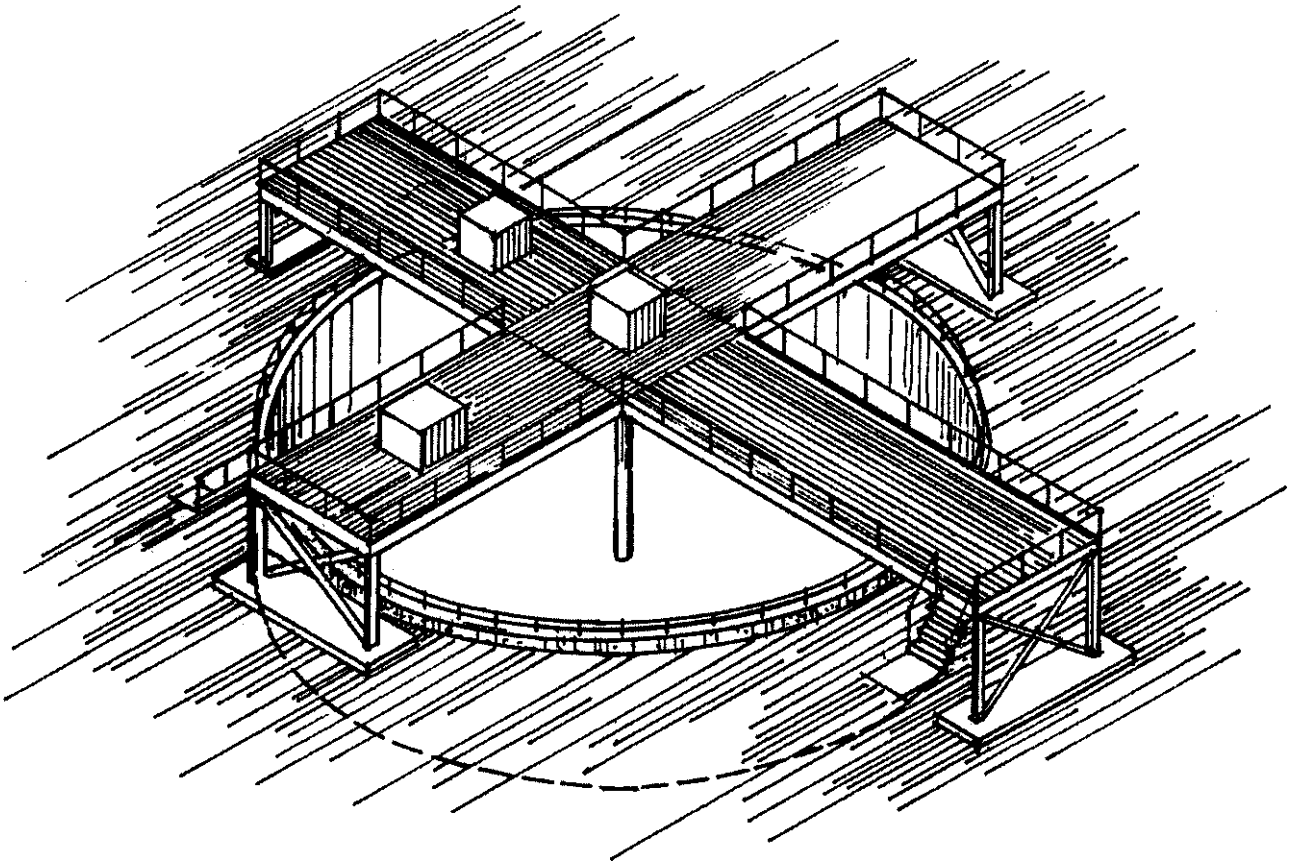
The CTTM facility will consist of an open-top tank to simulate a SST or DST. A steel bridge or primary superstructure will span the open tank and be of sufficient height above the tank to provide necessary clearance between the tank bottom and the bottom of the superstructure [platform] to accommodate SST waste retrieval equipment. Secondary superstructures to accommodate full-scale DST mixer and transfer pump installations will also be provided. The superstructures will be of sufficient structural strength and size so as to accommodate full-scale mixer pump and transfer pump system mockups. Additionally, the primary superstructure must support SST waste retrieval (e.g., crawler) support structures. Stairways will be provided for access to each superstructure platform. Access to the tank bottom for tank inspection, simulant removal or maintenance purposes will be provided. Although the superstructures will not be capable of direct simulation of the tank dome, it will be capable of supporting user provided hanging interference mockups and simulated pits. See Figures 1 and 2 for artistic renderings of possible below-grade and freestanding CTTM tank constructions.

The CTTM facility will include the following:

- 480 and 120 Vac power for those using the facility (Main and branch circuits only. CTTM facility users will provide a motor control center and other switchgear, as needed, for test articles/support equipment)
- Change area, a control area, office space, and sanitary facilities
- Potable and fire suppression water sources
- Site lighting
- Water distribution and removal/disposal system
- Lay-down area
- Crane access and area suitable for crane operation
- Vehicle access and parking area for testing personnel
- Warehouse storage for equipment and dry materials
- Area/facility for storage of spent simulants
- Fire alarm systems and emergency egress lighting

The CTTM facility users will provide the portable cranes and simulants necessary to setup and perform the tests. Any equipment required for simulant mixing (including mix tank) is to be provided by the CTTM facility users. Disposal of simulants (including sampling, classification, and transportation) is also the responsibility of the CTTM facility users.

Figure 1. Artist's Rendering of Below-Grade CTTM Tank.



3.2 CHARACTERISTICS

This section contains the minimum requirements related to performance characteristics, physical characteristics, reliability, maintainability, environmental conditions, transportability, and flexibility and expansion.

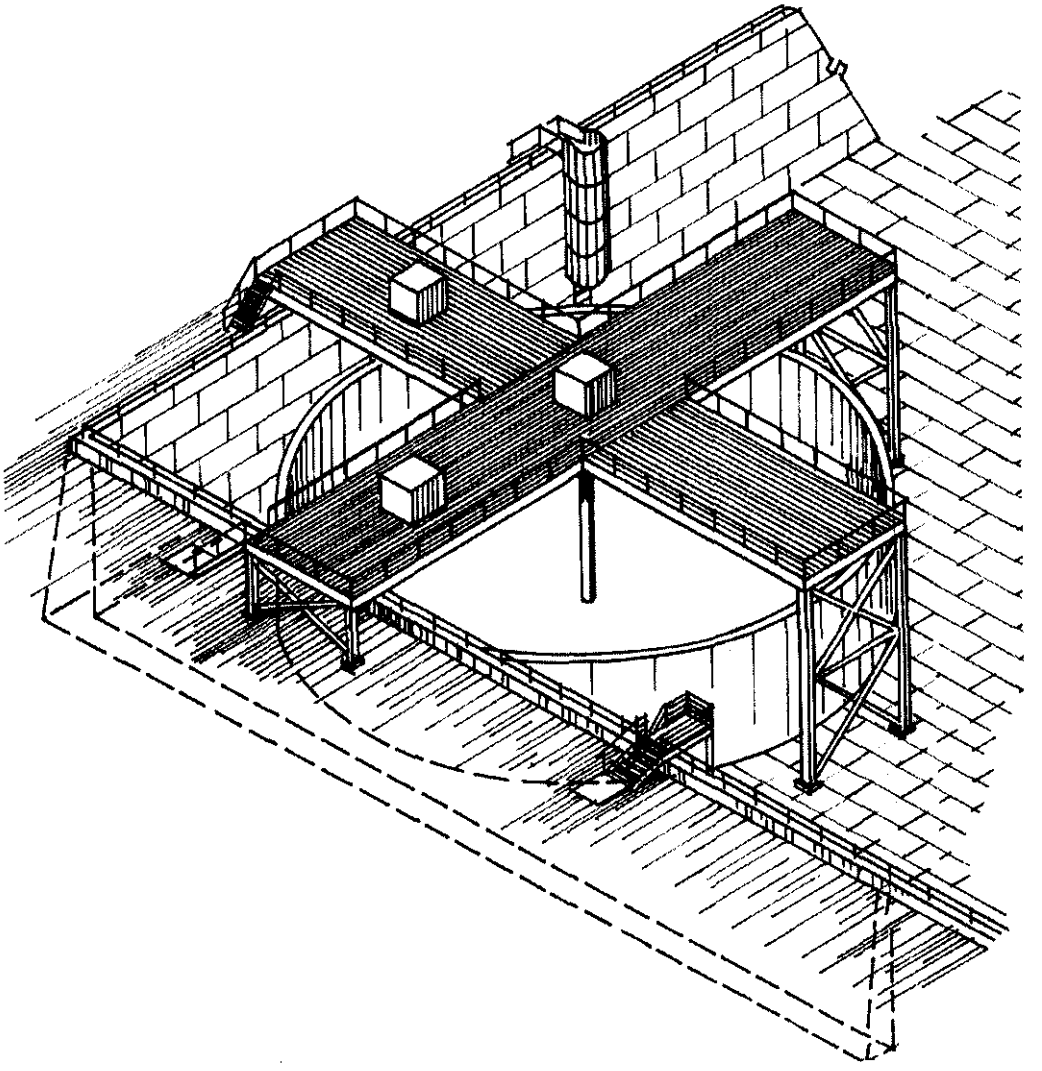
3.2.1 Performance Characteristics

This section contains all requirements related to the functionality and performance capabilities for the CTTM facility.

3.2.1.1 Receive Waste Simulants In-Tank

The CTTM facility shall be capable of accepting, staging, and directing up to 600,000 gallons of the CTTM facility user-supplied simulants into the desired location(s) of the CTTM tank within 5 days. User-supplied simulants to be accommodated by the CTTM facility are specified in Section 3.2.5.2.1.

Figure 2. Artist's Rendering of Freestanding CTTM Tank.



3.2.1.2 Contain Waste Simulants

The CTTM facility shall be capable of containing non-hazardous waste simulants within the CTTM tank any time waste simulants are present—i.e., all pre-test, test, and post-test activities.

3.2.1.3 Store/Dispose Waste Simulants

The CTTM facility shall be capable of segregated storage, separate from the CTTM tank, of the different types of waste simulants identified in Section 3.2.5.2.1. Total storage capacity shall be at least 700,000 gallons, divided into three approximately equal volumes. (Initial construction may only be for 1/3 of the total volume, however, a footprint shall be provided to accommodate constructing the remaining storage volume.) A sump pump capable of pumping liquids with a specific gravity up to 1.5 shall be provided.

3.2.1.4 Support On/In-tank Test Equipment

The CTTM facility shall be capable of physically supporting loads imposed by on/in-tank test equipment, auxiliary test equipment, and test personnel as described in Sections 3.2.5.2.2 - 3.2.5.2.4. On/in-tank test equipment includes, but is not limited to, mock-ups of transfer associated structures and tank risers, mixer pumps, transfer pumps, SST waste retrieval system and associated support structures, and on/in-tank instrumentation.

3.2.1.5 Monitor Tank for Waste Simulant Leaks

The CTTM facility shall be designed to locally monitor the CTTM tank simulant level to enable detection of a leak in the CTTM tank.

3.2.1.6 Respond to Waste Simulant Leaks

The CTTM facility/operator personnel shall be capable of responding to waste simulant leaks in the CTTM facility tank within 5 days. Possible responses include test shutdown and waste simulant removal prior to maintenance actions to repair the CTTM facility tank.

3.2.1.7 Distribute 480 Vac Power

The CTTM facility shall provide 3-phase 480/277 Vac power for the CTTM facility user that can be isolated without interrupting power to normal CTTM facility loads. Sufficient power, isolated separately, shall be provided to support simultaneous operation of two 300 hp variable speed mixer pumps and one 150 hp variable speed transfer pump, with an additional 100 kVa for other miscellaneous equipment such as instrumentation and control. The CTTM facility shall provide 3-phase, 480/277 Vac power to support area lighting and other loads determined during design.

3.2.1.8 Distribute 240(or 208)/120 Vac Power

The CTTM facility shall transform 480 Vac power to 240(or 208)/120 Vac power and distribute 240(or 208)/120 Vac power for use throughout the CTTM facility. Usage includes CTTM facility personnel spaces/control area loads (e.g., lighting; heating, ventilation, and air conditioning, and electrical outlets for user-supplied test-support equipment [e.g., power tools, welders]). The CTTM facility shall also accommodate the CTTM facility user 240(or 208)/120 Vac power needs with access to the 240(or 208)/120 Vac power bus and to convenience outlets distributed around the test bed to support maintenance and test setup. The number and locations of these outlets will be determined during design.

3.2.1.9 Light CTTM Facility

The CTTM facility shall include lighting for interior areas of the facility and exterior areas of the CTTM test bed (e.g., lay-down area, CTTM tank and superstructure) and support areas (e.g., roads, parking), as appropriate, in accordance with the illumination values given in Figure 11-1 of *The IESNA Lighting Handbook.*

3.2.1.10 Distribute Water

The CTTM facility shall provide water for fire protection in accordance with NFPA 24, *Installation of Private Fire Service Mains and Their Appurtenances*. The CTTM facility shall provide valved access for the CTTM facility user to a source of water adjacent to the test bed at 100 gal/min and 80 lbf/in^2. The CTTM facility shall provide sufficient potable water to support at least 10 people at the CTTM facility including personnel areas and eyewash and personnel shower locations within the CTTM facility, as required.

3.2.1.11 Accommodate CTTM Facility and User Personnel

The CTTM facility shall provide environmentally controlled change areas (including personnel showers), restrooms, and a lunch area for at least 10 people. Facility services shall include janitorial service and disposition of sanitary waste. The CTTM facility shall provide six environmentally controlled office spaces with space for two people each and a telephone drop for each. The CTTM facility shall provide a controlled access, monitor and control area with space for at least 4 personal computers and 10 people including at least two telephone drops. Environmentally controlled warehouse storage of at least 4,000 ft^2 shall be provided.

3.2.1.12 Inspect CTTM Facility for Suitability

The CTTM facility shall be designed for ease of inspection. The time required for a visual facility inspection (walk down) shall be less than 1 day after test user teardown and test article and simulant removal.

3.2.1.13 Weather Protection of Equipment

The CTTM facility design shall accommodate the potential to temporarily enclose test equipment on the primary and/or secondary superstructures for freeze protection.

3.2.2 External Interface Requirements

External electrical power and water sources are dependent upon the site location and will be determined during design.

3.2.3 Physical Characteristics

This section contains requirements related to physical characteristics (maximum/minimum physical size, weight, shape, etc.).

a. An open-top steel tank shall be constructed to simulate a lower tank section. The tank interior shall be 70 to 75 ft in diameter and capable of containing 25 ft of simulant with a freeboard of 2 ft.

b. A steel bridge or primary superstructure at approximately [surrounding] ground level shall span the open tank and be of sufficient height above the tank to provide 35 ft of clearance between the tank bottom and the bottom of the primary superstructure to accommodate SST waste retrieval equipment installation (see Figures 3 - 5). Principal structural member pairs shall be located in a "+" configuration with a 20 foot inside edge to inside edge separation (see Figure 6).

c. The primary superstructure shall be supported on foundation(s) that do not impose a load upon the tank and shall have sufficient clearance from the tank so as to preclude damage or interaction between these two elements.

d. The removable secondary superstructures shall extend above the primary superstructure to provide 55 feet of clearance from the tank bottom (see Figures 3 and 6).

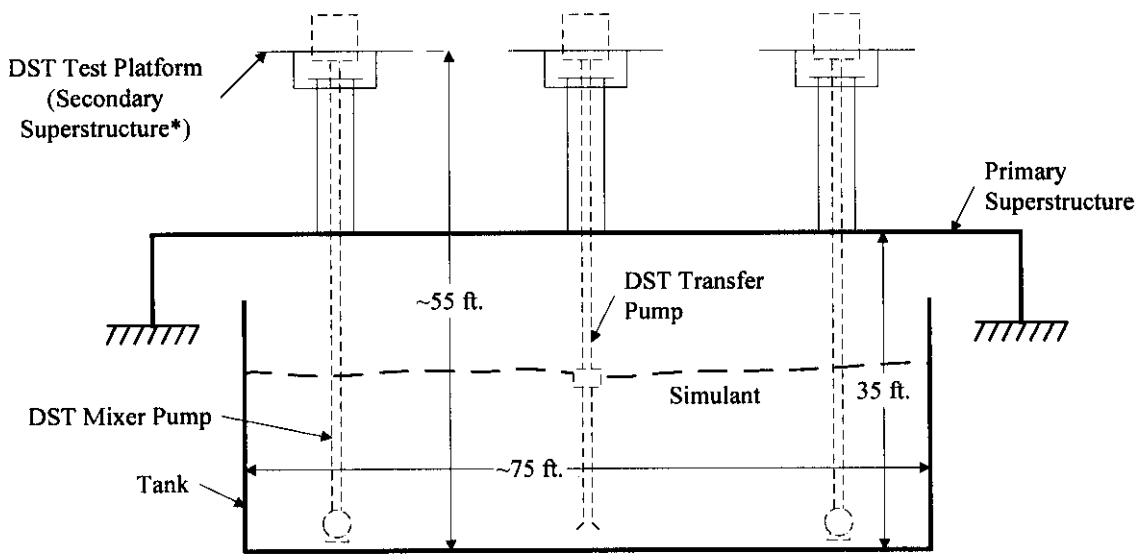
e. The CTTM facility shall provide a lay-down area of at least one acre.

f. The CTTM facility shall provide space adjacent to the lay-down area for simultaneous use by two 110-ton cranes and a 50-ft trailer.

g. The CTTM facility design shall provide a designated footprint adjacent to the CTTM tank large enough for the operation of a 110-ton crane. The structural integrity of this footprint shall preclude damage to the CTTM tank.

h. The CTTM spent simulant storage should be an above grade, watertight concrete trough with 4 to 5 foot high walls, provision for weather protection (to prevent rain and sand intrusion), and connected to the CTTM tank via removable hosing.

Figure 3. Schematic of DST Pump Installation at CTTM Facility.



* This is one concept of the secondary superstructure.
Another concept may be a single bi-level superstructure.

i. The CTTM spent simulant storage shall be easily accessible by an excavator for simulant removal/disposal.

j. Personnel access to the superstructure platform shall be provided.

k. Access into the tank for personnel shall be provided for regular cleaning/inspection work.

l. The CTTM facility shall provide parking space for at least 10 vehicles.

m. A corrosion/erosion allowance of 3 mils/yr shall be used in the CTTM tank design.

Figure 4. Schematic of SST Waste Retrieval Equipment Installation at CTTM Facility.

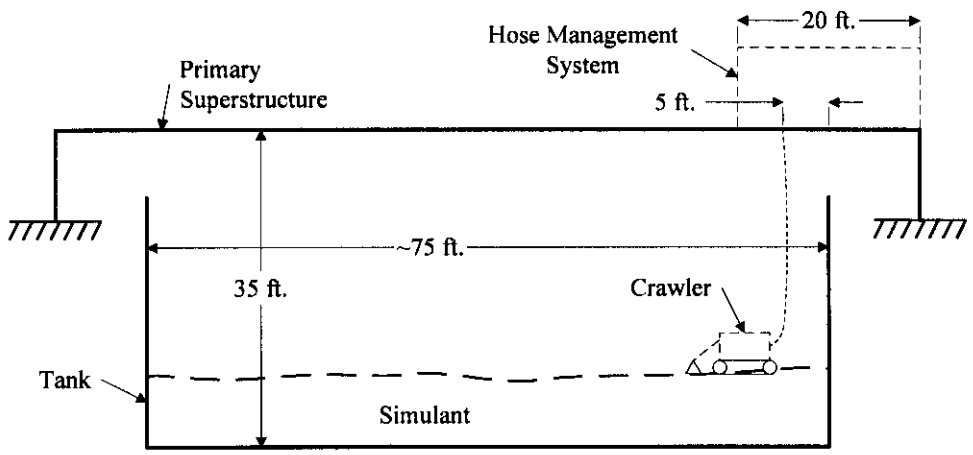


Figure 5. Schematic of SST Fluidic Mixer Installation at CTTM Facility.

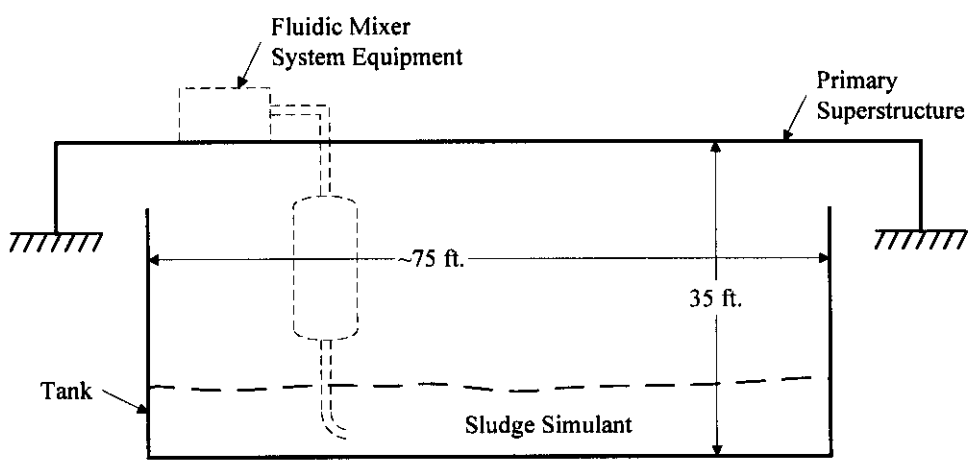
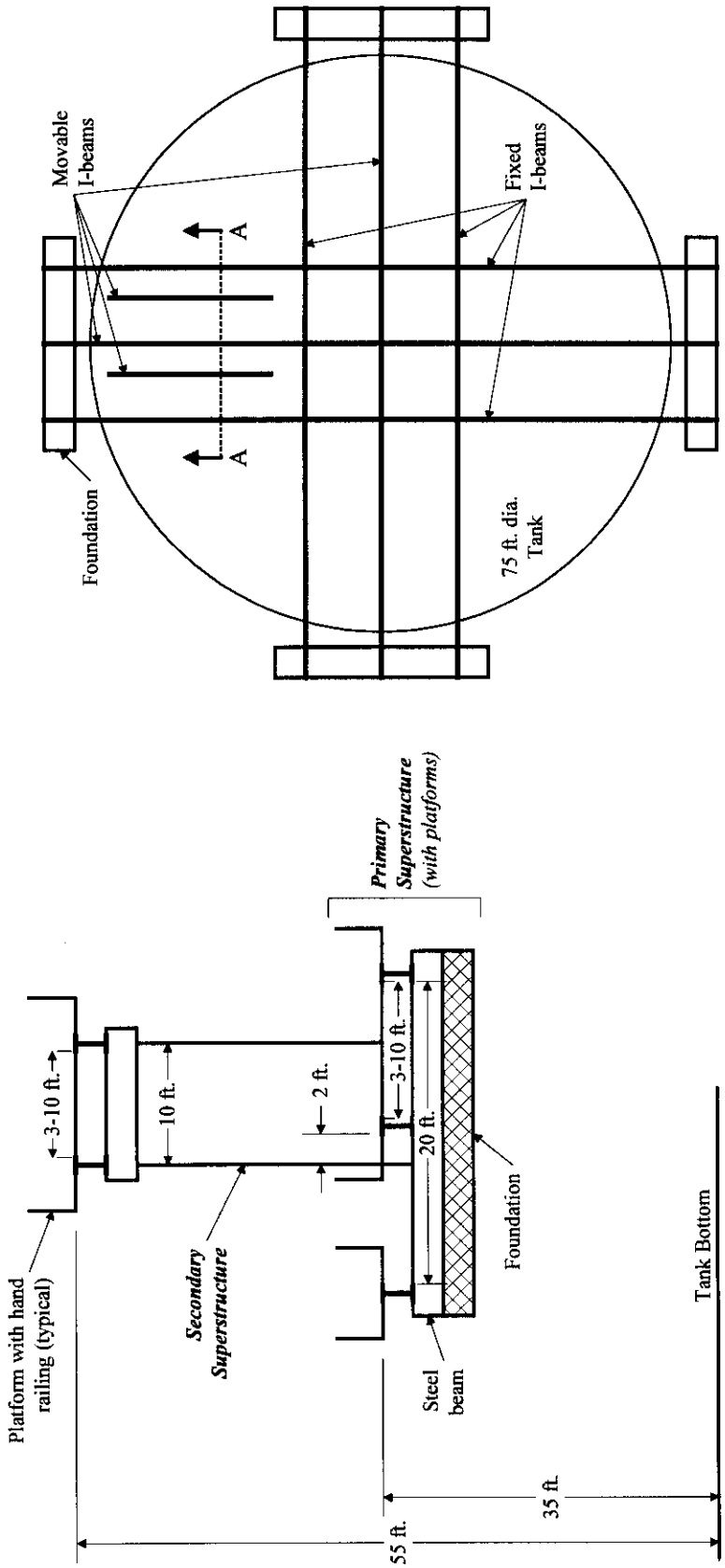


Figure 6. Secondary Superstructure Schematic.



3.2.4 Facility Quality Factors

The CTTM facility components shall have a design life of 30 years.

3.2.5 Environmental Conditions

This section provides design requirements relevant to natural and induced environmental conditions.

3.2.5.1 Natural Environments

The CTTM facility shall be designed for the natural environmental conditions occurring at the Hanford Site, as listed in Table 3. (Note: these environmental conditions must be modified if the CTTM facility is not located on the Hanford Reservation.) The CTTM facility shall be designed to withstand the natural phenomena hazards as specified in HNF-IP-0842, Volume IV, Section 3.14, "Engineering Design and Evaluation," for a PC-1 [general service] performance category designation.

Table 3. Hanford Environmental Conditions.

Maximum Precipitation in 6 hours	1.8 in.
Ambient Temperature	-25° to 115° F
Subsurface Temperature at depth of:	
0.5 in.	-25° to 160° F *
15 in.	10° to 95° F
36 in.	30° to 87° F
Wind (maximum peak gusts)	85 mile/hour
Maximum Distributed Load (includes snow and ashfall)	20 lbf/ft^2

* The maximum temperature is based on data from a site with no vegetation or shade. The minimum temperature is considerably lower than the minimum recorded at this depth to accommodate extreme differences in exposure and isolation at the Hanford Site.

Data Source: HNF-SD-GN-ER-501.

3.2.5.2 Induced Environments

This section defines the induced environment impinging on the CTTM facility including waste simulant chemistry, vibration, and equipment loads.

3.2.5.2.1 Waste Simulants. The CTTM facility components shall be designed to perform their intended function in the various *potential* waste simulant environments listed in Table 4. (Note: these are design basis values, not necessarily the actual composition.)

Table 4. Waste Simulant Composition.

Simulant	Composition *
Insoluble waste with large heavy particles	Silica Sand: Median particle size = 275 μm ±20 μm Density = 3 g/mL
Insoluble, high shear strength waste	Kaolin or bentonite clay
Soluble salt	Sodium bicarbonate or sodium nitrate
Concentrated supernatant	Supernatant consisting of sodium nitrate dissolved in water

* Note: these simulants are non-hazardous/non-dangerous compounds.

3.2.5.2.2 Static Loads. The CTTM superstructures shall be designed for test-induced static loads as defined in Figure 7.

3.2.5.2.3 Static Deflection. The maximum static deflection in the CTTM superstructures should be ≤ 2 inches.

3.2.5.2.4 Impact Loads. The CTTM superstructures shall be designed for test equipment installation impact loads equal to two times the maximum weight of test item. The maximum impact load shall be determined during design.

3.2.5.2.5 Vibration. The CTTM superstructures shall have lateral, axial, and torsional frequency ratios at least 1.5 times higher or lower than the corresponding dominant frequency of test equipment mounted on the superstructure. The test equipment will introduce torsional force frequencies between 16 to 19 Hz.

3.2.5.2.6 Operating Temperature. The maximum operating temperature for the CTTM tank shall be 125°F.

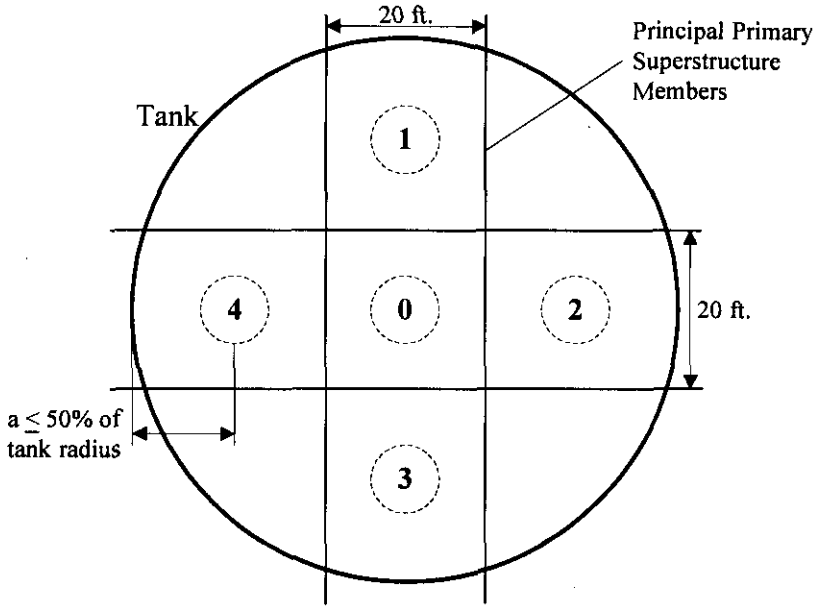
3.2.6 Flexibility and Expansion

The CTTM facility shall be designed to accommodate additional equipment and features over time. The CTTM shall be capable of testing SST retrieval equipment, DST WFD equipment, and equipment that supports both SSTs and DSTs (see Section 1.2.1 and Figures 3, 4 and 5). The secondary superstructures shall be a modular design that minimizes test set up and takedown times.

3.2.6.1 Additional Tank

The CTTM facility site shall be sized to permit installation of an additional 35-foot diameter tank in the future.

Figure 7. Static Load Schematic for the CTTM Facility.



Dead Load Combinations	Configuration	Position 0	Positions 1 through 4
1	2 Mixer & Transfer Pump Test (Off-Center Transfer Pump)	0	30 ton at any two positions 20 ton at any one position
2	2 Mixer & Transfer Pump Test (Center Transfer Pump)	20 ton	30 ton at any two positions (usually 1 & 3 or 2 & 4)
3	1 Mixer & Transfer Pump Test (Center Mixer Pump)	30 ton	20 ton at any one position
4 * **	Crawler Test (Off-Center with Center Transfer Pump)	20 ton	50 ton at any one position

* "a" should not exceed 18 ft. from the tank wall for this load combination.
** This load is for the primary superstructure only. All other load combinations are for both superstructures (primary and secondary).

3.3 DESIGN AND CONSTRUCTION

The CTTM facility shall be designed in accordance with the UBC, *Uniform Building Code*, and the structural components shall be designed in accordance with AISC ASD design rules.

3.3.1 Materials, Processes, and Parts

This section defines CTTM facility requirements governing the use of materials and processes.

a. The access road to the CTTM facility shall comply with WSDOT M 22-01, *Design Manual.*

3.3.2 Electromagnetic Radiation

Arc suppression shall be used for relay/switch contacts and electrical power shall be run through galvanized steel conduits. The CTTM facility design shall be based on the concept of two separate electrically insulated ground systems--the equipment ground system and the control common system. The manner in which the two systems are grounded will depend on the nature of the CTTM facility equipment and that installed by the CTTM facility user. See IEEE STD-518, Section 6.2.1.3 for guidance on equipment and control system grounding design practices.

3.3.3 Safety

The CTTM facility shall be designed to protect the workers and equipment in accordance with the requirements of this section. Use engineering controls whenever possible to eliminate hazardous conditions, including elimination of confined spaces.

a. The CTTM facility shall incorporate design features that comply with the applicable requirements of 29 CFR 1910, "Occupational Safety and Health Standards," Subparts D, E, G, J, L, N, O, and S.

b. The CTTM facility design shall incorporate fall protection requirements in accordance with 29 CFR 1926, Subpart M, "Fall Protection."

c. Fire protection measures shall be in accordance with the applicable requirements in NFPA 13, *Standard for the Installation of Sprinkler Systems*; NFPA 70, *National Electrical Code*; NFPA 72, *National Fire Alarm Code*; and NFPA 101, *Life Safety Code.*

d. Grounding systems shall comply with NFPA 70 and IEEE 142, *Recommended Practice for Grounding of Industrial and Commercial Power Systems.* A separate ground conductor shall be used. Raceway systems shall not be used as ground path.

3.3.4 Security

The CTTM facility shall prevent damage or loss of sensitive information, equipment or materials and prevent site intrusion. The CTTM facility perimeter shall be enclosed with a 6-foot high chain link/cyclone fence topped with barbed wire. Vehicle/personnel access shall be through a 16 ft wide lockable gate.

4.0 NOTES

4.1 ASSUMPTIONS

There were a number of assumptions that were adopted to prepare this F&R for the CTTM facility. The primary assumptions are listed below:

- Radioactive, contaminated, and hazardous waste simulants will not be used in the CTTM facility.
- Waste simulants used in the test facility will either be provided by the organization performing the test or through a reuse of spent simulants stored at the CTTM facility.

4.2 ACRONYMS AND ABBREVIATIONS

AISC	American Institute of Steel Construction
ASD	*Manual of Steel Construction – Allowable Stress Design*
CFR	*Code of Federal Regulations*
CTTM	Cold Test, Training, and Mockup [facility]
DOE	U.S. Department of Energy
DST	double-shell tank
F&R	functions and requirements
FY	fiscal year
RPP	River Protection Project
SST	single-shell tank
UBC	*Uniform Building Code*
Vac	volts alternating current
WFD	waste feed delivery
WSDOT	Washington State Department of Transportation
WTP	Waste Treatment Plant

4.3 DEFINITIONS

Sensitive—Information (including materials and equipment) subject to use or disclosure under the restrictions generally labeled as business sensitive, strictly private or a similar signifier. Sensitive information includes information about CHG or DOE plans, procurements or personnel and release of such information could cause financial or competitive harm to CHG or DOE.

Shall—Denotes a requirement.

Should—Denotes a recommendation. If a "should" requirement cannot be satisfied, justification of an alternative design shall be submitted to the Design Authority for approval.

Supernatant—The usually clear liquid floating on the surface of the waste (or waste simulant).

4.4 REFERENCES

Ecology et al., 1996, *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement), 89-10, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy.

HNF-2826, 1999, *Single-Shell Tank System Functional Analysis*, Rev. 1, Numatec Hanford Corporation for CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-5136, 2000, *Functional Analysis for Double-Shell Tank Subsystems*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-IP-0842, 2000, "Functions and Requirements Analysis Allocation and Development of Level 1 and 2 Specifications," in *RPP Administration*, Volume IV, Section 3.2, Rev. 1c, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-IP-0842, 2000, "Testing Practices Requirements," in *RPP Administration*, Volume IV, Section 4.28, Rev. 0b, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-SD-GN-ER-501, 2001, *Natural Phenomena Hazards, Hanford Site Washington*, Rev. 1A, Numatec Hanford Corporation for CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-SD-WM-SP-012, 2000, *Tank Waste Remediation System Operation and Utilization Plan*, Rev. 2, Numatec Hanford Corporation, Lockheed Martin Hanford Corporation, and COGEMA Engineering Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.

IEEE STD 518-1982, 1982, *IEEE Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources*, The Institute of Electrical and Electronics Engineers, Inc.

RPP-6525, 2000, *Functions and Requirements for the Tank 241-C-104 Waste Retrieval System (Project W-523)*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-7087, 2000, *Single-Shell Tank Retrieval Sequence: Fiscal Year 2000 Update*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-7502, 2000, *Acquisition Strategy for Cold Test, Training, and Mock-up Facilities*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.