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U.S. Department of Energy
Office of River Protection
P.O. Box 450
Richland, Washington 99352

JAN 29 2003

03-TPD-015

Mr. Michael A. Wilson, Program Manager
Nuclear Waste Program
State of Washington
Department of Ecology
1315 W. Fourth Avenue
Kennewick, Washington 99336

Dear Mr. Wilson:

HANFORD FEDERAL FACILITY AGREEMENT AND CONSENT ORDER (HFFACO)
M-45-05I-T01 30% DESIGN CONSULTATION MEETING

The purpose of this correspondence is to demonstrate completion by the U.S. Department of Energy, Office of River Protection for HFFACO M-45-05I-T01 30% Design Consultation meeting scheduled for January 30, 2003. The briefing presentation provides a project status report in accordance with the target requirements (Attachment 1). Also provided are the briefing agenda and sign-in roster (Attachment 2 & 3). The due date for this target date is January 31, 2003.

If you have any questions, please contact me, or your staff may contact James Thompson, Tank Farms Programs and Projects Division, (509) 373-9757.

Sincerely,

James E. Rasmussen

James E. Rasmussen, Director
Environmental Division

TPD:JFT

Attachments (3)
1. Project Status Report
2. Agenda
3. Sign-In-Roster

cc w/attachs:
W. T. Dixon, CHG
M. N. Jarayssi, CHG

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Tri-Party Agreement Milestone M-45-05I-T01

Conduct C-106 Waste Retrieval and Closure Demonstration Project 30% Design Consultation

Moses N. Jarayssi
CH2M HILL Hanford Group, Inc.

January 30, 2003

Office of River Protection

CH2MHILL
Hanford Group, Inc.

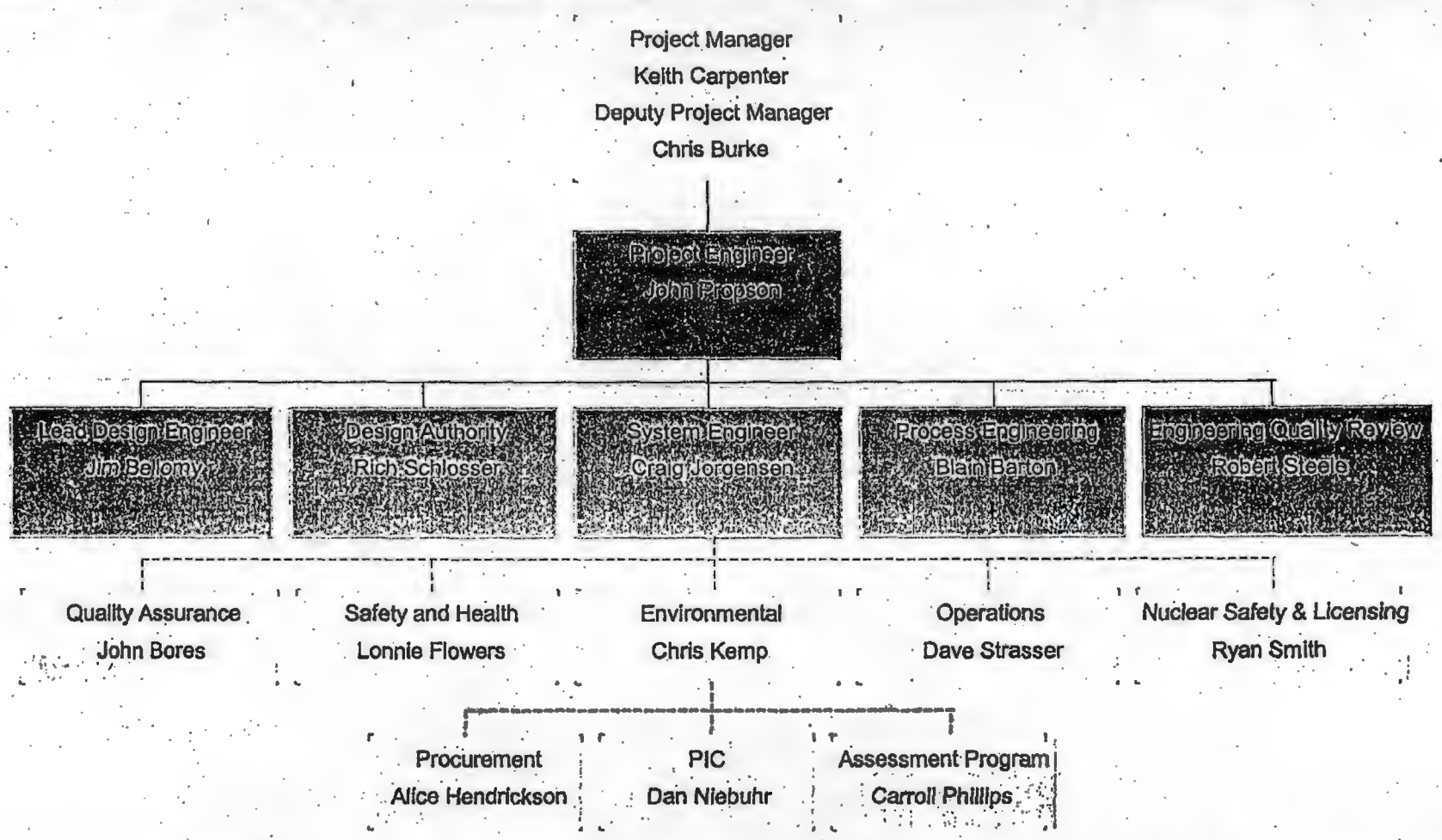
Overview

- Project Status
- Estimated Waste Volume
- Waste Volume After Retrieval
- Estimated Tc-99 Removed
- Leak Mitigation (Process Control Actions)
- Leak Detection and Monitoring Logic/Thresholds
- Retrieval Risk Assessment
- Project Challenges
- Summary

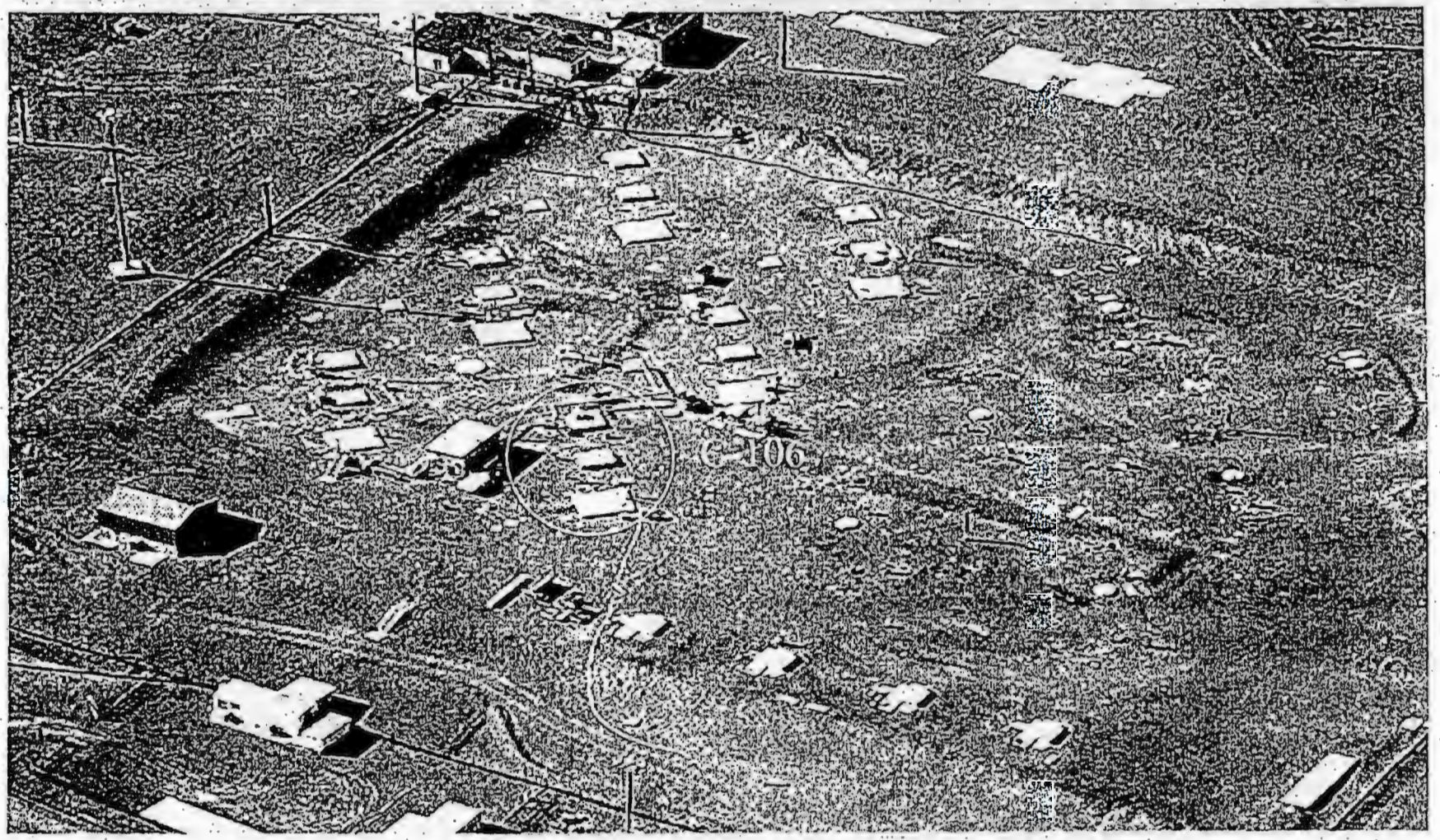
Project Status - Objective

- Provide systems, structures, and components necessary to retrieve waste and transfer to the DST system (remaining residual waste ≤ 360 cubic feet)
- Design equipment utilizing modular approach for rapid deployment and redeployment on successive tanks
- Minimize waste generation during retrieval and transfer
- Accelerate near-term risk reduction by removing liquids and mobilizing solids
- Perform final waste retrieval by November 1, 2003, or sooner, in accordance with TPA target milestone (M-45-05L-T01)
- Interim close tank by April 30, 2004, or sooner, in accordance with TPA milestone (M-45-05H)
- Final closure in accordance with approved Closure Plans and EIS-ROD

Project Status – Multi-Disciplinary Team



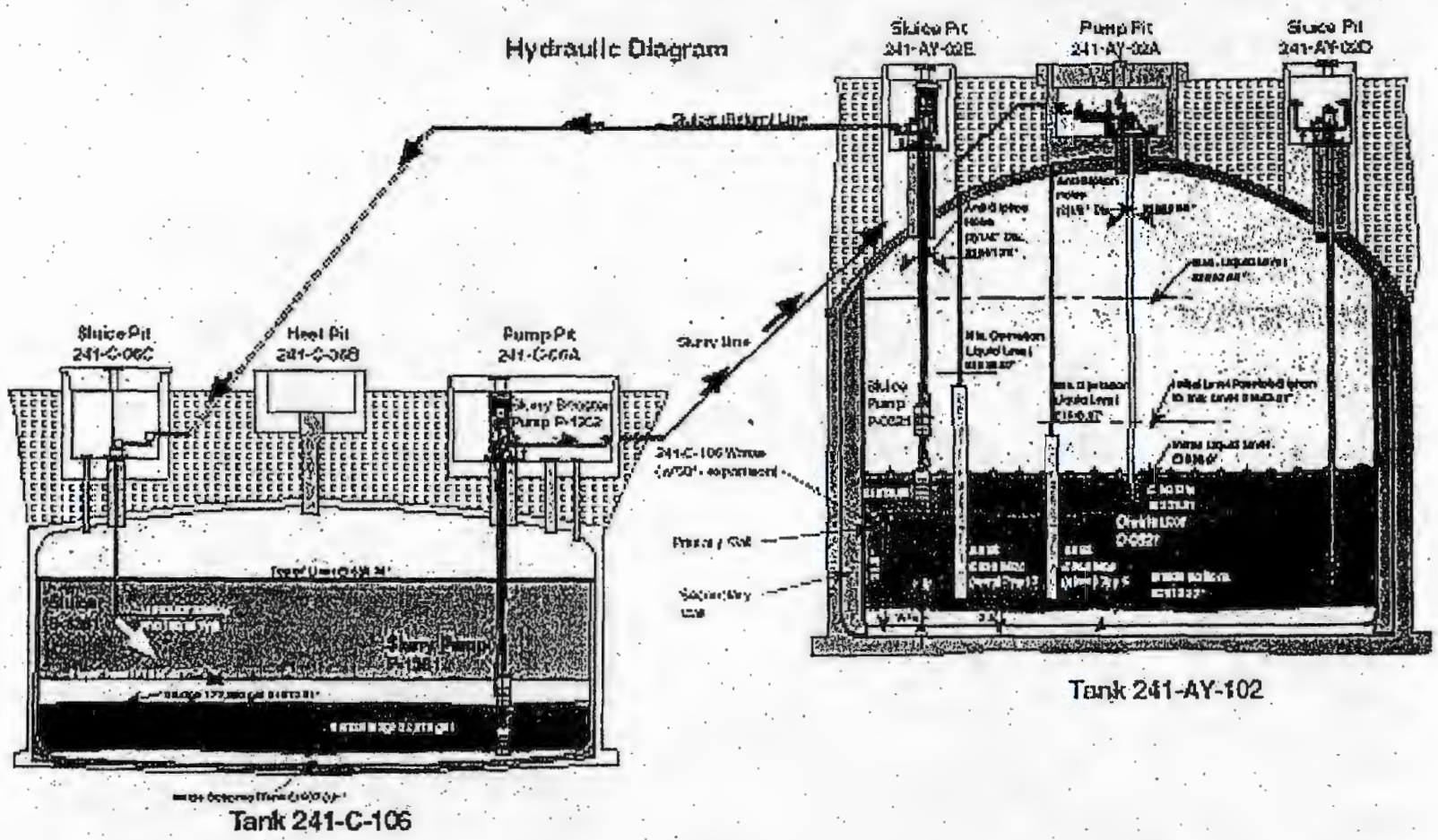
Project Status – C Tank Farm Aerial View



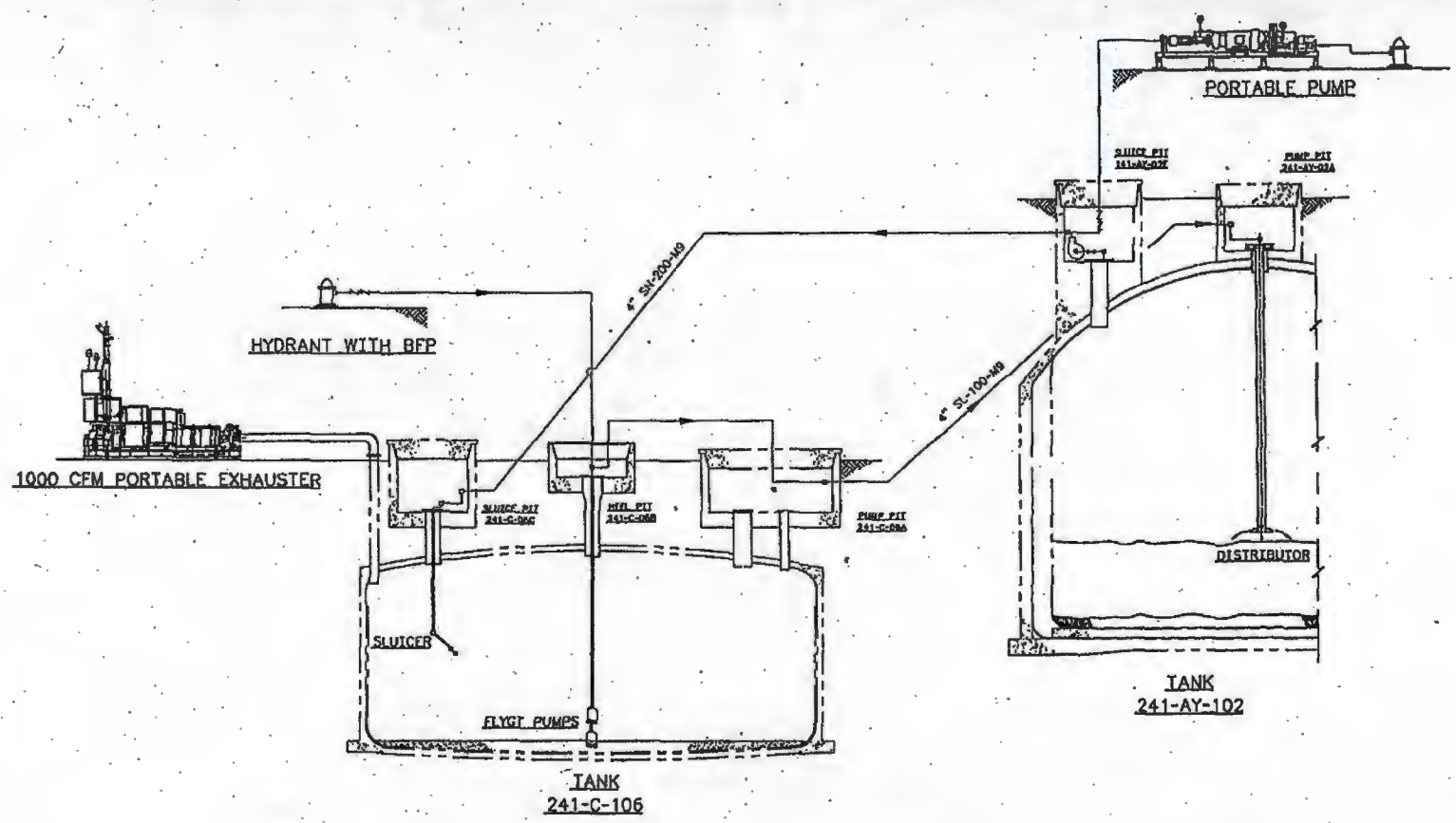
Project Status – Retrieval Concept

- Improve "past practice" sluicing using lower liquid volumes and more effective sluice operations, pump design, and pump placement
- Raw water initially introduced through sluicer to move waste to central location
- Accelerated risk reduction by removing liquids and mobilizing solids from C-106 and transfer to AY-102 using existing 4" line
- Utilize pumping or vacuum system and sluicer to mobilize remaining waste for removal and transfer via hose-in-hose transfer line (HIHTL) to AN-106

Project Status - C106 Past Practice Sluicing

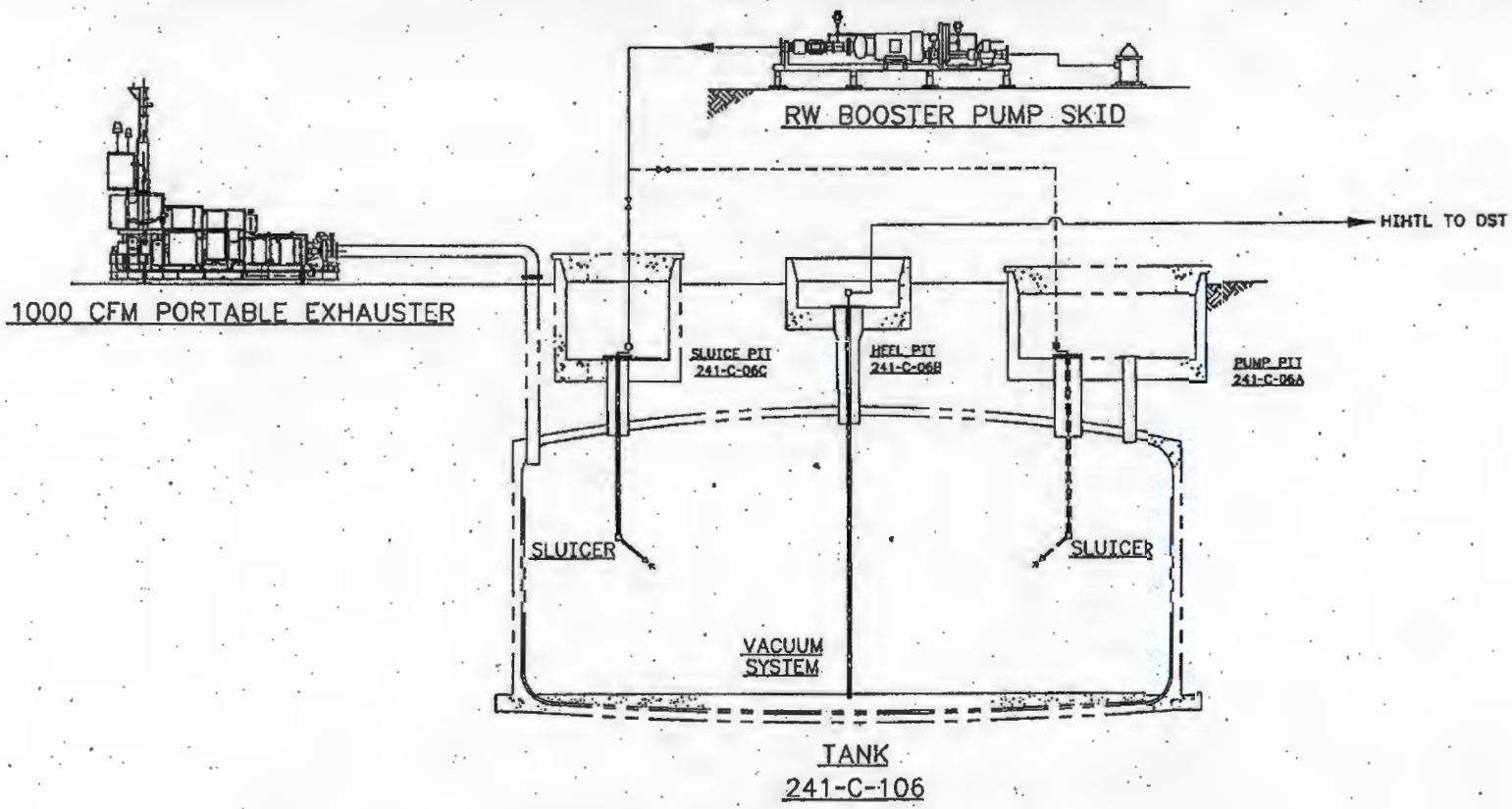


Project Status – Accelerated Risk Reduction



ACCELERATED RISK REDUCTION

Project Status – Risk Reduction



RISK REDUCTION

Project Status - C106 Process Control Plan

- Process Control Plan being developed and will be publicly released prior to initiation of waste removal operations
- Coordinates technical operating controls for waste retrieval and provides guidance for transfer system operations
- Technical operating controls include Final Safety Analysis Report, Technical Safety Requirements, Operating Specification Document, environmental controls, and good operating practices
- Describes tank conditions, waste conditions, major equipment, operating strategy, and response to off-normal conditions
- Provides controls to manage flammable gas, waste temperatures, ammonia releases, and solids precipitation
- Establishes monitoring requirements

Project Status – Supporting Equipment

- Raw water skid provides raw water at appropriate pressure and flow rate for sluicer operation
- Ventilation system provides control of potential emissions and visibility within tank space (NOC's approved)
- Camera systems enable effective sluicer operation
- Transfer lines provide means of waste transport
- Controls and instrumentation provides safe, secure, and effective waste retrieval system operation
- Utilities support operations

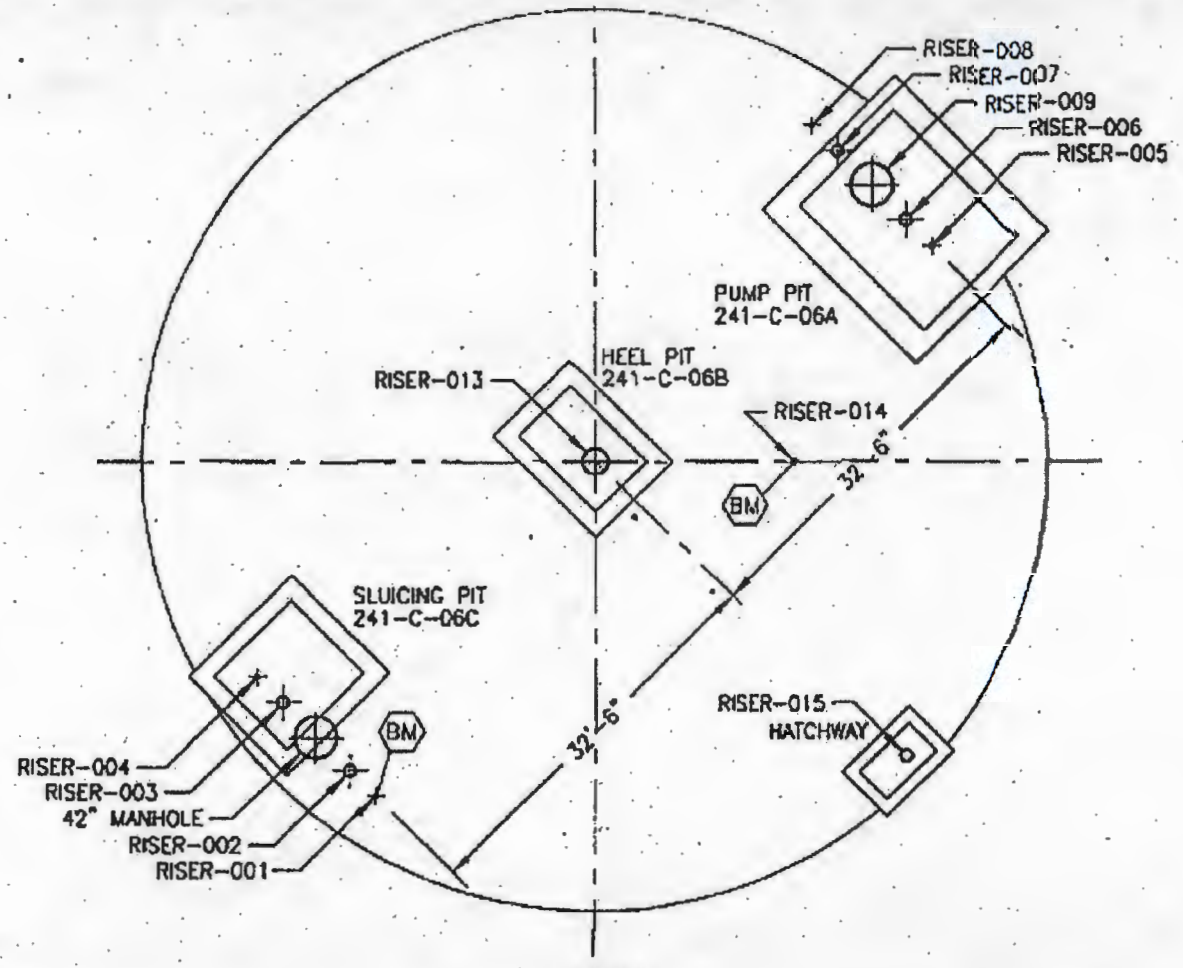
Project Status – Equipment Removal

- Thermocouple tree from riser #14
- Heel jet pump from riser #13
- Sluicer from riser #3
- Failed transfer pump from riser #6
- Slurry pump from riser #9

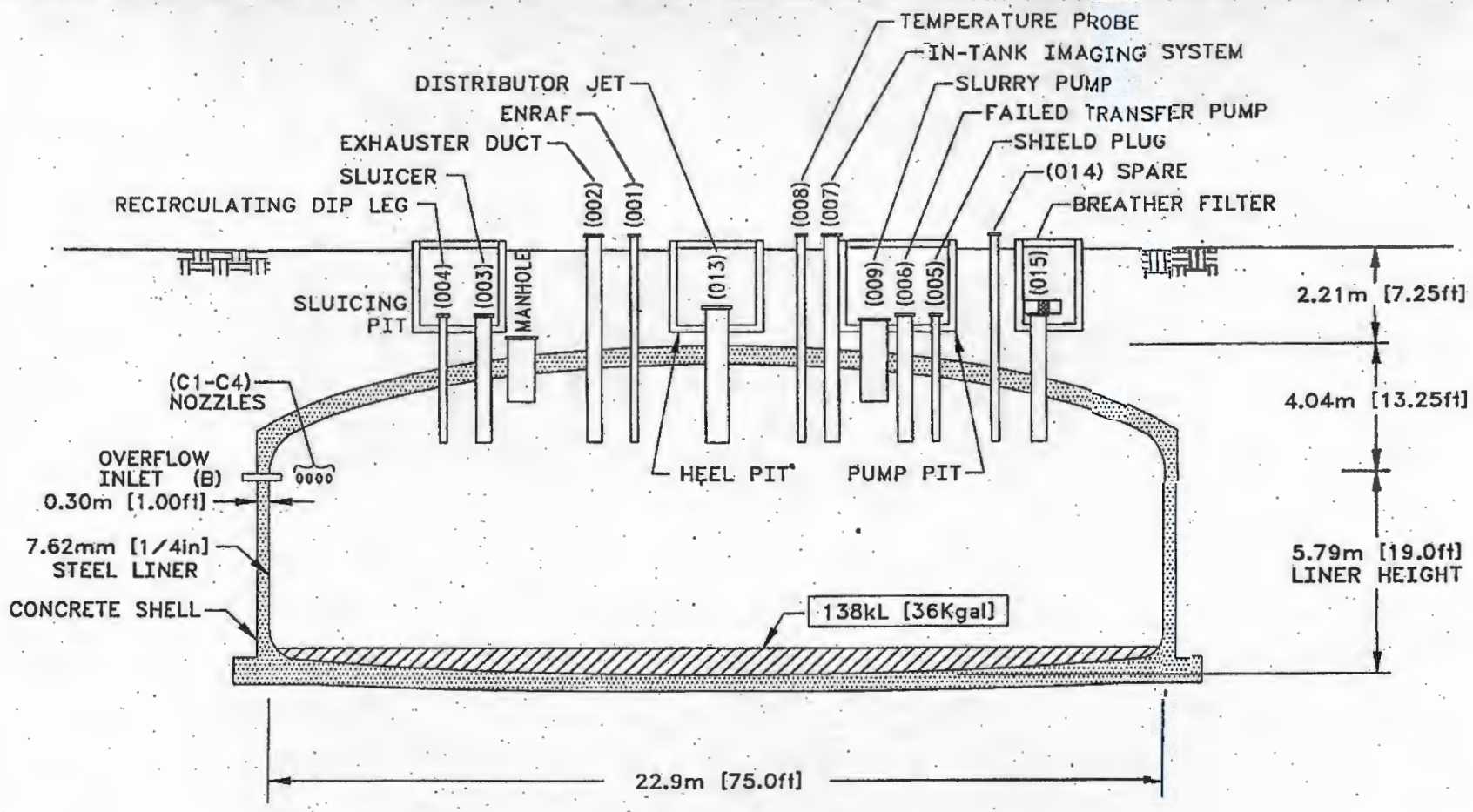
Project Status – Equipment Installation

- Transfer pump
- Raw water skid
- Ventilation system
- Camera systems
- Slurry pump/vacuum systems
- Controls, instrumentation, utilities, and miscellaneous equipment

Project Status - Plan View of Riser Locations



Project Status – Riser Profile



2006 kL [530 kgal]

Tank 241-C-106

Project Status - Riser Details

Riser ID	Minimum Diameter (Inches)	Description	Access	References and Comments
R1	4	Level indicating transmitter (Enraf)	Above grade	Ref. H-2-817634 (CH2M HILL 1999a, 1999b, 2000b, 2000c, 2001c, 2002d). ENRAF 854 ATG (retractable plummet in riser).
R2	12	HVAC duct conn. to exhauster	Above grade	Ref. H-14-020113, Sheet 2 (CH2M HILL 2002e).
R3	12	Sluicer jumper assembly	Inside pit 241-C-06C	Ref. H-2-818516 and H-2-818549 (ICF Kaiser 1998a and 1998b). Sluicing nozzle in riser.
R4	4	Recirculating dip leg (old).	Inside pit 241-C-06C	Vertical nozzle blank ref. H-2-73453 (LMHC 1997). Plugged 3-in. vertical pipe, hanging from riser above waste.
R5	4	Shield plug	Inside pit 241-C-06A	–
R6	12	Failed transfer pump.	Inside pit 241-C-06A	Approx. 4-in. pipe, hanging from riser above waste.
R7	12	Camera	Above grade	Formerly housed an in-tank imaging system (since removed). Access for portable camera or other equipment.

Project Status - Riser Details (cont.)

Riser ID	Minimum Diameter (Inches)	Description	Access	References and Comments
R8	4	Thermocouple tree (temperature probe)	Above grade	Approx. 2-in. pipe, extending from riser to waste.
R9	36 [30]	Slurry pump	Inside pit 241-C-06A	Ref. H-2-818494) (ICF Kaiser 1998c). Large pipe, hanging from riser (winched above waste.
R13	12	Heel jet pump (old).	Inside pit 241-C-06B	Ref. H-2-41294 (GEC 1953). 10-in. pipe with "foot," extending from riser to waste.
R14	4	Spare	Above grade	Formerly housed Thermocouple tree Approx. 2-in. pipe, extending from riser to waste.
R15	12	Air inlet filter on top of condenser pit	Above grade	Ref. H-2-818470 (ICF Kaiser 1999). Air inlet filter station acts as a passive breather when exhauster is shut down
HVAC	n/a	Condenser pit	Inside HVAC hatchway	No straight (i.e., vertical) access into tank.

Notes:
ATG = Advanced Technology Gauge
HVAC = heating ventilating and air conditioning
Ref. = Reference
Primary reference source for above data is H-2-73346, *Piping Waste Tank Isolation Tank 241-C-106* (LMHC 1998). Some information verified based on in-tank videos.

Project Status – Major Activities Completed

- Level 2 Specification issued
- ECNs for equipment removal issued
- Concept sketches developed
- P&IDs drafted
- Equipment plans and layouts drafted
- Ventilation system modifications drafted
- LDMM approach and systems identified

Project Status – Major Activities Completed (cont.)

- Lift analyses – Appendix A being issued
- Vendor interfaces – ongoing
- Process Control Plan – being developed
- Obtained Notice of Construction approval from WDOH
- Completed HAZOP and PDSA
- Enhanced Work Planning sessions for equipment removal
- Equipment removal system mockup testing
- Removed thermocouple tree from Riser #14

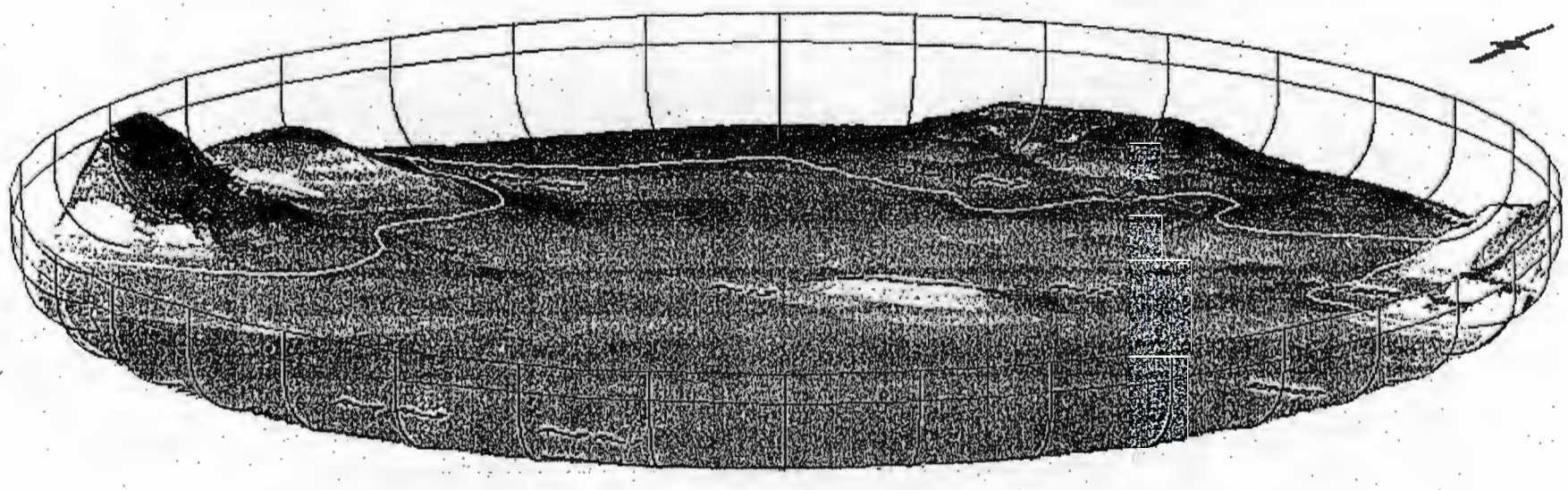
Estimated Waste Volume

- Performed with AutoCAD *Land Development Desktop*, Release 2i
- 3-D computer model developed from as-built drawings, video recordings, and other reference information
- Liquid levels and solids Triangulated Irregular Network (TIN) derived from ENRAF readings and videos
- Calculations account for "dish" tank bottom and "stiffener" rings

Waste Phase	Volume (m^3)	Volume (ft^3)	Volume (gallons)
Solids	34	1,211	9,056
Liquids	102	3,600	26,930
TOTAL	136	4,811	35,986

REF: RPP-12547, "Tank 241-C-106 Residual Liquids and Solids Volume Calculation"

Estimated Waste Volume - 3D Surface Profile



Estimated Waste Volume - Surface Plan View

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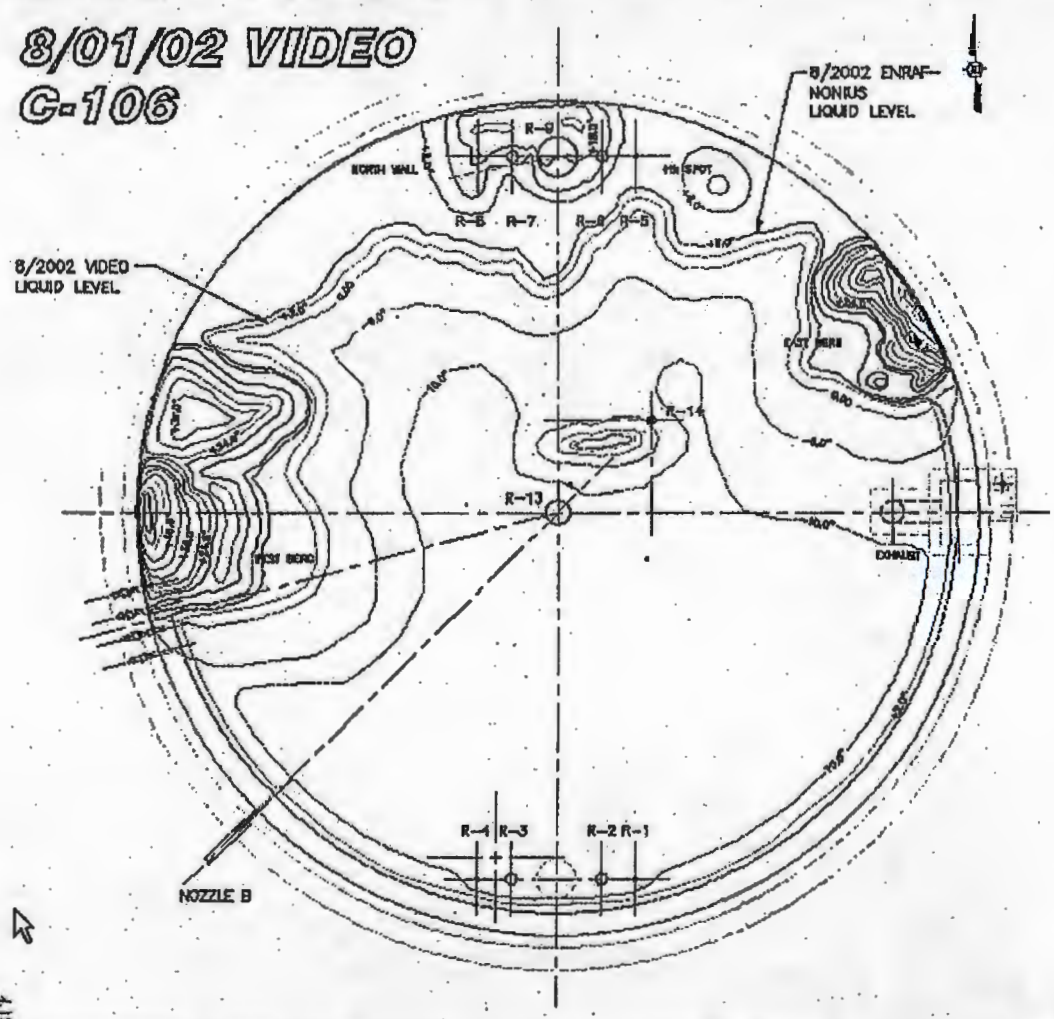
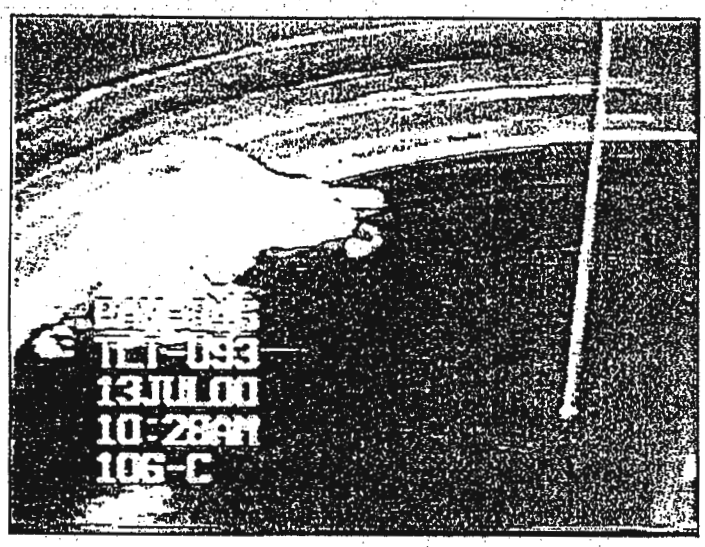
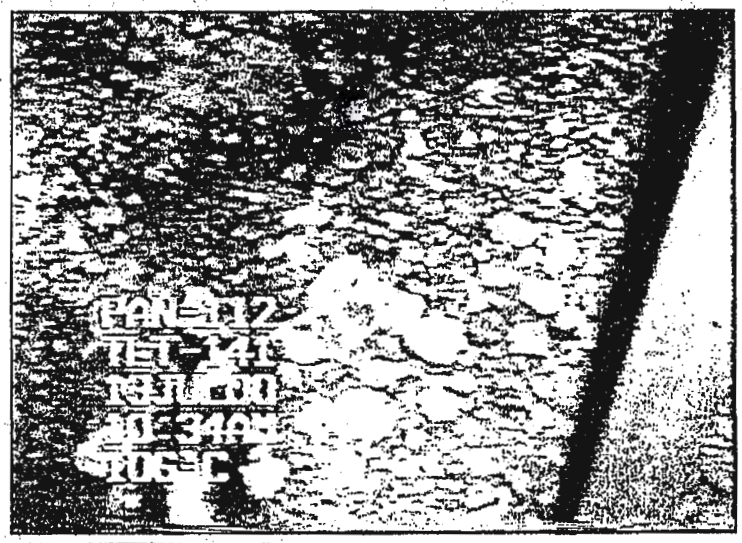
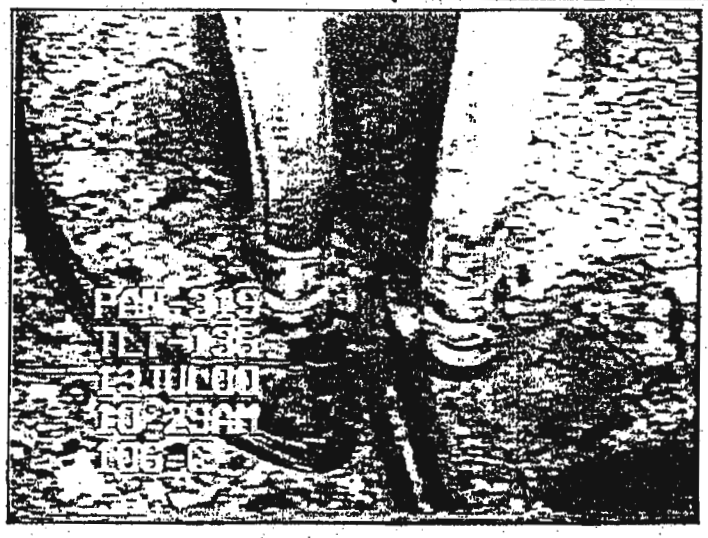


Tank C-106 Residual Wastes







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Estimated Waste Volume – Physical Properties

Physical Property	Value
Fluffing factor	1.4 (Range 1.0 to 1.8)
Liquid Density	1.17 g/mL
Particle density	2.61 g/mL
Sludge bulk density	1.55 g/mL
Viscosity	<3 (Supernatant, no data for sludge or solids)
Temperature	60 – 86 °F
Median particle size	0.75 – 6.4 micron

Waste Volume After Retrieval

- Retrieval system design and operations focused on achieving TPA goal of ≤360 cubic feet or limits of technology, whichever is less
- Near-term accelerated risk reduction achieved by removing liquids and mobilizing solids, followed by additional solids retrieval
- Sample at end of liquids removal to determine inventory of contaminants in residual wastes, physical properties of residual wastes, and associated risks
- Review sample results and associated risks with Ecology and decide appropriate path forward
- Sample results support technical basis for residual waste immobilization and stabilization methods

Estimated Tc-99 Removed

- Tc-99 inventory originally estimated at 26.2 Ci (Ref: RPP-6696, *Data To Support Tank C-106 Waste Retrieval Determination*, 9/00)
- Best Basis Inventory estimate of 3.14 Ci of Tc-99 roughly order of magnitude lower; based on AY-102 samples after receipt of C-106 wastes (BBI, 9/02)
- Soluble Tc-99 in solids expected to be mobilized during sluicing
- Estimated that >99% of soluble Tc-99 will be removed by sluicing

Analyte	Waste Phase	Waste Type	Inventory (Ci)
Tc-99	Sludge	AR (Solid)	1.03
Tc-99	Supernatant	AR (Liquid)	2.11
Tc-99	Total		3.14

Comparison of Tc-99 Estimates

	RPE (RPP-6696, 9/00)		BBI (12/02)		Ratio (BBI/RPE)
Tank	Tc-99 (Ci)	ILCR	Tc-99 (Ci)	ILCR	
C-101	0.0193	7.95E-10	0.6970	2.87E-08	36.14
C-102	0.0155	6.40E-10	1.3200	5.44E-08	85.02
C-103	2.6928	1.11E-07	34.2000	1.41E-06	12.70
C-104	0.3687	1.52E-08	58.0000	2.39E-06	157.29
C-105	3.6146	1.49E-07	81.4000	3.36E-06	22.52
C-106	26.2000	1.08E-06	3.1400	1.29E-07	0.12
C-107	2.1130	8.71E-08	37.9000	1.56E-06	17.94
C-108	0.0149	6.13E-10	6.1900	2.55E-07	416.25
C-109	1.0965	4.52E-08	32.3000	1.33E-06	29.46
C-110	0.8175	3.37E-08	31.8000	1.31E-06	38.90
C-111	0.0134	5.54E-10	2.7000	1.11E-07	200.90
C-112	1.7564	7.24E-08	61.1000	2.52E-06	34.79
C-201	0.0010	4.17E-11	0.0141	5.81E-10	13.94
C-202	0.0014	5.82E-11	0.0147	6.06E-10	10.41
C-203	0.0010	3.92E-11	0.0282	1.16E-09	29.65
C-204	0.0015	5.98E-11	0.0181	7.46E-10	12.48
C-101 row	3.3185	1.37E-07	128.3970	5.29E-06	38.69
C-102 row	3.6585	1.51E-07	91.6100	3.78E-06	25.04
C-103 row	31.7457	1.31E-06	130.7400	5.39E-06	4.12
C-200 row	0.0049	1.36E-07	0.0751	5.26E-06	15.56
Total	38.7275	1.73E-06	350.822	1.97E-05	9.06

LDMM Logic/Thresholds – General

- C-106 not currently leaking and has no history of past leaks
- Initial focus on removing liquids to quickly minimize leak potential
- Followed by solids retrieval with minimal liquid additions
- Ex-tank leak detection with gamma-ray logging and neutron moisture probe logging in dry wells surrounding tank
- Hand-held moisture monitoring on more frequent basis, if practical
- Totalized volume material balance during retrieval supplemented by static liquid level measurements
- Receiver tank and transfer lines also monitored for leakage

LDMM Logic/Thresholds – Leak Mitigation

- Control liquid to minimum level necessary and minimize fluid head
- Minimize contact of sluice stream with tank walls until final cleanout
- Pump down to minimum liquid heel during retrieval downtimes
- Time at risk relatively short due to pumping durations (2-15 days)
- If leak occurs, sluicing operations will cease and tank will be pumped down to minimum liquid level

LDMM Logic/Thresholds – Leak Detection and Monitoring

Dry Well Monitoring

- Eight dry wells located around periphery of C-106
- Monitoring with gamma-ray and neutron moisture probe logging
- Baseline established prior to retrieval operations; look for deviations
- Due to limitations of existing dry well monitoring methods and time required for liquids to migrate within sensitive range of leak detectors, small leak volumes (less than 4,000-12,000 gallons) cannot be detected reliably
- New leak detection techniques being tested for possible future applications following performance verification and acceptance

LDMM Logic/Thresholds – Leak Detection and Monitoring (cont.)

Material Balance

- Compare total liquid volume transferred out versus amount of liquid added for sluicing and flushing operations
- Liquid volume removed and transferred to DST receiver tank measured with process flow instrumentation
- Compare liquid pumped out versus amount entering receiver tank
- Uncertainties introduced into material balance including ENRAF level measurement accuracy, tank radius/volume tolerances, flow meter accuracy, retained gas volumes, flush water additions, caustic additions, sludge dissolution, and exposed solids volume
- Given material balance uncertainties, leaks less than 12,500 gallons cannot be detected reliably

C-106 Retrieval Risk Assessment

- Risk assessment completed based on previous work
  - Retrieval Performance Evaluation (RPE) Methodology for AX Tank Farm (DOE/RL-98-72)
  - Data to Support Tank C-106 Waste Retrieval Determination (RPP-6696)
  - Letter Report #1: Inventory Estimates to Support Tank C-106 Residual Waste Assessment (RPP-6629)
  - Field Investigation Report for Waste Management Area B-BX-BY (RPP-10098)
- Major assumptions in risk assessment include
  - Risk measured at tank farm fence line; Tc-99 primary ground water risk driver
  - Integrated Life-Time Cancer Risk (ILCR) is proportional to Tc-99 inventory and transport transfer function
  - Tc-99 inventories based on previous work for C-106 retrieval
  - Transport transfer function based on C-106 RPE residual waste (4.12E-8/Ci) and B-BX-BY Field Investigation Report for waste outside tanks (1.23E-5/Ci)

C-106 Retrieval Risk Assessment (cont.)

- Higher transport transfer function for ex-tank waste, no engineered barriers during much of travel time; lower transport transfer function for residual waste due to engineered barriers limiting infiltration rates
- Risk assessment results (shown graphically in following figures)
  - 1.0E-5 ILCR exists when 1 Ci of Tc-99 is released during retrieval or exists in soil
  - BBI inventory of 3.14 Ci of Tc-99 corresponds to ILCR of 1.3E-7
  - RPE inventory of 26.2 Ci of Tc-99 corresponds to ILCR of 1.0E-6
  - Residual inventory of 0.00936 Ci of Tc-99 corresponds to ILCR of 3.9E-10
  - Potential retrieval leakage loss of 5.01 Ci of Tc-99 from a 8,000 gallon leak corresponds to ILCR of 6.0E-5
- If point of compliance moved beyond fence line, then risk dominated by current estimated 41 Ci of Tc-99 leaked from tank C-101
- Risk assessment with current information and FIR approach due end of April; expanded tank/tank farm specific data due in early 2004

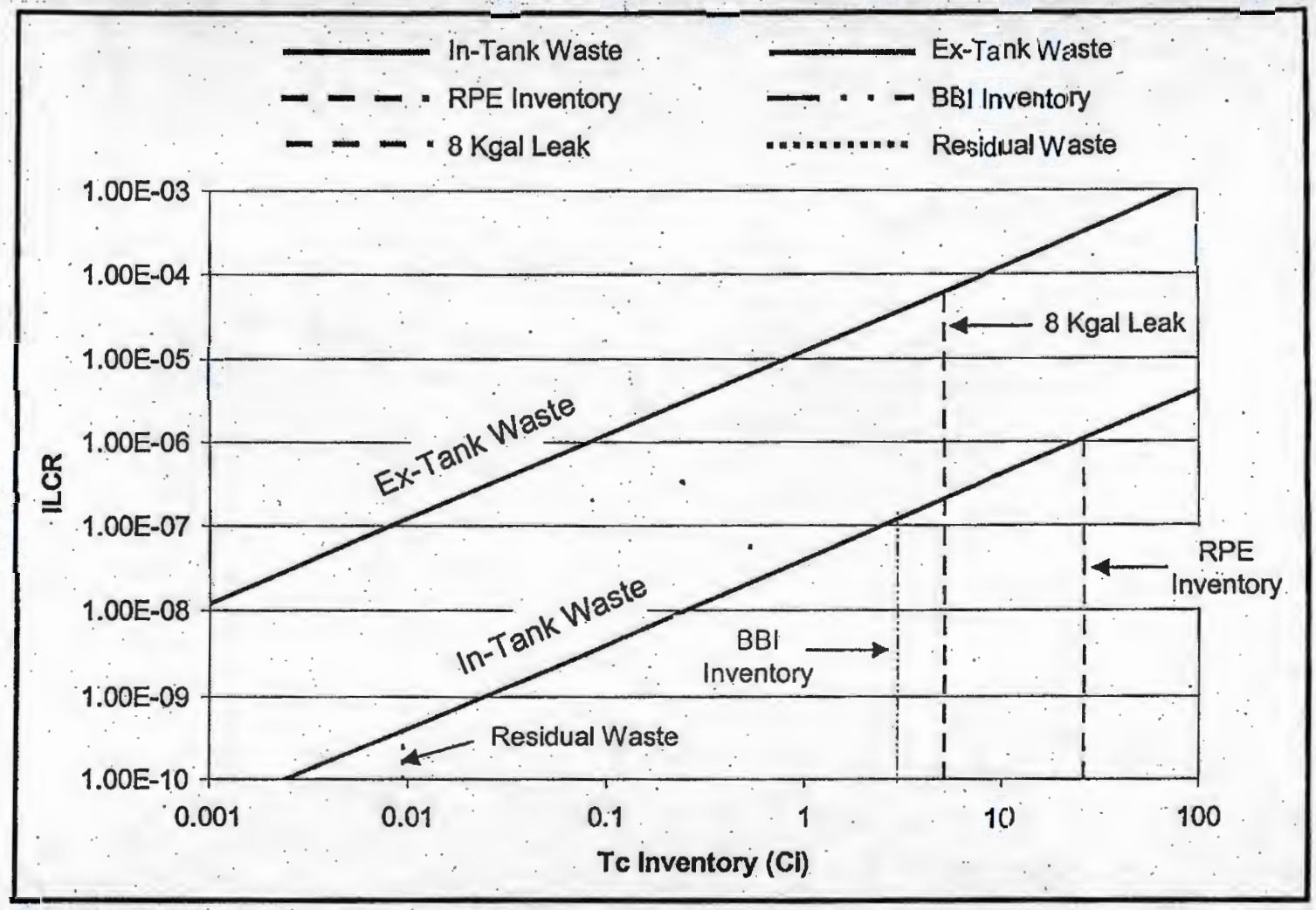
Tc-99 Inventory Versus ILCR

	No Retrieval		Residual Waste		Retrieval Leak		Past Leaks		Total external to tank		Total (post retrieval)	
Tank	Tc Inv	ILCR	Tc Inv	ILCR	Tc Inv	ILCR	Tc Inv	ILCR	Tc Inv	ILCR	Tc Inv	ILCR
C-101	0.0193	7.95E-10	0.00559	2.30E-10	0.0148	1.82E-07	41.3	5.08E-04	41.3148	5.08E-04	41.32039	5.08E-04
C-102	0.0155	6.40E-10	0.00432	1.78E-10	0.0117	1.44E-07	0	0.00E+00	0.0117	1.44E-07	0.01602	1.44E-07
C-103	2.6927	1.11E-07	1.18	4.86E-08	4.11	5.06E-05	0	0.00E+00	4.11	5.06E-05	5.29	5.06E-05
C-104	0.3687	1.52E-08	0.0696	2.87E-09	0.164	2.02E-06	0	0.00E+00	0.164	2.02E-06	0.2336	2.02E-06
C-105	3.6146	1.49E-07	1.77	7.30E-08	1.31	1.61E-05	0	0.00E+00	1.31	1.61E-05	3.08	1.62E-05
C-106	26.2000	1.08E-06	0.00936	3.86E-10	5.01	6.16E-05	0	0.00E+00	5.01	6.16E-05	5.01936	6.16E-05
C-107	2.1130	8.71E-08	0.645	2.66E-08	0.717	8.82E-06	0	0.00E+00	0.717	8.82E-06	1.362	8.85E-06
C-108	0.0149	6.13E-10	0.00632	2.61E-10	0.0213	2.62E-07	0	0.00E+00	0.0213	2.62E-07	0.02762	2.62E-07
C-109	1.0965	4.52E-08	0.534	2.20E-08	0.701	8.62E-06	0	0.00E+00	0.701	8.62E-06	1.235	8.64E-06
C-110	0.8175	3.37E-08	0.343	1.41E-08	0.962	1.18E-05	1.38	1.70E-05	2.342	2.88E-05	2.685	2.88E-05
C-111	0.0134	5.54E-10	0.00144	5.94E-11	0.00564	6.94E-08	0.0468	5.76E-07	0.05244	6.45E-07	0.05388	6.45E-07
C-112	1.7564	7.24E-08	0.836	3.45E-08	1.11	1.37E-05	0	0.00E+00	1.11	1.37E-05	1.946	1.37E-05
C-201	0.0010	4.17E-11	0.000233	9.60E-12	0.00102	1.25E-08	0.00562	6.91E-08	0.00664	8.17E-08	0.006873	8.17E-08
C-202	0.0014	5.82E-11	0.000207	8.53E-12	0.00106	1.30E-08	0.00435	5.35E-08	0.00541	6.65E-08	0.005617	6.66E-08
C-203	0.0009	3.92E-11	0.000319	1.31E-11	0.00134	1.65E-08	0.00453	5.57E-08	0.00587	7.22E-08	0.006189	7.22E-08
C-204	0.0014	5.98E-11	0.000407	1.68E-11	0.00167	2.05E-08	0.00318	3.91E-08	0.00485	5.97E-08	0.005257	5.97E-08
C-101 row	3.3185	1.37E-07	1.06319	4.38E-08	1.8578	2.29E-05	42.68	0.000525	44.5378	0.000548	45.60099	5.48E-04
C-102 row	3.6585	1.51E-07	1.78208	7.35E-08	1.34864	1.66E-05	0.0468	5.76E-07	1.39544	1.72E-05	3.17752	1.72E-05
C-103 row	31.7467	1.31E-06	2.55936	1.06E-07	10.931	0.000134	0	0	10.931	0.000134	13.49036	1.35E-04
C-200 row	0.004825	1.99E-10	0.00117	4.81E-11	0.00509	6.26E-08	.01768	2.17E-07	0.02277	2.8E-07	0.024	2.8E-07
Total	38.7275	1.6E-06	5.4058	2.23E-07	14.14253	0.000174	42.74448	0.000526	56.887	0.000739	62.293	7.00E-04

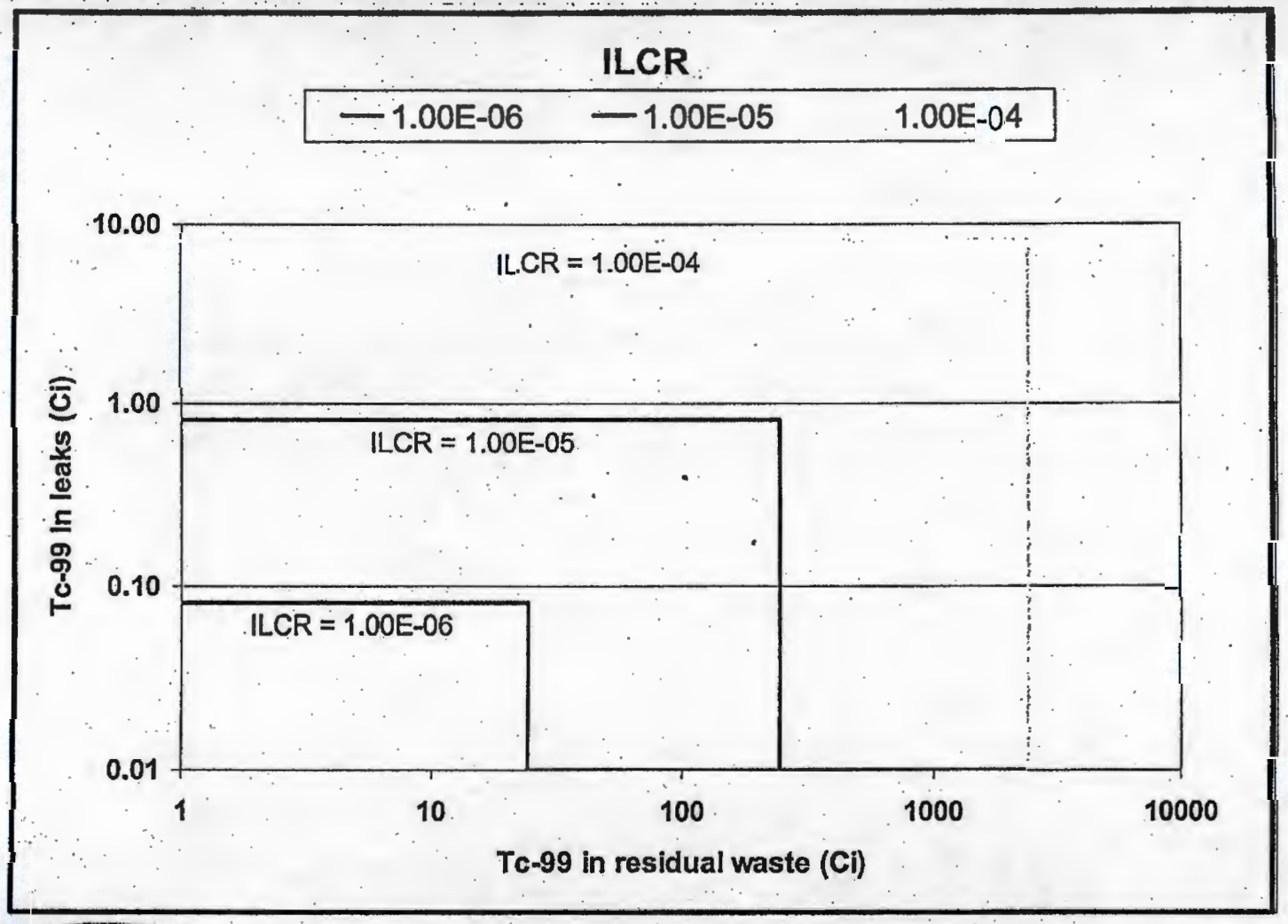
Tc is technetium-99
Inv is inventory (Ci); inventories taken from RPP-6696
ILCR is incremental lifetime cancer risk

C-101 row includes tanks C-101, C-104, C-107, and C-110
C-102 row includes tanks C-102, C-105, C-108, and C-111
C-103 row includes tanks C-103, C-106, C-109, and C-112
C-200 row includes tanks C-201, C-202, C-203, and C-204

Tc-99 Inventory Versus ILCR (cont.)



Residual Waste and Leaked Waste ILCR



Major Project Challenges

- Removal of Heel-Jet from Riser #13, and acceptance of waste container
- Availability of equipment (long-lead procurement durations)
- Procurement of critical fabrication components (near-term equipment including transfer pump and exhauster)
- All remaining long-length equipment removals (06A & 06B pits)

Summary

- Design, engineering, work package planning, fabrication, and procurement underway
- Long-lead procurements and removal of old equipment continue to provide schedule challenges; drive critical path for retrieval system installation and operations
- All activities being worked in parallel to minimize schedule impacts and support project completion in accordance with Tri-Party Agreement milestones and commitments
- Accelerated risk reduction will be achieved
- C-106 first tank to be retrieved and interim closed
- Demonstration provides opportunity to work through regulatory process to ensure cost-effective completion of work in a manner protective of human health and the environment

Backup Slides

"Functions & Requirements"

Functions and Requirements

Section	Function or Requirement Title	Source Document(s)	Remarks
3.1	Waste Retrieval System Definition.	HNF-IP-0842, Vol. 4, Sec. 3.2.	Follows prescribed process for functional analysis of higher-level system specifications.
3.1.1	Subsystem and Component Diagrams	HNF-IP-0842, Vol. 4, Sec. 3.2.	
3.1.2	Interface Definition	HNF-IP-0842, Vol. 4, Sec. 3.2.	
3.1.2.1.a	SST Electrical Power System	H-2-73948, Sh. 2; & H-2-818680.	Requires evaluation of electrical loads, power sources, needs of other projects.
3.1.2.1.b	SST Raw Water System	H-2-818562, Sh. 1.	
3.1.2.1.c	SST Service Air System (East Area)	H-2-818562, Sh. 1.	
3.1.2.1.d	DST Raw Water Subsystem	See remarks.	Raw water available from local hydrants in the area of 200E DST farms at pressures similar to 241-C Tank Farm supply (common source).
3.1.2.1.e	DST Electrical Power Subsystem	See HNF-4157, Sec. 3.2.1.1.	
3.1.2.1.f	DST Confinement Subsystem	See HNF-EP-0182 for available tank volume.	
3.1.2.1.g	System Interlocks	RPP-5586.	
3.1.2.2	Physical Interfaces	HNF-3912, Sec. 3.1.2.	
3.1.2.2.1	Tank 241-C-106	Facility drawings referenced in text.	Assumption is that the WRS is constrained to use the existing tank risers; no new tank penetrations on 241-C-106.

Functions and Requirements (cont.)

3.1.2.2.2	Receiving DST	Facility drawings referenced in text.	Assumption is that the WRS is constrained to use the existing tank risers; no new tank penetrations on the receiving DST.
3.2.1.1	Control Tank Structure and Waste Temperature	HNF-3912, Sec. 3.2.1.1.	
3.2.1.1.a	Tank Design Temperature Limits	OSD-T-151-00013.	HEPA filter integrity basis for maximum limits. Tank structural integrity basis for change rate. Operational limits may be more restrictive, based on piping design temperatures, other factors.
3.2.1.2	Control Tank Waste Level	HNF-3912, Sec. 3.2.1.1.	
3.2.1.2.a	Waste Level Limits	OSD-T-151-00013.	
3.2.1.2.b	Design Limit on Tank Structure	HNF-4712.	
3.2.1.3	Control Tank Vapor Space Pressure	HNF-3912, Sec. 3.2.1.1.	
3.2.1.3.a	Pressure Limits	OSD-T-151-00013.	Non-positive tank pressure required for radiological safety of tank farm personnel (i. e., confinement).
3.2.1.4	Control Tank Gaseous Discharges	HNF-3912, Sec. 3.2.1.1.	See also source documents for Sections 3.3.6.3.d and 3.3.6.3.e.
3.2.1.4.a	Air Treatment Requirements	OSD-T-151-00013.	

Functions and Requirements (cont.)

3.2.1.4.b	Tank Exhauster Stack CAM Interlock	OSD-T-151-00013; HNF-SD-WM-TSR-006, LCO 3.1.4.	
3.2.1.4.c	Flammable Gas Control Requirements	HNF-SD-WM-TSR-006, LCO 3.2.2 & LCO 3.2.3.	
3.2.1.5	Retrieve Waste from Tank 241-C-106	HNF-SD-WM-SP-012.	
3.2.1.5.a	Waste Retrieval Quantities	TPA M-45-00 (Ecology et al. 1996 as amended)	See also Sec. 1.2, Objective.
3.2.1.5.b	Waste Properties	WHC-SD-WM-ER-615; TWINS database (CHG 2002).	
3.2.1.5.1	Mobilize Tank Waste	See remarks.	Definitive section. Reflects functional requirement to retrieve tank waste, while minimizing addition of water to tank.
3.2.1.5.1.a	Existing In-Tank Hardware	See remarks.	Operational need. Consistent with Assumption 6 in Sec. 1.1; operational scenario does not include removing in-tank debris except as required for WRS installation.
3.2.1.5.1.b	In-Tank Aerosol Generation	See remarks.	Operational need and ALARA.
3.2.1.5.1.c	Raw Water Usage	See remarks.	Reiterates functional requirement to minimize addition of water to tank during retrieval.
3.2.1.5.2	Condition Tank Waste for Transport	HNF-3912.	Definitive section. Reflects functional requirement to retrieve waste from tank.

Functions and Requirements (cont.)

3.2.1.5.2.a	Retrieved Waste Characteristics	HNF-3912; HNF-SD-WM-OCD-015; HNF-SD-WM-TSR-006, AC 5.7, AC 5.8, & AC 5.12.	Additional definition of requirement to "condition" retrieved waste.
3.2.1.5.2.b	Waste Final Density in DST	HNF-SD-WM-OCD-015.	Additional definition of requirement to "condition" retrieved waste.
3.2.1.5.2.c	Entrained Gas	See remarks.	Operational need, to preclude adverse effects on flow instrumentation.
3.2.1.5.3	Convey Waste to Waste Transfer Line Subsystem	See remarks.	Definitive section. Separation of pumps or motive force from transfer lines allows greater design flexibility (e. g., motive force may be part of mobilization or waste conditioning equipment, or a separate process).
3.2.1.5.3.a	Transfer Line Plugging	See remarks.	Additional definition, addressing operational and ALARA needs.
3.2.1.5.3.b	Minimum Slurry Velocity	See remarks.	Additional definition to address operational needs, and to support transfer pump selection.
3.2.1.5.3.c	Fluid Design Temperature	HNF-4407.	Additional definition to support transfer pump selection.
3.2.1.6	Transfer SST Waste to Receiving DST	Derived from HNF-SD-WM-SP-012 & HNF-3912.	
3.2.1.6.a	Waste Transfer Lines	TBD	
3.2.1.6.b	Waste Transfer Line Flush Capability	TBD	

Functions and Requirements (cont.)

3.2.1.6.c	Waste Transfer Line Heat Tracing	TBD	
3.2.1.7	Control and Monitor Tank Waste Retrieval and Transfer Processes	HNF-3912.	Process control requirements to be developed, and control parameters specified for design, based on a process control plan to be prepared in accordance with HNF-IP-0842, Vol. 4, Sec. 4.8.
3.2.1.7.a	Signal Output Compatibility	See remarks.	Good engineering practice
3.2.1.7.b	Remote Operation	See remarks.	Supports ALARA principles; engineering judgment
3.2.1.7.c	Monitor In-Tank Operations	See remarks.	Operational need. Supports ALARA principles and remote operation.
3.2.1.7.d	Monitor Waste Retrieval and Transfer Processes	HNF-SD-WM-TSR-006, AC 5.12.	
3.2.1.7.e	WRS Emergency Stop Feature	See remarks.	Supports Conduct of Operations
3.2.1.7.f	Administrative Lock Features	HNF-SD-WM-TSR-006, AC 5.20. See also remarks.	Administrative locks required on active ventilation, if used, to prevent inadvertently exceeding OSD limit when exhauster is shut down. Other equipment to be reviewed by DA for administrative lock needs.
3.2.1.7.g	WRS Process Parameters	Supports HNF-SD-WM-TSR-006, AC 5.12. See also remarks.	This list of parameters will need to be verified as part of a process control strategy for the WRS process, based on a process control plan to be prepared in accordance with HNF-IP-0842, Vol. 4, Sec. 4.8.

Functions and Requirements (cont.)

3.2.1.7.1	Detect Tank Leaks during Waste Retrieval and Transfer	HNF-SD-WM-TSR-006, LCO 3.1.3.	
3.2.1.7.2	Mitigate Leaks during Waste Retrieval and Transfer	TBD	
3.2.1.7.2.a	Leak Detection System Shutdown	TBD	
3.2.1.8	Decontaminate and Remove In-Tank and Ex-Tank Retrieval Equipment	See remarks.	Based on ALARA and operational need. Also supports compliance with D&D req's in Sec. 3.3.8.
3.2.1.8.a	Decontamination Solution	See remarks.	Needed to protect WRS equipment from damage during decontamination process.
3.2.1.8.b	Waste Pipe Flushing	See remarks.	Additional definition of Sec. 3.2.1.9, based on current tank temperatures.
3.2.1.8.c	WRS Radiological Design	See remarks.	Additional definition of Sec. 3.2.1.9. Metal surface finish specified based on engineering judgment.
3.2.1.8.d	Decontamination Controls	See remarks.	Based on engineering judgment.
3.2.1.8.e	Equipment Disposal Considerations	See remarks.	Based on ALARA and control of disposal costs. Supports compliance with D&D req's in Sec. 3.3.8.
3.2.1.8.f	Waste Pipe Gravity Drain	See remarks.	Additional definition of Sec. 3.2.1.9, based on good engineering practice. See WHC-SD-GN-DGS-30011, Sec. 3.4.2, Item 6, for example.

Functions and Requirements (cont.)

3.2.1.8.g	Removability of In-Tank Equipment	See remarks.	Additional definition of Sec. 3.2.1.9, based on good engineering practice.
3.2.1.9	Distribute Utilities to the WRS (241-C Tank Farm)	See remarks	Based on required utility needs for WRS operation
3.2.1.9.a	Electrical Power Transformation	HNF-3912, Sec. 3.2.1.1.2.	
3.2.1.9.b	Electrical Power Distribution	HNF-3912, Sec. 3.2.1.1.2.	
3.2.1.9.c	Raw Water and Service Air Distribution	HNF-3912, Sec. 3.2.1.1.2.	
3.2.1.10	Distribute Utilities to the WRS (Receiving DST)	See remarks.	Based on required utility needs for WRS operation
3.2.1.10.a	Electrical Power Distribution	See remarks.	Corollary to Sec. 3.2.1.10.b, for DST portion of WRS.
3.2.1.10.b	Raw Water Distribution	See remarks.	Corollary to Sec. 3.2.1.10.c, for DST portion of WRS.
3.2.2.1.a	Axial Loads, 4-in. Tank 241-C-106 Risers	See remarks.	Based on engineering judgment and consideration of riser load limits for instrumentation and other minor (i. e., smaller and lighter-weight) equipment installations.
3.2.2.1.b	Axial Loads, 12-in. and Larger Tank 241-C-106 Risers	See remarks.	Based on engineering judgment and consideration of riser load limits for instrumentation and other minor (i. e., smaller and lighter-weight) equipment installations.
3.2.2.1.c	Allowable Load on Tank 241-C-106 Bottom	WHC-SD-W340-ANAL-001, Rev. 1, Section 3.3.	Tank bottom loads are based on analyses performed for light-duty utility arm (LDUA), Project W-340.

Functions and Requirements (cont.)

3.2.2.1.d	Tank 241-C-106 Dome Loading	HNF-SD-WM-SAR-067; HNF-SD-WM-TSR-006, AC 5.16.	
3.2.2.2	Waste Transfer Covers	See remarks.	Supports compliance with HNF-SD-WM-TSR-006, AC 5.16.
3.2.2.3	Over-ground Waste Transfer Line Vehicle Barriers	See remarks.	Supports compliance with HNF-SD-WM-TSR-006, AC 5.16.
3.2.3.1	Component Selection	See remarks.	Good engineering practice, related to equipment reliability and Conduct of Operations.
3.2.3.2	Overall Reliability/Availability	TBD	
3.2.3.3	Operational Life	See remarks.	The requirement for 1-year availability before operations begin to perform acceptance tests and readiness reviews is based on previous experience (e. g., Project W-320).
3.2.3.4	In-Tank and In-Pit Component Design Life	See remarks.	Design life for in-tank and in-pit components eliminates the need for maintenance, supporting ALARA principles.
3.2.3.5	Above-Grade Component Design Life	See remarks.	Five-year design life is based on an approximate 2-year operational life and an allowance for schedule slippage.
3.2.3.6	Temporary Over-Ground Transfer Lines	See remarks.	Shelf and service life consistent with previously specified hose-in-hose transfer line material, e. g., HNF-4407, and provide schedule flexibility.
3.2.4	Maintainability	See remarks.	Good engineering practice. Supports reuse of equipment for future retrieval campaigns in other tanks.

Functions and Requirements (cont.)

3.2.5.1	Natural Environments	See remarks.	Engineering judgment; based on comparison with similar (i. e., waste transfer) systems, likelihood is that many major components will be Safety Significant. See also Sec. 3.3.9.3.
3.2.5.1.a	Natural Environments	Temperature range HNF-SD-W320-FDC-001; humidity pers. comm. w/ Hanford Weather Station; other data HNF-SD-GN-ER-501.	Selection based on engineering judgment, considering temporary nature of installation and short duration of retrieval operation.
3.2.5.1.b	Ultraviolet Resistant Components	See remarks.	Good engineering practice.
3.2.5.2	Structural Loads	TFC-ENG-STD-06.	
3.2.5.3	Chemical Environment	HNF-SD-WM-SP-012, Appendix B	
3.2.5.4.a	In-Tank Radiological Exposure Rates	In-tank radiation environments: recent in-tank surveys, August 2002.	
3.2.5.4.b	In-Tank Humidity Range	HNF-SD-GN-ER-501 and pers. comm. with Hanford Weather Station for min. value.	
3.2.5.4.c	Waste pH Range	WHC-SD-WM-ER-615; TWINS data (CHG 2000).	Tank 241-C-106 is caustic deficient, hence pH < 12.
3.2.5.4.d	Temperature Range	TWINS data (CHG 2000).	
3.2.5.4.e	Vapor Space Pressure	See Sec. 3.2.1.3.	
3.2.5.4.f	Flammable Gas	HNF-SD-WM-TSR-006, AC 5.9.	

Functions and Requirements (cont.)

3.2.5.4.g	Organic Vapors	HNF-3732.	No data on organic vapors in Tank 241-C-106 collected since sluicing (WRSS) operations in 1999.
3.2.6	Transportability	See remarks.	Good engineering practice; intent of requirement to prevent design of hardware so massive that existing Hanford Site roads, transport equipment, etc. cannot accommodate transport. Modularity will facilitate installation and reuse of equipment.
3.2.7	Flexibility and Expansion	See remarks.	Operational need. Receiving DST is TBD, or is subject to change.
3.3.1.1	Materials Restrictions	HNF-SD-WM-OCD-015.	
3.3.1.2.a	Process Piping Code	TFC-ENG-STD-06.	
3.3.1.2.b	Flexible Piping Code	TFC-ENG-STD-06.	
3.3.1.2.c	Pressure Vessels and Vacuum Systems	TFC-ENG-STD-06.	
3.3.1.2.d	Jumpers		Operational and ALARA need.
3.3.1.2.e	Process Piping Temperature	See remarks.	Design temperature consistent with previously specified hose-in-hose transfer line material, e. g., HNF-4407. Related note on Sec. 3.2.1.5.3.
3.3.1.2.f	Siphoning Constraints	See remarks.	Operational need. This requirement drives design features to preclude siphoning waste back into SST.

Functions and Requirements (cont.)

3.3.1.2.g	Flush Connections	See remarks.	Need design feature at receiving DST to support transfer line flushes from high point (DST) to low point in system (241-C Tank Farm SST).
3.3.1.3	WRS Raw Water Connections	HNF-SD-WM-TSR-006, Rev. 2, LCO 3.1.2.	
3.3.1.3.a	Backflow Prevention	WAC 246-290-490.	
3.3.1.3.b	Service Water Pressure Detection	HNF-SD-WM-TSR-006, LCO 3.1.2.	
3.3.1.4	Toxic Products and Formulations	General; see remarks.	HNF-IP-0842, Vol. 6, Sec. 2.6 provides guidance on how to deal with regulated substances.
3.3.1.4.a	Lead	TFC-ENG-DESIGN-P-17.	TFC-ENG-DESIGN-P-17 implements 29 CFR 1910.1025 & 29 CFR 1926.62.
3.3.1.4.b	Toxic Substances Control Act	HNF-IP-0842, Vol. 6, Sec. 2.6.	HNF-IP-0842, Vol. 6, Sec. 2.6 implements 40 CFR 700 (Subchapter R).
3.3.1.4.c	Hydraulic Fluid	Estey 1994.	Operational precedence and past TFC approval.
3.3.1.5	Air and Gas Treatment System Design	ASME AG-1; ASME N509; & ASME N510.	
3.3.1.6	WRS Hoisting and Rigging Design	See remarks.	Operational need and site standard requirement.
3.3.1.6.a	Hoisting Design and Test Reviews	DOE-RL-92-36.	
3.3.1.6.b	Built-in Hoisting Equipment	DOE-RL-92-36.	
3.3.1.6.c	Below-the-Hook Lifting Device Requirements	DOE-RL-92-36.	
3.3.1.6.d	Critical Welds	DOE-RL-92-36.	
3.3.1.6.e	Below-the-Hook Lifting Device Markings	DOE-RL-92-36.	
3.3.1.7.a	Electrical Equipment Listing	HNF-2962.	Standard Site requirement.

Functions and Requirements (cont.)

3.3.1.7.b	Electrical Cabinet Design	HNF-2962.	
3.3.1.7.c	Surge Protection in AC Power Circuits	HNF-2962.	
3.3.1.7.d	Surge Withstand Capability	HNF-2962.	
3.3.2	Electromagnetic Radiation	HNF-2962.	
3.3.2.1	Equipment Installation and Wiring Practices	HNF-2962.	
3.3.2.2	Radio Frequency Interference Susceptibility	HNF-2962.	
3.3.3	Nameplates and Equipment Marking	HNF-IP-0842, Vol. 2, Sec. 6.1.	
3.3.4	Workmanship	See remarks.	Good engineering practice. Procurement and design documentation should be reviewed for requirements pertaining to workmanship.
3.3.5.1	Fabrication Weld Standards	See remarks.	Good engineering practice and standard Site requirement.
3.3.5.2	Welder Certification	See remarks.	Good engineering practice and standard Site requirement.
3.3.6	Safety	HNF-MP-003.	
3.3.6.1.a	Occupational Radiological Protection	10 CFR 835; ORP (1999); HNF-5183.	
3.3.6.1.b	Radiation Shielding	See remarks.	Based on engineering judgment & ALARA principles.

Functions and Requirements (cont.)

3.3.6.1.c	Occupational Safety and Health	29 CFR 1910; 29 CFR 1926; ORP (1999).	
3.3.6.1.d	Hazard Identification	See remarks.	Based on engineering judgment & ALARA principles. Will support HAZOP development.
3.3.6.2	Equipment Protection	TFC-ENG-STD-06.	
3.3.6.2.a	Vibration	API 610.	Good engineering practice. May not apply to all types of pumps. Requirement to be evaluated during design.
3.3.6.2.b	WRS Structural Integrity and Design	40 CFR 265; WAC 173-303-640(3); ORP (1999).	
3.3.6.2.c	Fire Protection	DOE-STD-1066-99; HNF-IP-0842, Vol. 9, Sec. 5.2.	HNF-IP-0842 specifies mandatory design criteria found in CFR, DOE Orders, WAC, and consensus standards imposed by the TFC contract.
3.3.6.2.d	Damage to SST	TFC-ENG-STD-06.	
3.3.6.2.e	DST Design Limits	HNF-SD-WM-TRD-007; HNF-3350.	
3.3.6.3.a	Secondary Containment and Leak Detection	WAC 173-303-640; ORP (1999).	
3.3.6.3.b	Transfer Pits and Process Skids	WAC 173-303-640.	
3.3.6.3.c	Spill Prevention and Controls	40 CFR 265; WAC 173-303-640; ORP (1999).	The cited WACs and CFRs address design features to mitigate spills.

Functions and Requirements (cont.)

3.3.6.3.d	Non-radioactive Airborne Emissions	WAC 173-400; WAC 173-460; ORP (1999).	
3.3.6.3.e	Radioactive Airborne Emissions	ORP (1999); HNF-IP-0842, Vol. 6, Sec. 1.7.	
3.3.6.3.f	Radiation Protection of the Public and Environment	10 CFR 20; WAC 246-247; ORP (1999).	
3.3.7	Human Performance and Human Factors Engineering	ORP (1999); DOE 6430.1A.	Human engineering includes designing system to preclude or minimize the likelihood of "operator error".
3.3.7.1	Lighting	See remarks.	Additional definition of human engineering requirement.
3.3.8	Decontamination and Decommissioning	ORP (1999); DOE 6430.1A.	
3.3.9	Nuclear Safety	HNF-SD-WM-TSR-006.	
3.3.9.1	Criticality Safety	HNF-SD-WM-TSR-006, AC 5.7; HNF-IP-1266.	
3.3.9.2	Flammable Gas Design Requirements	HNF-SD-WM-TSR-006.	Requirements to be verified by Flammable Gas Equipment Advisory Board (FGEAB).
3.3.9.3	Nuclear Safety Classification	HNF-IP-0842, Vol. 4, Sec. 6.9 – 6.12; HNF-SD-WM-SAR-067.	
3.4.1	Engineering Documents	HNF-PRO-222; HNF-IP-0842, Vol. 4, Sec. 3.5.	
3.4.2	Master Equipment List	RPP-MP-606.	

Functions and Requirements (cont.)

3.5.1	Maintenance and Operation	See remarks.	Operational need, and incorporating ALARA principles
3.5.1.a	Corrective and Preventive Maintenance	See remarks.	Hanford Site crafts have required tank farm-specific training, provide the most cost-effective source of maintenance resources in most cases.
3.5.1.1	Calibration	See remarks.	Operational need, based on good engineering practice and incorporating ALARA principles.
3.5.1.1.a	Cycles, Methods, and Equipment Calibration	See remarks.	Good engineering practice.
3.5.1.1.b	After-Installation Calibration	See remarks for 3.2.3.4.	
3.5.2	Spares	See remarks.	Operational need, based on good engineering practice
3.5.3	Existing In-Tank Hardware Removal	See remarks.	Limited risers and current tank configuration does not support retrieval; equipment removal needed prior to installing new WRS equipment.
3.5.4	Solid Waste Generated	RPP-MP-609.	Radioactive waste is not included in this category.
3.6	Personnel and Training	HNF-IP-0842, Vol. 3, Sec. 10, et. seq.	Referenced procedures tie to DOE Order 5480.20A.
3.7.1	Retrieval and Conveyance Subsystem	See remarks.	Provides summary of subsystem characteristics, and references requirements in Sec. 3.0.
3.7.2	Waste Transfer Line Subsystem	See remarks.	Provides summary of subsystem characteristics, and references requirements in Sec. 3.0.
3.7.3	Tank Ventilation Systems	See remarks.	Provides summary of subsystem characteristics, and references requirements in Sec. 3.0.

Functions and Requirements (cont.)

3.7.4	Monitor and Control Subsystem	See remarks.	Provides a summary of subsystem characteristics, and references requirements in Sec. 3.0.
3.7.5	Electrical Power Distribution (241-C Tank Farm)	See remarks.	This requirement is based on interfaces identified for WRS design.
3.7.6	Raw Water Distribution (241-C Tank Farm)	See remarks.	This requirement is based on interfaces identified for WRS design.
3.7.7	Service Air Distribution (241-C Tank Farm)	See remarks.	This requirement is based on interfaces identified for WRS design.
3.7.8	DST Transfer Piping and Valving Subsystems	HNF-4160 and HNF-4161.	
3.7.9	DST Utilities Subsystems	HNF-4157.	
3.8	Precedence	HNF-3912.	

Note: See Section 6.2, "Terms", for acronym definitions.

Attachment 2
03-TPD-015

AGENDA
Hanford Federal Facility Agreement and Consent Order (HFFACO)
Milestone M-45-05I-T01, "CONDUCT C-106 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT 30% DESIGN CONSULTATION
ORP Offices
2440 Stevens Center
Richland, Washington

January 30, 2003

Project Status
Estimated Waste Volume
Waste Volume after Retrieval
Estimated Tc-99 Removed
Leak Mitigation (Process Control Actions)
Leak Detection and Monitoring Logic/Thresholds
Retrieval Risk Assessment
Project Challenges
Summary

Attachment 3
03-TPD-015

Attendance List
Hanford Federal Facility Agreement and Consent Order (HFFACO)
Milestone M-45-05I-T01, "CONDUCT C-106 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT 30% DESIGN CONSULTATION
ORP Offices
2440 Stevens Center
Richland, Washington
January 30, 2003

Meeting Title: C-106 Waste Retrieval and Closure Demonstration Project 30% Design Consultation, M-45-05I-T01.

Date: January 30, 2003

Name	Company	Phone Number
Jim Thompson	ORP	373-9757
Keith Carpenter	CHG	372-2452
John G. Propson	CHG	372-0455
Blaine Barton	CHG	376-5118
Andy Stevens	ORP	376-8235
Janet Badden	CHG	372 9698
Moses Jaraysi	CH2M Hill	372-9242
Suzanne Dahl	Ecology	736-5705
Tony Knepp	CH2M	531-1563
Jeff Lyon	Ecy	736-3098

Task Detail Report

01/29/2003 02:30 PM

Task #: ORP-TPD-2003-0016 - Closed (01/29/2003)

Parent Task #:
Reference #: 03-TPD-015
Subject: Concurrence: 03-TPD-015 HFFACO M-45-05I-T01 30% Design Consu.. Mtg.
Deliverable: None
Category: None
Status: Closed
Due Date:
Priority: None
Originator: Perez, Annez
Originator Phone: (509)372-1382

Assigned By: Self
Assigned Date: 01/28/2003
Assigned Role: Originator
Assigned Due Date:

Routing Lists: **Route List - Inactive**

- Thompson, James F - Approve - Approve - 01/29/2003 06:54
- Hoertkorn, Thomas R - Approve - Approve with comments - 01/29/2003 14:26 (By: Perez, Annez)
- Noyes, Delmar L - Approve - Approve with comments - 01/29/2003 14:25 (By: Perez, Annez)
- Swailes, John H - Approve - Withdrawn - 01/29/2003 14:24
- Rasmussen, Jim E - Approve - Approve - 01/29/2003 13:49 (By: Gano, Becky)

Instructions:
bcc: TPD Off File
TPD Rdg File
MGR Rdg File
J. H. Swailes, AMTF
L. Erickson, DEPORP
J. E. Rasmussen, ED
R. W. Russell, ED
J. S. O'Connor, OPA
S. D. Stubblebine, ORP
T. R. Hoertkorn, TPD
D. L. Noyes, TPD
J. F. Thompson, TPD

[redacted]

Correspondence is being routed for concurrence via hard copy instead of electronically. Once you receive the correspondence, please approve or disapprove electronically via E-STARS and route to the next person on the routing/concurrence list.

Attachments: 1. 03-TPD-015.HFFACO M-45-05I-t01 30% Design Consult. Meeting

Comments

Response Comments

Poster / Date : Noyes, Delmar L (Perez, Annez) - 2003-01-29 14:25:17
Subject : Perez, Annez -- Approve
Delmar signed 1/29/2003
Poster / Date : Hoertkorn, Thomas R (Perez, Annez) - 2003-01-29 14:26:00

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Subject ; Perez, Annez -- Approve
Tom Hoertkorn signed 1/29/03

Task Due Date History:

Date Modified	Task Due Date	Modified By

-- End of Report --

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Task Detail Report 01/28/2003 11:14 AM

Task #: ORP-TPD-2003-0016

Parent Task #:
Reference #: 03-TPD-015
Subject: Concurrence: 03-TPD-015 HFFACO M-45-05I-T01 30% Design Consu.. Mtg.
Deliverable: None
Category: None
Status: Open
Due Date:
Priority: None
Originator: Perez, Annez
Originator Phone: (509)372-1382

Assigned By: Self
Assigned Date: 01/28/2003
Assigned Role: Originator
Assigned Due Date:

Routing Lists: **Route List - Active**

- Thompson, James F - Approve - Awaiting Response JFT 1/29/03
- Hoertkorn, Thomas R - Approve - Awaiting Response 1/29/03
- Noyes, Delmar L - Approve - Awaiting Response DLN 1/29/03
- ~~Swailes, John H - Approve - Awaiting Response~~
- Rasmussen, Jim E - Approve - Awaiting Response JER 1/29/03

Instructions:
bcc: TPD Off File
TPD Rdg File
MGR Rdg File
J. H. Swailes, AMTF
L. Erickson, DEPORP
J. E. Rasmussen, ED
R. W. Russell, ED
S. D. Stubblebine, ORP
T. R. Hoertkorn, TPD
D. L. Noyes, TPD
J. F. Thompson, TPD
J Ocasio

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Attachments: 1. 03-TPD-015.HFFACO M-45-05i-t01 30% Design Consult. Meeting

Comments

Task Due Date History:

Date Modified	Task Due Date	Modified By

-- End of Report --

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