Double-Shell Tank Emergency Pumping Guide

DW Reberger
CH2M Hill Hanford Group, Inc.
Richland, WA 99352
U.S. Department of Energy Contract DE-AC27-99RL14047

EDT/ECN: 720583 R0 UC: NA
Cost Center: 7G230 Charge Code: 16519-6
B&R Code: NA Total Pages: 54

Key Words: Double-Shell Tank, Annulus Emergency Pumping, Tank Farm Emergency, Pumping, Secondary Containment, Annulus

Abstract: This document provides preplanning necessary to expeditiously remove any waste that may leak from the primary tank to the secondary tank for Hanford's 28 DSTs. The strategy is described, applicable emergency procedures are referenced, and transfer routes and pumping equipment for each tank are identified.

5/22/03
Release Approval Date

Approved For Public Release

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution List	DW Reberger	Date 5/18/03
Project Title/Work Order		EDT No. NA
Double-Shell Tank Emergency Pumping Guide HNF-3484		ECN No. 720583 R0

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
JJ Badden	S5-07	x			
J Honeyman	H6-03	x			
TM Horner	S5-13	x			
W Kennedy	S5-03	x			
N Kirch	R3-73	x			
DC Lowe	R2-58	x			
P Miller	R1-51	x			
TC Oten	S5-05	x			
LA Domnoske-Rauch	S5-13	x			
DW Reberger (3)	S5-13	x			
JA Voogd	S4-43	x			

ENGINEERING CHANGE NOTICE

Page 1 of 7

☒ DM ☐ FM ☐ TM

1a. ECN 720583 R 0

1b. Proj. ECN W- -

2. Request Information Record Information on the ECN-1 Form	3a. Design Inputs -Record Information on the ECN-2 Form	3b. Design References - Record Information on the ECN-3 Form	3c. Engineering Evaluation / Estimate / Approval to Proceed w/ the Design - Record Information on the ECN-4 Form

4. Originator's Name, Organization, MSIN, & Phone No.
Dan Reberger, Waste Transfer Process Engineering, S5-13, 373-3926

5. USQ Number
No. TF - -
☒ N/A
Init. DwR Date 5/18/03

6. Date
5/18/03

7. Title
Revision to DST Emergency Pumping Guide HNF-3484

8. Bldg. / Facility No.
241-AN, AP, AW, AY, AZ & SY

9. Equipment / Component ID
NA

10. Approval Designator
E

11. Document Numbers Changed by this ECN (For FM or TM Changes Record Information on the ECN-5 Form) Sheet and Rev.
HNF-3484 Revision 3a

12. Design Basis Documents?
☐ Yes ☒ No

13. Safety Designation
☐ SC ☐ SS ☐ GS
☒ N/A

14. Expedited / Off-Shift ECN?
☐ Yes ☒ No

15a. Work Package Number
NA

15b. Modification Work Completed
NA
Responsible Engineer / Date

15c. Restored to Original Status (TM)
NA
Responsible Engineer / Date

16. Fabrication Support ECN?
☐ Yes ☒ No

17. Description of the Change (Use ECN Continuation pages, as needed)
This ECN revises the Double-Shell Tank Emergency Pumping Guide HNF-3484 revision 3a in its entirety to revision 4.

The primary change was to address two concerns by the Washington Department of Ecology (WDOE). The first item was the incorrect location of six flexible jumpers stored in the 2101-M warehouse, in Appendix F. The second item identified that spare storage space in the double-shell tanks was often occupied, and the Guide did not give current instructions for using any other tanks in the DST system for waste receipt. Both of these concerns were corrected in the revision. Other general updates were included to reflect the current references and tank farm configuration.

18. Justification of the Change (Use ECN Continuation pages, as needed)
The Washington Department of Ecology (WDOE) in a letter January 30, 2003 to the Office of River Protection (ORP) identified two concerns in Document HNF-3484. ORP in letter 03-ED-023 on February 5, 2003 requested CH2M Hill Hanford Group (CHG) to evaluate the required actions and prepare a response letter. The response letter CH2M-0300460 R1 to ORP committed to a final revision to the document that would be provided by May 30, 2003.

19. ECN Category
☒ Direct Revision
☐ Supplemental

ECN Revision Type
☐ Void/Cancel
☐ Closure
☐ Revision

20. Distribution (Name and MSIN)
See Distribution List

Release Stamp
MAY 22 2003
DATE:
STA: 4
HANFORD RELEASE
ID: 21

ENGINEERING CHANGE NOTICE	Page 2 of 7	☒ DM ☐ FM ☐ TM	1a. ECN 720583 R 0
			1b. Proj. ECN W- -

21. Design Check	22. Design Verification Required?	23. Closeout / Cancel / Void
Record Information on the ECN-6 Form Peer Check	☐ Yes ☒ No If Yes, as a minimum attach the one page checklist from TFC-ENG-DESIGN-P-17.	☐ Yes ☒ No If Yes, Record Information on the ECN-7 Form and attach form(s).

24. Revisions Planned (Include a brief description of the contents of each revision)

No revisions planned

Note: All Revisions shall have the approvals of the affected organizations as identified in block 9 "Approval Designator," on page 1 of this ECN.

25a. Commercial Grade Item Dedication Numbers (associated with this design change)	25b. Engineering Data Transmittal Numbers (associated with this design change, e.g., new drawings, new documents)
NA	NA

26a. Design Cost Estimate	26b. Materials / Procurement Costs	26c. Estimated Labor Hours
$5,000	$0	40

27. Field Change Notice(s) Used? (Used for ECN Revisions only)

☐ Yes ☐ No

If Yes, Record Information on the ECN-8 Form attach form(s) and identify permanent changes.

NOTE: ECN Revisions are required to record and approve all FCN's issued during the field modification work process. If the FCN's have not changed the original design media then they are just incorporated into the ECN file via an ECN revision. If the FCN did change the original design media then the ECN Revision will include the necessary engineering changes to the original design media changes.

28. Approvals

	Signature	Date
Design Authority		
Team Lead/Lead Engr. DW Reberger	DW Reberger	5/22/03
Resp. Engineer _DW Reberger	DW Reberger	5/22/03
Resp. Manager _TM Horner	T.M. Horner	5/22/03
Quality Assurance		
IS&H Engineer		
NS&L Engineer		
Environ. Engineer P Miller		5/22/03
Project Engineer		
Design Checker WE Meeuwsen		5/22/03
Design Verifier		
Operations		
Radcon		
Other		
Other		

	Signature	Date
Originator/Design Agent _DW Reberger	DW Reberger	5/22/03
Professional Engineer		
Project Engineer		
Quality Assurance		
Safety		
Designer		
Environ. Engineer		
Other		
Other		

DEPARTMENT OF ENERGY / OFFICE OF RIVER PROTECTION

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL SIGNATURES

ECN - 1 ENGINEERING REQUEST FORM Page 3 of 7	☒ DM ☐ FM ☐ TM	1a. ECN 720583 R 0 1b. Proj. ECN W- -

Requestor's Name (Print)	*Date*	REA Reference
Dan Reberger	5/16/03	

Equipment Name	Estimated Need Date
DST Emergency Pumping Guide HNF-3484	5/20/03

Problem/Issue Statement

Need to release Revision 4 to HNF-3484 Double-Shell Tank Emergency Pumping Guide

Purpose for the Proposed Modification

The Washington Department of Ecology (WDOE) in a letter January 30, 2003 to the Office of River Protection (ORP) identified two concerns in Document HNF-3484. ORP in letter 03-ED-023 on February 5, 2003 requested CH2M Hill Hanford Group (CHG) to evaluate the required actions and prepare a response letter. The response letter CH2M-0300460 R1 to ORP committed to a final revision to the document that would be provided by May 30, 2003.

Basis for the Estimated Need Date

Letter CH2M-0300340 R1 commitment

Requestor's Signature	*Date*	*Requestor's Manager's Signature*	*Date*
Dan Reberger	5/16/03	TM HORNER T.M. Horner	5/19/03

Responsible Manager Approval

Work Package Number (If Known)	Estimated Evaluation ROM Cost $	*CACN*
Process as a Simple Modification? ☒ Yes ☐ No	*Assigned to (Team Lead)* Dan Reberger	*Date* 5/1/03
Responsible Manager's Signature TM HORNER T.M. Horner	☒ Approve ☐ Reject	*Date* 5/19/03

If rejected, explain reason for rejection:

(Once rejected the Responsible Manager returns the request to the Requestor's Manager)

Italicized text items need to be addressed. Standard text items need to be addressed as applicable to the problem/issue described.

ECN - 5 DRAWING / DOCUMENT CHANGE LIST FORM Sheet 1 of ECN – 5 Page 4 of 7	☒ DM ☐ FM ☐ TM	1a. ECN 720583 R 0 1b. Proj. ECN W- -

List of Engineering Drawings/Documents to be Modified (Use the attached checklist for guidance)

Dwg./Doc. Number (Sheet/Page, Rev)	Title/Type	Shared	Existing Change Document Nos.
HNF-3484 Revision ~~4~~ 3A C-5-22-03	Double-Shell Tank Emergency Pumping Guide	☐	ECN-631966, ECN-647696, ECN-629195, ECN-649070, EDT-618220
		☐	
		☐	
		☐	
		☐	
		☐	
		☐	
		☐	
		☐	
		☐	
		☐	
		☐	

Submitted to Document Service Center Prior to ECN Release?

☐ Yes ☒ No	Team Lead	Date

List of Non-Engineering Documents Needed to be Modified

Document Number/Revision, Sheet/Page (If Available)	Document Title	Document Owner (Organization)	Individual Notified	Method	Date Notified
TO-001-281 Revision A-13	Emergency Annulus Pumping Procedure for AN Farm	Dan Reberger	Yes	Phone	5/1/03
TO-001-282 Revision A-11	Emergency Annulus Pumping Procedure for AP Farm	Dan Reberger	Yes	Phone	5/1/03
TO-001-283 Revision A-12	Emergency Annulus Pumping Procedure for AW Farm	Dan Reberger	Yes	Phone	5/1/03
TO-001-284 Revision A-10	Emergency Annulus Pumping Procedure for SY Farm	Dan Reberger	Yes	Phone	5/1/03
TO-001-288 Revision A-12	Emergency Annulus Pumping Procedure for AY Farm	Dan Reberger	Yes	Phone	5/1/03
TO-001-289 Revision A-13	Emergency Annulus Pumping Procedure for AZ Farm	Dan Reberger	Yes	Phone	5/1/03

ECN - 5 DRAWING / DOCUMENT CHANGE LIST FORM Sheet 2 of ECN – 5 Page 5 of 7	☒ DM ☐ FM ☐ TM	1a. ECN 720583 R 0 1b. Proj. ECN W- -

Drawings/Documents to be Modified Checklist			
System Design Description	☐ Yes ☒ No ☐ N/A	Operating Procedure	☒ Yes ☐ No ☐ N/A
Functional Design Criteria	☐ Yes ☒ No ☐ N/A	System/Subsystem Specifications	☐ Yes ☒ No ☐ N/A
Functional Requirements	☐ Yes ☒ No ☐ N/A	Engineering Flow Diagram Drawing	☐ Yes ☒ No ☐ N/A
Operating Specification	☐ Yes ☒ No ☐ N/A	General Arrangement Drawing	☐ Yes ☒ No ☐ N/A
Criticality Specification	☐ Yes ☒ No ☐ N/A	Material Specification	☐ Yes ☒ No ☐ N/A
Conceptual Design Report	☐ Yes ☒ No ☐ N/A	Sampling Plan	☐ Yes ☒ No ☐ N/A
Detailed Design Report	☐ Yes ☒ No ☐ N/A	Inspection Plan	☐ Yes ☒ No ☐ N/A
Equipment Specification	☐ Yes ☒ No ☐ N/A	Radiation Control Procedure	☐ Yes ☒ No ☐ N/A
Procurement Specification	☐ Yes ☒ No ☐ N/A	Spare Parts List	☐ Yes ☒ No ☐ N/A
Construction Specification	☐ Yes ☒ No ☐ N/A	Test Specification	☐ Yes ☒ No ☐ N/A
Vendor Information	☐ Yes ☒ No ☐ N/A	Test Plan	☐ Yes ☒ No ☐ N/A
Operations / Maintenance Manual	☐ Yes ☒ No ☐ N/A	Acceptance Test Procedure	☐ Yes ☒ No ☐ N/A
Safety Analysis / FSAR / SAR / DSA	☐ Yes ☒ No ☐ N/A	Pre-Operational Test Procedure	☐ Yes ☒ No ☐ N/A
Technical Safety Requirement	☐ Yes ☒ No ☐ N/A	Operational Test Procedure	☐ Yes ☒ No ☐ N/A
Master Equipment List	☐ Yes ☒ No ☐ N/A	ASME Coded Item / Vessel	☐ Yes ☒ No ☐ N/A
Safety Equipment List	☐ Yes ☒ No ☐ N/A	Human Factor Consideration	☐ Yes ☒ No ☐ N/A
Radiation Work Permit	☐ Yes ☒ No ☐ N/A	Automated Control Configuration Procedure	☐ Yes ☒ No ☐ N/A
Environmental Requirement	☐ Yes ☒ No ☐ N/A	Computer / Automated Control Software Plan	☐ Yes ☒ No ☐ N/A
Environmental Permit	☐ Yes ☒ No ☐ N/A	Raceway / Cable Schedules	☐ Yes ☒ No ☐ N/A
Seismic / Stress / Structural Analysis	☐ Yes ☒ No ☐ N/A	Work Control Procedure	☐ Yes ☒ No ☐ N/A
Design Report	☐ Yes ☒ No ☐ N/A	Corrective Maintenance Procedure	☐ Yes ☒ No ☐ N/A
Interface Control Drawing	☐ Yes ☒ No ☐ N/A	Process Control Plan	☐ Yes ☒ No ☐ N/A
Calibration Procedure	☐ Yes ☒ No ☐ N/A	Process Control Procedure	☐ Yes ☒ No ☐ N/A
Preventive Maintenance Procedure	☐ Yes ☒ No ☐ N/A	Flow Sheet	☐ Yes ☒ No ☐ N/A
Engineering Procedure	☐ Yes ☒ No ☐ N/A	Purchase Requisition	☐ Yes ☒ No ☐ N/A
Security Plan	☐ Yes ☒ No ☐ N/A	Hazards Analysis	☐ Yes ☒ No ☐ N/A
Emergency Plan	☐ Yes ☒ No ☐ N/A	JCS PM Activity Datasheet	☐ Yes ☒ No ☐ N/A
	☐ Yes ☐ No ☐ N/A		☐ Yes ☐ No ☐ N/A
	☐ Yes ☐ No ☐ N/A		☐ Yes ☐ No ☐ N/A

ECN - 6 DESIGN CHECK LIST Sheet 1 of ECN – 6 Page 6 of 7	☒ DM ☐ FM ☐ TM	1a. ECN 720583 R 0 1b. Proj. ECN W- -

Design Details/Attributes (to be filled out by the change originator) identified in the ECN.			
1. Issue/Problem Statement included	☒ Yes ☐ No ☐ N/A	21. Basis for Selected Alternative explained, including assumptions	☐ Yes ☐ No ☒ N/A
2. Safety/Commitment/Programmatic Impacts identified – NEPA Documentation completed	☐ Yes ☐ No ☒ N/A	22. Potential Component/System Impacts identified and resolved	☐ Yes ☐ No ☒ N/A
3. System/Equipment/Personnel Impacts identified	☐ Yes ☐ No ☒ N/A	23. Potential Software Impacts identified and resolved	☐ Yes ☐ No ☒ N/A
4. Technical Evaluation included	☐ Yes ☐ No ☒ N/A	24. Potential Safety Impacts are identified and resolved (e.g., energized electrical equipment)	☐ Yes ☐ No ☒ N/A
5. Compliance w/ Design Basis identified	☐ Yes ☐ No ☒ N/A	25. Modification is Constructible and can be implemented	☐ Yes ☐ No ☒ N/A
6. Assumptions/Sources clearly identified	☒ Yes ☐ No ☐ N/A	26. Design considers Operational Impacts	☐ Yes ☐ No ☒ N/A
7. Affected Documents and Databases clearly identified	☒ Yes ☐ No ☐ N/A	27. Contamination Controls are planned	☐ Yes ☐ No ☒ N/A
8. Inputs Verified	☐ Yes ☐ No ☒ N/A	28. Pre-Installation/Mockup/Prototype Testing planned	☐ Yes ☐ No ☒ N/A
9. Required Function(s) / changes clearly identified	☐ Yes ☐ No ☒ N/A	29. Sketches/Drawings for Tools/Fabricated Components included	☐ Yes ☐ No ☒ N/A
10. Safety Basis/Commitments/Concerns evaluated	☐ Yes ☐ No ☒ N/A	30. Hardware Design described	☐ Yes ☐ No ☒ N/A
11. Application of Industry Standards/Codes explained	☐ Yes ☐ No ☒ N/A	31. Software/Firmware Design described	☐ Yes ☐ No ☒ N/A
12. Proper Analytical Techniques employed	☐ Yes ☐ No ☒ N/A	32. Inspections (per Codes & Standards) / Quality Checks included	☐ Yes ☐ No ☒ N/A
13. Interfaces evaluated and identified	☐ Yes ☐ No ☒ N/A	33. Dimensions and Tolerances included	☐ Yes ☐ No ☒ N/A
14. Material/Component Compatibility evaluated	☐ Yes ☐ No ☒ N/A	34. Sketches/Drawings for Installation included	☐ Yes ☐ No ☒ N/A
15. ALARA/Radiological controls/chemical hazards evaluated	☐ Yes ☐ No ☒ N/A	35. Housekeeping/Personnel Safety Requirements identified	☐ Yes ☐ No ☒ N/A
16. Human/Machine Interface evaluated	☐ Yes ☐ No ☒ N/A	36. Walkdown(s) performed/Labeling Correct	☐ Yes ☐ No ☒ N/A
17. Program impacts evaluated	☐ Yes ☐ No ☒ N/A	37. Acceptance Test generated and Acceptance Criteria included	☐ Yes ☐ No ☒ N/A
18. Design Basis Calculations updated	☐ Yes ☐ No ☒ N/A	38. M&TE Requirements identified	☐ Yes ☐ No ☒ N/A
19. Alternatives described/evaluated and address resolution of problem	☐ Yes ☐ No ☒ N/A	39. Training/Qualification of Test Personnel identified	☐ Yes ☐ No ☒ N/A
20. Impacts on Maintenance and OPS described	☐ Yes ☐ No ☒ N/A	40. Safety and Hazards Analysis assessed	☐ Yes ☐ No ☒ N/A

Design Originator (Print/Sign)	Date
DAN REBERGER Dan Reberger	5/18/03

Italicized text items need to be addressed. Standard text items need to be addressed as applicable to the change as described.

ECN - 6 DESIGN CHECK LIST	☒ DM ☐ FM ☐ TM	1a. ECN 720583 R 0
Sheet 2 of ECN – 6 Page 7 of 7		1b. Proj. ECN W- -

Design Check Method (Select method(s) and provide explanation of how to be performed):

☒ Peer Check	☐ Design Check Team*	☐ Other _____

Design Check Explanation:

VERIFY THAT CHANGE PACKAGE IS COMPLETE AND ADEQUATE.

* Design check team members other than the originating organization normally should consist of personnel representing: Operations, Maintenance & Reliability Engineering, Maintenance Management, Maintenance Crafts, Safety, and Projects.

Design Check Details

Design inputs correctly identified?	☒ Yes ☐ No ☐ N/A	*Design changes properly documented?*	☒ Yes ☐ No ☐ N/A
Calculations checked and are correct?	☐ Yes ☐ No ☒ N/A	*Test procedures reviewed and are correct?*	☐ Yes ☐ No ☒ N/A
Design assumptions are stated and verified?	☐ Yes ☐ No ☒ N/A	*Is the design change adequate?*	☒ Yes ☐ No ☐ N/A
Design criteria incorporated into the design?	☐ Yes ☐ No ☒ N/A	*Is the design change complete?*	☒ Yes ☐ No ☐ N/A
Interfaces clearly identified in the design?	☐ Yes ☐ No ☒ N/A	*Is the design change correct?*	☒ Yes ☐ No ☐ N/A
EQRG pre-release review required?	☐ Yes ☒ No	EQRG Pre-release Approval	Date

Comments:

NONE

Reference TFC-ENG-DESIGN-P-17, Design Verification

Design Checker (Print/Sign) WE Meeuwsen	***Date*** 5/22/03

Italicized text items need to be addressed. Standard text items need to be addressed as applicable to the problem/issue described.

RECORD OF REVISION

(1) Document Number: HNF-3484

(2) Title: DOUBLE-SHELL TANK EMERGENCY PUMPING GUIDE

Change Control Record

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
4 RS	(7) Incorporate ECN 720583 R0	Dan Rebuge 5/19/03	T.M. Homan 5/22/03
3a	Incorporate ECN 631966		
3	Incorporate ECN 647696		
2	Incoporate ECN 629195		
1	Incorporate ECN 649070		
0	Initial issue per EDT 618220		

HNF-3484
Revision 4

DOUBLE-SHELL TANK

EMERGENCY PUMPING GUIDE

Prepared for the United States Department of Energy

CH2M HILL Hanford Group Inc.
P. O. Box 1500
Richland, Washington 99352

CONTENTS

APPENDICES

FIGURES

TERMS

DST	double-shell tank
gpm	gallons per minute
in.	inches
mm	millimeters
ORP	U.S. Department of Energy, Office of River Protection
RPP	River Protection Project
SST	single-shell tank
USQ	Unreviewed Safety Question

1.0 GENERAL INFORMATION

1.1 PURPOSE, SCOPE, AND BACKGROUND

The purpose of this plan is to provide as much preplanning as practical for pumping waste out of the annulus or secondary containment of Double-Shell Tanks (DST). If the primary tank leaks, waste would accumulate in the secondary tank. For the purposes of this report, the terms "secondary tank" and "annulus" are used interchangeably. The preplanning will expedite emergency pumping and provide the basis for demonstrating that the leaked waste will be "removed from the secondary containment system within 24 hours, or in as timely a manner as is possible" as required by the Washington Administrative Code (WAC) 173-303-640 (4) (iv) "Tank Systems."

There are 177 underground waste storage tanks in the Hanford Site 200 East and 200 West Areas. There are 149 single-shell tanks (SSTs), and 28 DSTs. The scope of this plan includes all 28 of the Hanford Site DSTs in AN, AP, AW, AY, AZ and SY Tank Farms. The scope also includes the transfer lines, pump pits, valve pits, jumpers, transfer pumps, sump pumps, and procedures necessary to accomplish the emergency pumping.

1.2 DISCUSSION OF SPARE TANK SPACE

In the previous versions of this document two DSTs were identified as spares, one for typical DST Waste and one for Aging Waste. The identified spare tanks were 241-AP-108 and 241-AY-101, respectively, which roughly provided two-million gallons of tank space. The Aging Waste has historically been segregated in the AY and AZ Tank Farms because of the high heat content of the solids and liquid. The DSTs in the AY and AZ Tank Farms are designed to handle the higher heat content waste. The current heat content of the liquid in the Aging Waste Tanks has significantly decreased due to the decay of the short-lived radionuclides. The heat content is low enough that the liquid can be transferred to a standard DST for storage (TWINS 2003). This reduces the need for emergency storage space in the DSTs to one-million gallons.

The previously identified spare tanks, 241-AP-108 and 241-AY-101, were meant to be the likely designated receiving tanks, illustrating the methodology for responding to an emergency transfer from an annulus. Tank 241-AP-108 is the sampling/storage tank for the 242-A Evaporator. Tank 241-AW-102 is the feed tank to the 242-A Evaporator. Typically, one of these tanks is empty or is being prepared for evaporation. Therefore, tank 241-AP-108 was identified as the most likely tank to be available or could quickly be made available to receive annulus waste. Over the next few years with the accelerated retrieval of waste from the SSTs, tank space will be dynamic, and at a premium in the DST system. Waste will constantly be moved into the DST system from SSTs and run through the 242-A Evaporator for concentration. To maximize available tank space in the DSTs, re-concentration of some of the existing waste and raising the maximum tank

levels is being considered. At any given time in the future, it will not be possible to keep one single tank empty as a spare for emergency pumping, because of the planned transfer sequences to evaporate and stage waste. The plan for annulus emergency pumping is to have one-million gallons of distributed tank space available at all times. As explained in Section 3.3 of this document, a leak into the annulus is expected to be at a relatively slow rate. The annulus pump-out operations would not be expected to be delayed significantly by the use of distributed space. Piping configuration changes to additional tanks are in many cases performed by valving manipulations. Alternative jumper reconfigurations to other DST storage locations can primarily be performed simultaneously with ongoing pumping operations.

The DST transfer system is composed of a series of pipe encased transfer lines connecting each tank within a tank farm, and a series of transfer lines connecting the six Tank Farms. Routings between tanks are accomplished by using removable piping connections (jumpers) in concrete pits. The W-314 Project has recently modified pits in AN and AW Tank Farms with multi-valved jumper manifolds that allow transfers between tanks within the Tank Farms to be made with simple valving manipulations. The AP Tank Farm also has this manifold configuration to simplify transfers. The accelerated retrieval operations at the Hanford Site are requiring many transfers to be made to the different tank farms. Additional jumper configurations are currently being installed to facilitate these transfers. These jumper configurations will in turn make annulus emergency pumping transfers to distributed tank space more efficient.

1.2 SUMMARY OF INFORMATION PROVIDED

This guide contains a general description of the DSTs and discussions of the requirements, strategy, transfer routes, procedures, and equipment that will be used to expeditiously respond to a leaking DST. References to statutory requirements are included. The Authorization Basis requirements for DST Emergency Pumping are implemented through operating procedures and work packages. Information for each DST about the waste transfer routes, procedures, and equipment required for the transfers are contained or referenced in the appendices. These include:

Appendix A: **PROPOSED TRANSFER ROUTES**

Contains a tabulated summary description of a proposed transfer route for each DST. Routes are included for transferring the waste from the primary tank to the designated receiver tank. Tank 241-AP-108 is the selected designated receiver tank for emergency transfers from all DSTs for this document. Other or multiple tanks in the DST system may be utilized for emergency annulus pumping operations. The receiver tank for 241-SY-103 is tank 241-AP-108 via tank 241-SY-102. Since the DST space is so dynamic, alternate routings to any of the six DST farms may be utilized for annulus emergency pumping.

Appendix B: **IMPLEMENTING PROCEDURES AND RELEVANT INFORMATION**

Contains a list of applicable transfer operating procedures, a list of Piping and Instrumentation Drawings (P&ID) for each DST farm, and a listing of design/fabrication/installation drawings for the annulus pumping equipment.

Appendix C: **INVENTORY AND STATUS OF REQUIRED EQUIPMENT**

Contains a list of equipment that would be used to transfer waste out of a leaking DST.

Appendix D: **CROSS SECTION OF ANNULUS OF DOUBLE-SHELL TANK**

Contains a sketch of a cross section of the bottom of a typical DST, a list of assumptions, and a table of the volume of liquid that would be present in the annulus at various depths.

Appendix E: **ANNULUS PUMPING ROUTES**

Contains a tabulated summary description of a proposed transfer route for each DST annulus. Routes are included for transferring the waste from the annulus to the designated receiver tank. Tank 241-AP-108 is the selected designated receiver tank for emergency annulus transfers from all DSTs for this document. Other or multiple tanks in the DST system may be utilized for emergency annulus pumping operations. The receiver tank for 241-SY-103 is 241-AP-108 via tank 241-SY-102. Since the DST space is so dynamic, alternate routings to any of the six DST farms may be utilized. Also included is a table of available annulus pumping risers.

Appendix F: **APPLICABLE ANNULUS EQUIPMENT**

Contains lists of applicable annulus equipment and storage locations. This equipment includes six flex jumpers, components for two complete rigid jumpers, four submersible pumps, two reciprocating pumps, components for pump assemblies, and a skid for air and electrical support equipment.

2.0 EQUIPMENT DESCRIPTION

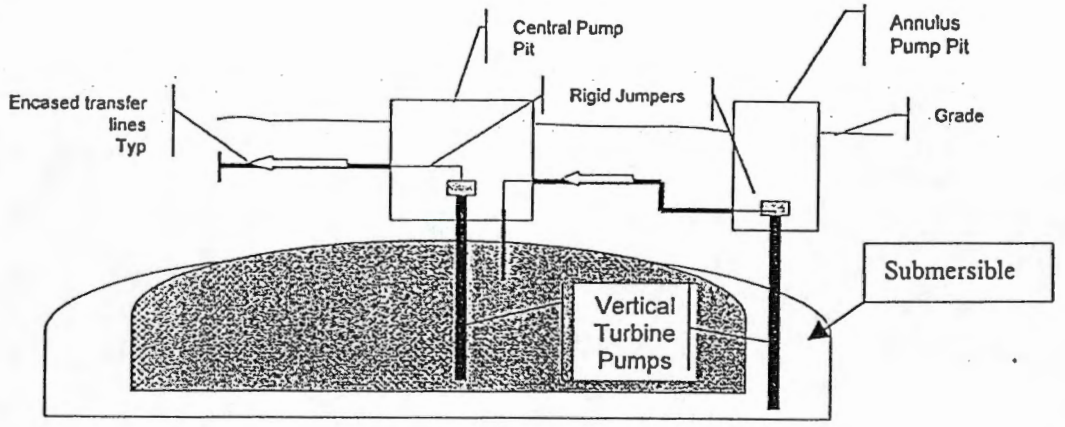


Figure 1 - Typical DST Configuration

All DSTs are similar in design and each has a capacity of approximately 3.8 million liters (1 million gal) (see Figure 1). Slight differences in the tank and ancillary equipment, however, have occurred over the years from design improvements and because of the need to accommodate variations in waste composition. Twenty-eight DSTs are located in six farms, five farms in 200 East Area and one farm in 200 West Area. DSTs consist of a carbon steel primary tank and a carbon steel secondary tank encased by a protective reinforced concrete shell. The tanks contain a mixture of liquid, sludge, and saltcake waste with both radioactive and chemically toxic hazardous constituents. Liquids exist as supernate (liquid above solids) and interstitial liquid (liquid filling the voids between solids) in the tanks. Sludge consists primarily of solids (hydrous metal oxides) precipitated by the neutralization of acid wastes. Saltcake, generally between the supernate and sludge; consists of the various salts formed by the evaporation of water from the waste. These waste types do not necessarily exist as distinct layers and may be intermingled to differing degrees. Some sludges and saltcakes contain interstitial liquid and are relatively soft; others may be drier and harder.

Each tank is equipped with riser pipes that penetrate the concrete dome and the top of the primary or secondary tank. The risers provide access to the primary tank and to the annulus space for waste transfer operations or equipment installation for monitoring. Most risers extend above grade. However, some risers are located under covered pits (e.g., Central Pump Pits and Annulus Pump Pits).

Pits provide access from the surface to process piping and tank risers and are the points where jumper (temporary piping systems), pumps, and other equipment are installed to establish waste transfer routes. A rigid jumper is a steel pipe that is fitted to specific wall nozzle configurations. The flexible jumpers are braided, stainless steel, flexible hose that permit connections to multiple wall nozzles.

There are three types of pumps used at the River Protection Project (RPP) to transfer waste into and out of DSTs. These types are (1) jet pumps in combination with centrifugal pumps, with nominal capacities of 0.05 to 4.0 gpm; (2) submersible pumps, with nominal capacities of 10 to 30 gpm; and (3) transfer pumps, with nominal capacities of 100 to 250 gpm.

The components of a jet pump system located within a pump pit are a centrifugal pump, flexible or rigid jumpers, a flush line, and a flow totalizer. The centrifugal pump supplies motive fluid to the submerged jet pump system. Jet pumps are used to move liquid at very low rates.

A submersible pump can be used to raise large volumes of supernatant. The pump motor is below the pump intake and is submersed in the liquid being pumped.

Transfer pumps are typically installed in a pump pit, with the motor located in the pit and the intake located in the tank waste. Transfer pumps are normally deep-well, vertical turbine pumps, where the pump intake is a rigid pipe that extends to a fixed depth in the tank waste. Some transfer pumps have a floating intake, which is a flexible jumper connected to rigid pipe that does not extend into the waste.

2.1 PRIMARY TANK PIT CONFIGURATION

All DSTs have a Central Pump Pit, which is approximately centered over the primary tank. The primary function of the pit is to provide confinement for a possible spray leak during waste transfers and to provide radiation shielding during waste transfers. The Central Pump Pits provide for access to the tank for supernatant filling or removal, slurry distribution, and mixing. Supernatant filling is accomplished though piping or jumpers connected to the riser. For supernatant removal, Central Pump Pits are designed to hold a deep-well turbine pump and piping jumpers. Central Pump Pits for receiver tanks that store slurry are equipped with slurry distributors. The jumpers installed in the Central Pump Pit are either rigid or flexible jumpers. Transfer or submersible pumps are normally used to remove large volumes of supernatant. Jet pumps would be used to remove interstitial liquid because the liquid drains out of the sludge interstices too slowly to employ the transfer pumps. Before a jet pump system can be used to pump interstitial liquid, a stainless steel, salt screen must be installed in the waste to prevent solids from plugging the jet intakes.

2.2 SECONDARY CONTAINMENT PIT CONFIGURATION

The Annulus Pump Pit is located directly above the annulus and is connected to the annulus by a riser. The pit and riser provide access for pumping out any liquids that may accumulate in the annulus.

In the Annulus Pump Pit a rigid or flex jumper assembly connects the annulus pump outlet to a 51-mm (2-in.) waste transfer line enclosed in a 102-mm (4-in.) encasement. The encasement drains to the Annulus Pump Pit. The waste transfer line terminates at the Central Pump Pit of the tank. The two AY and AZ tanks have an additional route back to the primary tank via a waste transfer route from the Annulus Pump Pit to a riser, which connects directly to the primary tank.

2.3 SUPPORT SYSTEMS

Virtually all of the equipment and support systems that would be used for emergency pumping of DSTs exist and are in nominal serviceable condition. Submersible pumps and other emergency equipment for use in annulus pumping will be stored in HO-64-07008, which is an enclosed portable trailer. Flex jumpers to be used will be stored in the 2101-M Warehouse. This equipment will be maintained per the PMS (Preventative Maintenance System) using data sheets. The following data sheets have been developed for the PMS system to provide maintenance of the pumps ET-7459, ET-7460, ET-7666, and ET-7667. Procedure OTP-001-001, "*Operational Test Procedure for DST Annulus Emergency Pumping Equipment*," will be used to test the pump performance prior to installation.

For Additional information on the Annulus Emergency Pumping Equipment see references below:

- *DST Annulus Pumping Acceptance Test Report* (RPP-6638)
- *Technical Information to Support DST Emergency Annulus Pumping* (RPP-6485)
- *DST Annulus Pumping Acceptance Test Report Supplement* (RPP-7919)
- *System Design Description for Tank Farms Double-Shell Tank Emergency Annulus Pumping Systems* (RPP-9174)
- *Double Shell Tank Annulus Pumping Vendor Information File* (VI-50121)

3.0 PLAN OF ACTION

3.1 REGULATORY REQUIREMENTS APPLICABLE TO LEAKING DOUBLE-SHELL TANKS

Title 40, *Code of Federal Regulations* (CFR), Part 265.193 (c) (4) Containment and Detection of Releases" (40 CFR 265.193)

> "...sloped or otherwise designed or operated to drain and remove liquids resulting from leaks, spills or precipitation. Spilled or leaked waste and accumulated precipitation must be removed from the secondary containment system within 24 hours, or in as timely a manner as is possible to prevent harm to human health or the environment, if removal of the released waste or accumulated precipitation cannot be accomplished within 24 hours."

Washington Administrative Code **(WAC) 173-303-640 (4) (iv) "Tank Systems"**

> "...sloped or otherwise designed or operated to drain and remove liquids resulting from leaks, spills, or precipitation. Spilled or leaked waste and accumulated precipitation must be removed from the secondary containment system within twenty-four hours, or in as timely a manner as is possible to prevent harm to human health and the environment, if the owner or operator can demonstrate to the department that removal of the released waste or accumulated precipitation cannot be accomplished within twenty-four hours."

3.2 GENERAL STRATEGY

The general strategy for emergency pumping a leaking DST is based on several assumptions. The more significant assumptions are:

- Tank 241-AP-108 is the designated receiver tank for all DST emergency pumping in this document and supporting procedures. The procedural documentation illustrates the method that will be used to respond to an emergency annulus transfer. Transfers required to any of the other DST's would be performed using the same type of documentation, equipment and controls.
- Tank 241-AP-108 is the primary receiver, but in the event it is not available, alternate routings to any of the six DST Farms could be established to transfer to distributed space. Waste compatibility will need to be addressed, but is not expected to be an issue that causes a delay in the pumping.
- Tank 241-AP-107 is the designated receiver tank for tank 241-AP-108.

- To the maximum extent possible, existing double-contained, underground transfer lines will be used.
- Existing transfer pumps in the DST central pump pits will be used to pump waste out of the primary tank.
- Leaks from tanks 241-SY-101 and 241-SY-103 could be pumped to tank 241-SY-102.
- About 6 inches of liquid would need to accumulate in the bottom of the annulus before the submersible pump would automatically prime upon starting.
- Each DST annulus has a probe installed that is set to alarm if liquid is detected within the annulus.
- Each DST annulus has at least one probe installed that could be used to monitor liquid level in the annulus.
- A pumping strategy plans to use submersible pumps in all annulus locations.

3.3 POTENTIAL LEAK SCENARIOS

The best strategy for emergency pumping of a specific DST to "prevent harm to human health and the environment" will depend upon the rate or size of leak from the primary tank. For purposes of this plan, leak scenarios are divided into three classes based upon the rate of the leak. The Minor Leak is treated separately because pumpable quantities of waste are likely to be slow to accumulate. Moderate and Major Leaks are treated together because the emergency response to them would be the same in either case.

A submersible pump will be installed 2.5 inches above the bottom of the secondary tank. This will allow for pumping of the waste to within approximately 6 inches of the bottom of the tank. An air pump will also be installed to within 2.5 inches of the bottom of the secondary tank and would be capable of pumping to within approximately 3 inches of the bottom of the tank. Assuming there is no absorption of waste in the insulating concrete, about 3,900 liters (1,030 gallons) of residual waste will remain in the annulus. Repeated water flushing could be used as a method to remove the residual waste. Any moisture from the unpumpable residue would be evaporated by the high-efficiency particulate air (HEPA) filtered annulus ventilation system.

3.3.1 Strategy for Emergency Pumping after a Minor Leak

Scenario: Primary steel tank corrosion causes small breach. Waste dribbles into annulus and the annulus Continuous Air Monitor (CAM) alarms. Leak rate is so slow that dried waste will form on side of tank. Liquid accumulates in the bottom of the annulus very slowly over a period of weeks or months, if at all. See Figure 2 for schematic depiction of minor leak.

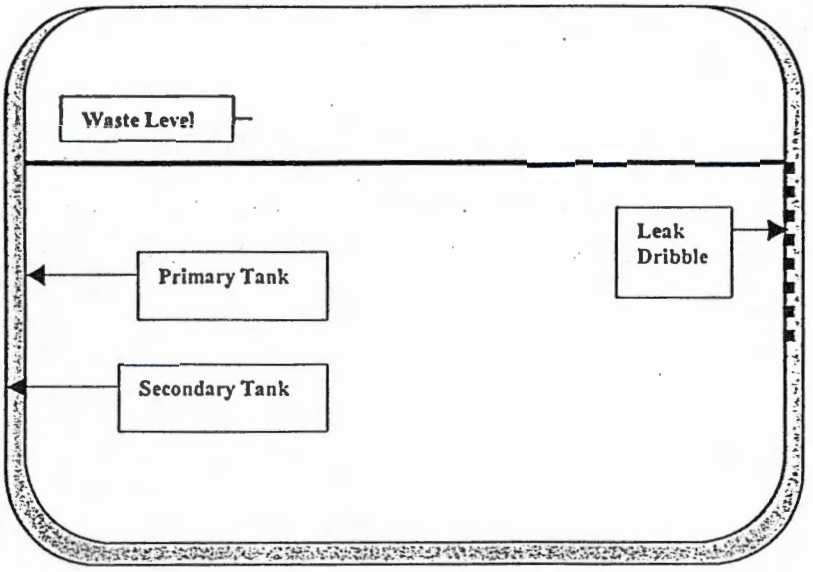


Figure 2. Schematic Diagram of Minor Leak

OBJECTIVE: Pump waste out of annulus within 24 hours or as timely as possible.

STRATEGY: Begin pumping primary tank contents via existing underground supernatant transfer pipelines with the existing transfer pump already installed in the central pump pit. In parallel, install and prepare an annulus pump. Visually inspect annulus using a remote video camera mounted on a hand-held wand or using a remote video camera mounted on a robot similar to ones used for tank integrity assessments to determine location of leak. Continue pumping the primary tank until the waste level is sufficiently below the leak path. When and if pumpable quantities of liquid accumulate in the annulus, the annulus will then be pumped through the annulus pump pit, via the submersible or reciprocating pump, to the designated or alternate receiving tank.

BENEFITS OF STRATEGY: For minor leaks, this strategy minimizes the amount of waste that will be leaked to the annulus by using transfer pumps and pipelines already installed and serviceable to lower the waste level in the primary tank. If pumpable quantities accumulate in the annulus, they will be removed as expeditiously as possible.

Once the primary tank waste level has been lowered below the leak path and any pumpable quantities of waste in the annulus are removed, the emergency nature of the transfers can be downgraded and a permanent resolution determined. Removing as much of the waste as possible in a non-emergency mode is more likely to prevent harm to human health or the environment than pumping all of the tank's contents in an emergency mode.

3.3.2 Strategy for Emergency Pumping after a Moderate or Major Leak

Scenario: A moderate or major leak occurs in the primary steel tank somewhere below the waste level. The waste levels in the primary tank and secondary tank equilibrate within hours or days. See Figure 3 for schematic depiction of a moderate to major leak.

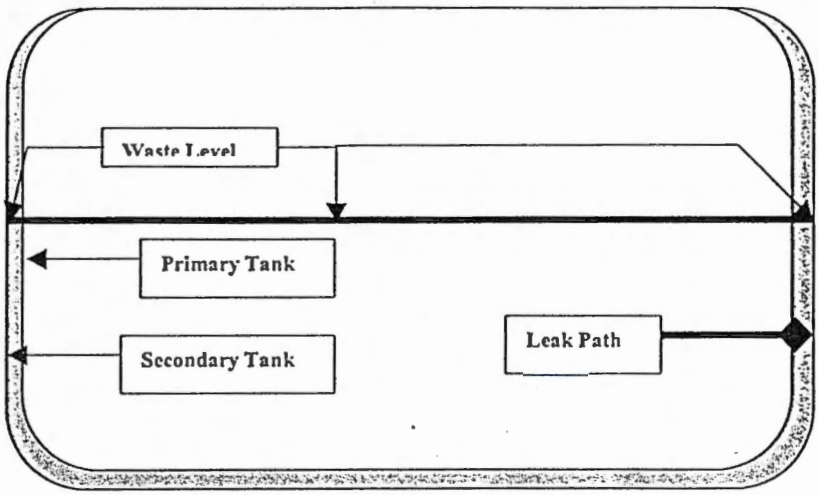


Figure 3. Schematic Diagram of Major Leak in Double-Shell Tank

OBJECTIVE: Pump waste out of annulus within 24 hours or as timely as possible.

STRATEGY: Begin pumping primary tank via existing underground supernatant transfer pipelines with the transfer pump installed in the leaking tank's central pump pit. Monitor levels and material balances in primary tank to determine elevation of leak path on the sidewall or bottom of primary tank. In parallel with pumping of primary tank, install and prepare annulus pump. Monitoring and controlling the waste level in the annulus with respect to the waste level in the primary tank is important to prevent buoyant forces from floating the primary tank.

Once the primary tank waste level has been lowered below the leak path, begin pumping waste from the annulus via existing underground transfer lines from the annulus pump pit to the central pump pit. From the central pump pit, the route would be jumpered to the same route used for transferring waste from the primary tank to the designated or alternate receiver tank.

BENEFITS TO STRATEGY: Most DSTs have primary transfer pumps installed. This strategy uses transfer pumps and pipelines already installed and serviceable so that pumping could be initiated more quickly. The leak will be stabilized faster and the portion of the annulus above the leak path will be pumped faster by using the higher capacity primary tank transfer pump than by using the annulus pump.

The waste in the annulus would be pumped to the designated receiver tank via the established transfer route as necessary. Once the location of the leak is determined and the annulus is pumped, the emergency nature of the transfer could be downgraded. The waste remaining in the non-leaking portion of the tank could be left in the tank or pumped to some other tank, depending upon the best solution under the circumstances. Removing as much of the waste as possible in a non-emergency mode is more likely to prevent harm to human health or the environment, than pumping all of the tanks contents in an emergency mode.

If the leak path is near the bottom of the tank, then this approach will result in removing waste from the annulus in the most timely manner because the highest capacity pump and transfer routes are employed. The annulus level will equalize with the primary tank level and have a volume reduction as the primary is pumped.

Because the primary tank pumping and annulus pumping use a common route to the designated receiver tank, an alternate strategy could also be considered. This alternate strategy would be to initiate pumping of the primary tank to the designated receiver and then pump the annulus back into the leaking tank. This strategy would allow both primary tank and annulus transfers simultaneously through separate routes.

3.4 RESPONSIBILITIES

The responsibilities for various actions and activities associated with emergency pumping are detailed in the specific emergency pumping procedures. See Appendix B. Because a leaking tank may constitute both a safety issue and an environmental issue, the emergency response must be planned in cooperation with the Richland Office of the Office of River Protection (ORP), the State of Washington Department of Ecology, and the Washington State Department of Health. Notifications and responses will be made in accordance with the following CH2M HILL Hanford Group, Inc. procedures:

- Event Notification (TFC-OPS-OPER-D-01),
- Critique and Event Investigation Process (TFC-OPS-OPER-C-14),
- Occurrence Reporting and Processing of Operations Information (HNF-IP-0842, Volume 2 Section 4.6.2), and
- Emergency Management (TFC-OPS-EM-C-01).

3.5 MAJOR ACTIVITIES

3.5.1 Pre-Emergency Pumping Planning Activities

- Hold a kickoff meeting to bring together all required participants (i.e., Operations management, Engineering management and Environmental, Safety, Health, and Quality [ESH&Q] management) to assign responsibilities and action items necessary to initiate pumping.

- Walk-down facility to identify needed repairs or scheduled maintenance that may need to be accelerated.

- Review applicable operating and emergency transfer procedures and validate for specific conditions or circumstances if necessary.

- Other activities as defined by the *Time Deployment Study for Annulus Pumping* (RPP-5842).

3.5.2 Check Waste Characterization and Compatibility

Before waste is transferred, compatibility tests or assessments are performed on the waste in both the supply and receiver tanks to ensure that undesirable chemical reactions do not occur. The document, *Data Quality Objectives for the Waste Compatibility Program* (HNF-SD-WM-DQO-001) discusses the criteria used to assess the compatibility of wastes before they are mixed. Most of the transfers discussed in this plan involve moving waste only to tank 241-AP-108, which normally contains a minimum heel of very dilute waste that should pose no compatibility problems.

In preparation for final waste retrieval, there is an ongoing Characterization Program within RPP to fully document the chemical and physical characteristics of the waste stored in each tank. This data will be used if available.

3.5.3 Review/Prepare Safety Documentation

All provisions of *Tank Farms Final Safety Analysis Report* (HNF-SD-WM-SAR-067) and *Tank Farms Technical Safety Requirements* (HNF-SD-WM-TSR-006) must be met during emergency pumping activities.

Provisions of Occupational Safety and Health procedures, Radiation Protection Procedures, and *Tank Farms Health and Safety Plan* (HNF-SD-WM-HSP-002) apply to all work performed. Health physics shall assist in issuing special Radiation Work Permits as needed to safely pump waste from the DST primary or secondary tanks.

The emergency pumping procedures (see Appendix B) will be pre-approved and will have unreviewed safety question (USQ) screening/determinations completed to ensure that emergency pumping can be executed within the existing authorization basis. The

USQ procedure is defined in the Engineering Procedure Manual, Safety Basis Section, Procedure TFC-ENG-SB-C-03.

3.5.4 Ensure Equipment Readiness

Confirm proposed transfer route, destination of the waste and heat trace operability. A proposed transfer route for each primary tank is identified in Appendix A. A proposed transfer route for each annulus is identified in Appendix E.

Obtain and install necessary jumpers in valve pits, if required. Ensure availability and readiness of transfer pumps.

3.6 ESTIMATED TIME TO START PUMPING TANKS

To the extent practical, all equipment and documentation necessary to perform emergency transfers from the secondary tanks of the DSTs have been prepared ahead of time.

The regulations require removing "Spilled or leaked waste and accumulated precipitation... from the secondary containment system within twenty-four hours, or in as timely a manner as possible to prevent harm to human health and the environment, if the owner or operator can demonstrate to the department that removal of the released waste or accumulated precipitation cannot be accomplished within twenty-four hours." In most cases, the nature of the leak will make a 24-hour response impossible.

The major tasks involved in installing a submersible annulus pump into a DST include: preparing and approving work packages, validating the transfer procedure, performing dome loading calculations, preparing a critical lift procedure for the crane, setting up the crane, removing pit cover blocks, inserting the pump, installing necessary pipe jumpers, making electrical connections and closing the pit. A rough order of magnitude for the time required to complete the major tasks necessary to install an annulus pumping system is ten days.

4.0 REFERENCES

40CFR, Part 256.193 (c) (4), "Containment and detection of releases," *Code of Federal Regulations*, as amended.

HNF-IP-0842, 2003, *RPP Administrative Procedures*, Volume 2 Section 4.6.2 "Occurrence Reporting and Processing of Operations Information," Rev. 6J, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-SD-WM-DQO-001, 2002, *Data Quality Objectives for the Waste Compatibility Program*, Rev. 5, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-SD-WM-HSP-002, 2002, *Tank Farm Health and Safety Plan*, Rev. 4, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-SD-WM-SAR-067, 2003, *Tank Farms Final Safety Analysis Report*, Rev. 3-L, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-SD-WM-TSR-006, 2003, *Tank Farms Technical Safety Requirements*, Rev. 2-O, CH2M HILL Hanford Group, Inc., Richland, Washington.

OTP-001-001, 2000, "*Operational Test Procedure for DST Annulus Emergency Pumping Equipment*" A-0, CH2M HILL Hanford Group, In., Richland, Washington.

RPP-5842, 2000, *Time Deployment Study for Annulus Pumping*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

TFC-ENG-SB-C-03, 2003, Engineering Procedure Manual, Safety Basis Section, Procedure "Unreviewed Safety Question Process," Rev. B-1, CH2M HILL Hanford Group, Inc., Richland, Washington.

TFC-OPS-EP-C-01, 2003, "Emergency Management," Rev. A-1, CH2M HILL Hanford Group, Inc., Richland, Washington.

TFC-OPS-OPER-C-14, 2002, "Critique and Event Investigation Process," Rev. A, CH2M HILL Hanford Group, Inc., Richland, Washington.

TFC-OPS-OPER-D-01, 2003, "Event Notification," Rev, B-1, CH2M HILL Hanford Group, Inc., Richland, Washington.

TWINS, 2003, Tank Waste Information Network System, Queried 5/22/03, [Tanks 241-AY-101, 241-AY-102, 241-AZ-101, and 241-AZ-102 BBI data], http://twins.pnl.gov:8001.

WAC 173-303-640 (4) (iv) "Tank Systems, "*Washington Administrative Code*, as amended.

RPP-6638, 2000, *DST Annulus Pumping Acceptance Test Report*, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-6485, 2000, *Technical Information to Support DST Emergency Annulus Pumping*" CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-7919, 2001, *DST Annulus Pumping Acceptance Test Report Supplement*, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-9174, 2002, *System Design Description for Tank Farms Double-Shell Tank Emergency Annulus Pumping Systems*, CH2M HILL Hanford Group, Inc., Richland, Washington

Vendor Information VI-50121, 2000, "Double Shell Tank Annulus Pumping Vendor Information File," CH2M HILL Hanford Group, Inc., Richland, Washington.

APPENDIX A

PROPOSED EMERGENCY PUMPING TRANSFER ROUTES FROM PRIMARY TANK TO DESIGNATED RECEIVER TANK

APPENDIX A

The proposed transfer routes described below are for the emergency pumping of the primary tanks. The transfer pipelines for pumping all DST primary tanks are pipe-in-pipe, or encased pipelines.

TRANSFER ROUTES FROM 241-AN PRIMARY TANKS TO DESIGNATED RECEIVER TANK 241-AP-108

Tank 241-AN-101 Transfer Route to Designated Receiver Tank	
241-AN-01A Pump Pit	Transfer Pump through Rigid Jumper to Nozzle A to Line SN-261
241-AN-B Valve Pit	Nozzle R15 through Flex/Rigid Jumper to Nozzle R2 via D to Line SN-260
241-AZ-02B Pump Pit	Nozzle U7 through Flex Jumper to Nozzle U5 to Line SN-600
241-AX-A Valve Pit	Nozzle L16 through Flex Jumper to Nozzle L1 to Line SN-214/201
241-A-A Valve Pit	Nozzle L1 through Rigid Jumper Nozzle L2 to Line SN-220
241-AW-A Valve Pit	Nozzle L2 through Rigid Jumper to Nozzle L18 to Line SL-169
241-AW-B Valve Pit	Nozzle R18 through Rigid Jumper to Nozzle R20 Line SN-274
241-AW-04A Pump Pit	Nozzle L through Flex Jumper to Nozzle A Line SN-264
241-AW-B Valve Pit	Nozzle R14 through Rigid Jumper to Nozzle R1 Line SN-268
241-AW-02A Pump Pit	Nozzle H through Rigid Jumper to Nozzle U to Line SN-610
241-AP Valve Pit	Nozzle 14 through Rigid Jumpers to Nozzle 22 via P, M, H & J to Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)
Tank 241-AN-102 Transfer Route to Designated Receiver Tank	
241-AN-02A Pump Pit	Transfer Pump through Rigid Jumper to Nozzle A to Line SN-262
241-AN-B Valve Pit	Nozzle R16 through Flex/Rigid Jumper to Nozzle R2 via D to Line SN-260
Same as remaining 241-AN-101 to 241-AP-108 route	

TRANSFER ROUTES FROM 241-AN PRIMARY TANKS TO DESIGNATED RECEIVER TANK 241-AP-108

Tank 241-AN-103 Transfer Route to Designated Receiver Tank	
241-AN-03A Pump Pit	Transfer Pump through Rigid Jumper to Nozzle A to Line SN-263
241-AN-B Valve Pit	Nozzle R14 through Flex/Rigid Jumper to Nozzle R2 via D to Line SN-260
Same as remaining 241-AN-101 to 241-AP-108 route	
Tank 241-AN-104 Transfer Route to Designated Receiver Tank	
241-AN-04A Pump Pit	Transfer Pump through Rigid Jumper to Nozzle A to Line SN-246
241-AN-A Valve Pit	Nozzle L15 through Flex/Rigid Jumper to Nozzle L19 via E to Line SN-268
241-AN-B Valve Pit	Nozzle R19 through Rigid Jumper to Nozzle R2 via D Line SN-260
Same as remaining 241-AN-101 to 241-AP-108 route	
Tank 241-AN-105 Transfer Route to Designated Receiver Tank	
241-AN-05A Pump Pit	Transfer Pump through Rigid Jumper to Nozzle A to Line SN-265
241-AN-A Valve Pit	Nozzle L16 through Flex/Rigid Jumper to Nozzle L19 via E to Line SN-268
241-AN-B Valve Pit	Nozzle R19 through Rigid Jumper to Nozzle R2 via D to Line SN-260
Same as remaining 241-AN-101 to 241-AP-108 route	
Tank 241-AN-106 Transfer Route to Designated Receiver Tank	
241-AN-06A Pump Pit	Transfer Pump through Flex Jumper to Nozzle A to Line SN-266
241-AN-A Valve Pit	Nozzle L14 through Flex/Rigid Jumper to Nozzle L19 via E to Line SN-268
241-AN-B Valve Pit	Nozzle R19 through Rigid Jumper to Nozzle R2 via D to Line SN-260
Same as remaining 241-AN-101 to 241-AP-108 route	
Tank 241-AN-107 Transfer Route to Designated Receiver Tank	
241-AN -07A Pump Pit	Transfer Pump through Rigid Jumper to Nozzle A to Line SN-267
241-AN-A Valve Pit	Nozzle L1 through Flex/Rigid Jumper to Nozzle L19 via E to Line SN-268
241-AN-B Valve Pit	Nozzle R19 through Rigid Jumper to Nozzle R2 via D to Line SN-260
Same as remaining 241-AN-101 to 241-AP-108 route	

TRANSFER ROUTES FROM 241-AP PRIMARY TANKS TO DESIGNATED RECEIVER TANK 241-AP-108

Tank 241-AP-101 Transfer Route to Designated Receiver Tank	
241-AP-01A Pump Pit	Transfer Pump through Rigid Jumper to Nozzle A to Line SN-611
241-AP Valve Pit	Nozzle 18 through Rigid Jumper to Nozzle 22 via J to Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)
Tank 241-AP-102 Transfer Route to Designated Receiver Tank	
241-AP-02A Pump Pit	Transfer Pump through Rigid Jumper to Nozzle A to Line SN-612
241-AP Valve Pit	Nozzle 19 through Rigid Jumper to Nozzle 22 to Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)
Tank 241-AP-103 Transfer Route to Designated Receiver Tank	
241-AP-03A Pump Pit	Transfer Pump through Rigid Jumper to Nozzle A to Line SN-613
241-AP Valve Pit	Nozzle 17 through Rigid Jumper to Nozzle 22 to Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)
Tank 241-AP-104 Transfer Route to Designated Receiver Tank	
241-AP-04A Pump Pit	Transfer Pump through Rigid Jumper to Nozzle A to Line SN-614
241-AP Valve Pit	Nozzle 20 through Rigid Jumper to Nozzle 22via D, C, N, P, M, H & J to Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)
Tank 241-AP-105 Transfer Route to Designated Receiver Tank	
241-AP-05A Pump Pit	Transfer Pump through Rigid Jumper to Nozzle A to Line SN-615
241-AP Valve Pit	Nozzle 24 through Rigid Jumper to nozzle 22 via K to Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)
Tank 241-AP-106 Transfer Route to Designated Receiver Tank	
241-AP-06A Pump Pit	Transfer Pump through Rigid Jumper to Nozzle A to Line SN-616
241-AP Valve Pit	Nozzle 21 through Rigid Jumper to Nozzle 22 to Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)

TRANSFER ROUTES FROM 241-AP PRIMARY TANKS TO DESIGNATED RECEIVER TANK 241-AP-108

Tank 241-AP-107 Transfer Route to Designated Receiver Tank	
241-AP-07A Pump Pit	Transfer Pump through Rigid Jumper to Nozzle A to Line SN-617
241-AP Valve Pit	Nozzle 23 through Rigid Jumper to Nozzle 22 to Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)
Tank 241-AP-108 Transfer Route to Alternate Receiver Tank	
241-AP-08A Pump Pit	Transfer Pump through Rigid Jumper to Nozzle A to Line SN-618
241-AP Valve Pit	Nozzle 22 through Rigid Jumper to Nozzle 23 to Line SN-617
241-AP-07A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)

TRANSFER ROUTES FROM 241-AW PRIMARY TANKS TO DESIGNATED RECEIVER TANK 241-AP-108

Tank 241-AW-101 Transfer Route to Designated Receiver Tank	
241-AW-01A Pump Pit	Pump Nozzle through Flex/Rigid Jumper to Nozzle A to Line SN-261
241-AW-A Valve Pit	Nozzle L16 through Rigid/Flex Jumper to Nozzle L1 via D to Line SN-267
241-AW-02A Pump Pit	Nozzle J through Rigid Jumper to Nozzle V to Line SN-609
241-AP Valve Pit	Nozzle 14 through Rigid Jumper to Nozzle 22 via P, N, C, & D to Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)
Tank 241-AW-102 Transfer Route to Designated Receiver Tank	
241-AW-02E Pump Pit	Pump Nozzle through Rigid Jumper to Nozzle D to Line SN-272
241-AW-02A Pump pit	Nozzle K through Flex Jumper to Nozzle V to Line SN-609
241-AP Valve Pit	Nozzle 14 through Rigid Jumper to Nozzle 22 via P, N, C, & D to Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)
Tank 241-AW-103 Transfer Route to Designated Receiver Tank	
241-AW-03A Pump Pit	Pump Nozzle through Rigid Jumper to Nozzle A to Line SN-263
241-AW-A Valve Pit	Nozzle L14 through Rigid Jumper to Nozzle L1 via F & D to Line SN-267
241-AW-02A Pump Pit	Nozzle J through Rigid Jumper to Nozzle V to Line SN-609
241-AP Valve Pit	Nozzle 14 through Rigid Jumper to Nozzle 22 via P, N, C, & D to Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)
Tank 241-AW-104 Transfer Route to Designated Receiver Tank	
241-AW-04A Pump Pit	Pump Nozzle through Rigid Jumper to Nozzle A to Line SN-264
241-AW-B Valve Pit	Nozzle R-14 through Rigid Jumper to Nozzle R1 via C to Line SN-268
241-AW-02A Pump Pit	Nozzle H through Rigid Jumper to Nozzle U to Line SN-610
241-AP Valve Pit	Nozzle 13 through Rigid Jumper to Nozzle 22 via N, C & D to Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)

TRANSFER ROUTES FROM 241-AW PRIMARY TANKS TO DESIGNATED RECEIVER TANK 241-AP-108

Tank 241-AW-105 Transfer Route to Designated Receiver Tank	
241-AW-05A Pump Pit	Pump Nozzle through Rigid Jumper to Nozzle A and Line SN-265
241-AW-A Valve Pit	Nozzle L15 through Rigid Jumper to Nozzle L1 via F & D to Line SN-267
241-AW-02A Central Pump Pit	Nozzle J through Rigid Jumper to Nozzle V to Line SN-609
241-AP Valve Pit	Nozzle 14 through Rigid Jumper to Nozzle 22 via P, N, C, & D to Line SN-618
241-AP-08A Central Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)
Tank 241-AW-106 Transfer Route to Designated Receiver Tank	
241-AW-06A Pump Pit	Pump Nozzle through Rigid Jumper to Nozzle A to Line SN-266
241-AW-B Valve Pit	Nozzle R-15 through Rigid Jumper to Nozzle R-1 via C to Line SN-268
241-AW-02A Pump Pit	Nozzle H through Rigid Jumper to Nozzle U to Line SN-610
241-AP Valve Pit	Nozzle 13 through Rigid Jumper to Nozzle 22 via N, C, & D to Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)

TRANSFER ROUTES FROM 241-AY PRIMARY TANKS TO DESIGNATED RECEIVER TANK 241-AP-108

Tank-241-AY-101 Transfer Route to Designated Receiver Tank	
241-AY-01D Pump Pit	Pump Nozzle through Flex Jumper to Nozzle U2 to Line SL-504
241-AY-02A Pump Pit	Nozzle U8 through Rigid Jumper to Nozzle U3 to Line SL-503
241-AY-02D Pump Pit	Nozzle U2 through Rigid Jumper to Nozzle U3 to Line SL-502
241-AX-B Valve Pit	Nozzle R16 through Flex Jumper to Nozzle R1 to Line SN-213/200
241-A-B Valve Pit	Nozzle R1 through Flex Jumper to Nozzle R19 to Line SN-204
241-A-A Valve Pit	Nozzle L19 through Rigid Jumper to Nozzle L2 to Line SN-220
241-AW-A Valve Pit	Nozzle L2 through Rigid Jumper to Nozzle L18 to Line SL-169
241- AW-B Valve Pit	Nozzle R18 through Rigid Jumper to Nozzle R20 Line SN-274
241-AW-04A Pump Pit	Nozzle L through Flex Jumper to Nozzle A Line SN-264
241-AW-B Valve Pit	Nozzle R14 through Rigid Jumper to Nozzle R1 Line SN-268
241-AW-02A Pump Pit	Nozzle H through Rigid Jumper to Nozzle U Line SN-610
241-AP Valve Pit	Nozzle 13 through Rigid Jumpers to Nozzle 22 via N, C, D & K to Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)
Tank 241-AY-102 Transfer Route to Designated Receiver Tank	
241-AY-02D Pump Pit	Pump Nozzle through Rigid Jumper to Nozzle U3 to Line SL-502
Same as remaining 241-AY-101 to 241-AP-108 route	

TRANSFER ROUTES FROM 241-AZ PRIMARY TANKS TO DESIGNATED RECEIVER TANK 241-AP-108

Tank 241-AZ-101 Transfer Route to Designated Receiver Tank	
241-AZ-01C Pump Pit	Pump Nozzle through Flex Jumper to Nozzle U6 to Line SN-601
241-AZ-02B Pump Pit	Nozzle U6 through Flex Jumper to Nozzle U5 to Line SN-600
241-AX-A Valve Pit	Nozzle L16 through Flex Jumper to Nozzle L1 to Line SN201/214
241A-AValve Pit	Nozzle L1 through Rigid Jumper to Nozzle L2 to Line SN-220
241AW-A Valve Pit	Nozzle L2 through Rigid Jumper to Nozzle L18 Line SL-169
241AW-B Valve Pit	Nozzle R18 through Rigid Jumper to Nozzle R20 Line SN-274
241AW-04A Pump Pit	Nozzle L through Flex Jumper to Nozzle A Line SN-264
241-AW-B Valve Pit	Nozzle R14 through Rigid Jumper to Nozzle R1 Line SN-268
241-AW-02A Pump Pit	Nozzle H through Rigid Jumper to Nozzle U Line SN-610
241-AP Valve Pit	Nozzle 13 through Rigid Jumper Nozzle 22 Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)
Tank 241-AY-102 Transfer Route to Designated Receiver Tank	
241-AZ-02B Pump Pit	Pump Nozzle through Flex Jumper to Nozzle U5 to Line SN-600
Same as remaining 241-AZ-101 to 241-AP-108 route	

TRANSFER ROUTES FROM 241-SY PRIMARY TANKS TO DESIGNATED RECEIVER TANK 241-AP-108

Tank 241-SY-101 Transfer Route to Designated Receiver Tank	
241-SY-101, 42" Riser #007	Pump Nozzle through Rigid Jumper to Over Ground Transfer Line
241-SY-A Valve Pit	Rigid/Flex Jumper Nozzle I to Nozzle L12 via L & H to line SNL-3150
Same as remaining 241-SY-102 to 241-AP-108 route	
Tank 241-SY-102 Transfer Route to Designated Receiver Tank	
241-SY-02A Pump Pit	Pump Nozzle through Rigid Jumper to Nozzle J to Line SN-285
241-SY-A Valve Pit	Nozzle L11 through Rigid Jumper to Nozzle L12 to Line SNL-3150
244-A Lift Station	Through 6241-A Diversion Box & 6241-V Vent Station to Nozzle P17 through Flex Jumper to Nozzle P7 to Line SN-215
241-A-A Valve Pit	Nozzle L16 through Rigid/Flex Jumper to Nozzle L2 to Line SN-220
241-AW-A Valve Pit	Nozzle L2 through Rigid Jumper to Nozzle L18 to Line SL-169
241- AW-B Valve Pit	Nozzle R18 through Rigid Jumper to Nozzle R20 Line SN-274
241-AW-04A Pump Pit	Nozzle L through Flex Jumper to Nozzle A Line SN-264
241-AW-B Valve Pit	Nozzle R14 through Rigid Jumper to Nozzle R1 Line SN-268
241-AW-02A Pump Pit	Nozzle H through Rigid Jumper to Nozzle U Line SN-610
241-AP Valve Pit	Nozzle 13 through Rigid Jumper to Nozzle 22 via N, C, D & K to Line SN-618
241-AP-08A Pump Pit	Nozzle A through Rigid Jumper to Nozzle E (Tank Return)
Tank 241-SY-103 Transfer Route to Designated Receiver Tank	
241-SY-03A Pump Pit	Pump Nozzle through Flex Jumper to Nozzle A to Line SN-279
241-SY-B Valve Pit	Nozzle R14 through Flex Jumper to Nozzle R19 to Line SN-280
241-SY-A Valve Pit	Nozzle L19 through Flex Jumper to Nozzle L16 via H to Line SN-277
241-SY-02A Pump Pit	Nozzle A through Rigid Jumper to Nozzle G (Tank Return) into Tank SY-102
Waste would then be pumped from 241-SY-102 to 241-AP-108 using its specified route.	

APPENDIX B

LIST OF IMPLEMENTING PROCEDURES AND RELEVANT DRAWINGS

APPENDIX B

DST ANNULUS EMERGENCY PUMPING PROCEDURES

TANK FARM	PROCEDURE NUMBER	PROCEDURE TITLE
AN	TO-001-281	Emergency Annulus Pumping Procedure for AN Farm
AP	TO-001-282	Emergency Annulus Pumping Procedure for AP Farm
AW	TO-001-283	Emergency Annulus Pumping Procedure for AW Farm
AY	TO-001-288	Emergency Annulus Pumping Procedure for AY Farm
AZ	TO-001-289	Emergency Annulus Pumping Procedure for AZ Farm
SY	TO-001-284	Emergency Annulus Pumping Procedure for SY Farm

APPENDIX B

PIPING AND INSTRUMENT DIAGRAMS

TANK FARM	DWG. NO.	TITLE
AN	H-14-020501	WASTE STORAGE TANK ANNULUS INSTM SYS WSTA O&M SYS P&ID
	H-14-020601	WASTE STORAGE TANK INSTM SYSTEM WST O&M SYSTEM P&ID
	H-14-020801	WASTE TRANSFER SYSTEM-WST-O&M SYSTEM P&ID
AP	H-14-020503	WASTE STORAGE TANK ANNULUS INSTM SYS WSTA O&M SYS P&ID
	H-14-020603	WASTE STORAGE TANK INSTR SYSTEM WST O&M SYSTEM P&ID
	H-14-020803	WASTE TRANSFER SYSTEM (WT) O&M SYSTEM P&ID
AW	H-14-020502	WASTE STORAGE TANK ANNULUS INSTM SYS WSTA O&M SYS P&ID
	H-14-020602	WASTE STORAGE TANK INSTM SYSTEM WST O&M SYSTEM P&ID
	H-14-020803	WASTE TRANSFER SYSTEM-WT-O&M SYSTEM P&ID
AX	H-14-020609	WASTE STORAGE TANK SYSTEM (WST) O&M SYSTEM P&ID
	H-14-020809	WASTE TRANSFER SYSTEM (WT) O&M SYSTEM P&ID
AY	H-2-64462	P&ID TANK 241-AY-102 ANNULUS
AZ	H-14-020801	WASTE TRANSFER SYSTEM (WT) O&M SYSTEM P&ID
SY	H-14-020531	WASTE STORAGE TANK ANNULUS SYSTEM (WSTA) O&M SYSTEM P&ID
	H-14-020631	WASTE STORAGE TANK SYSTEM (WST) O&M SYSTEM P&ID
	H-14-020831	WASTE TRANSFER SYSTEM (WT) O&M SYSTEM P&ID

APPENDIX B
ANNULUS PUMPING EQUIPMENT DRAWINGS

DRAWING NO.	TITLE
DRAWING LIST	
H-14-104118	DRAWING LIST AND AREA MAP
PIPING & VESSEL	
H-14-103889 SH 1	TEST SKID SUBMERSIBLE PUMP ARRANGEMENT
H-14-103889 SH 2	TEST SKID SUBMERSIBLE PUMP VIEWS AND DETAILS
H-14-103870	AIR PUMP IN TANK TEST ARRANGEMENT
H-14-103871 SH 1	MOCK ANNULUS RISER AND LOWER PUMP ARRANGEMENT
H-14-103871 SH 2	MOCK ANNULUS RISER AND LOWER PUMP DETAILS
H-14-103872	AIR DRIVEN PUMP ADAPTER ARRANGEMENTS AND ASSEMBLY
H-14-103873	JUMPER ASSEMBLY ANNULUS PUMP PITS PRELIMINARY FABRICATION
H-14-104122	JUMPER ARRANGEMENT ANNULUS PUMP PIT 241-AN-01B THRU –07B
H-14-104123 SH 1	JUMPER ARRANGEMENT ANNULUS PUMP PIT 241-AP-01B, 03B, 06B, 08B
H-14-104123 SH 2	JUMPER ARRANGEMENT ANNULUS PUMP PIT 241-AP-02B, 04B, 05B, 07B
H-14-104124	JUMPER ARRANGEMENT ANNULUS PUMP PIT 241-AW-01B THRU –06B
H-14-104125	JUMPER ARRANGEMENT ANNULUS PUMP PIT 241-AY-01F & -02F
H-14-104126	JUMPER ARRANGEMENT ANNULUS PUMP PIT 241-AZ-01F & -02F
H-14-104127	JUMPER ARRANGEMENT ANNULUS PUMP PIT 241-SY-01B, -02B & -03B
H-14-104128 SH 1&2	JUMPER ASSEMBLY ANNULUS PUMP PIT 241-AN-01B THRU –07B
H-14-104129 SH 1&2	JUMPER ASSEMBLY ANNULUS PUMP PIT 241-AP-01B THRU –08B
H-14-104130 SH 1&2	JUMPER ASSEMBLY ANNULUS PUMP PIT 241-AW-01B THRU –06B
H-14-104131 SH 1&2	JUMPER ASSEMBLY ANNULUS PUMP PIT 241-AY-01F & -02F
H-14-104132 SH 1&2	JUMPER ASSEMBLY ANNULUS PUMP PIT 241-AZ-01F & -02F
H-14-104133 SH 1&2	JUMPER ASSEMBLY ANNULUS PUMP PIT 241-SY-01B, -02B & -03B
H-14-104134 SH 1&2	PUMP ASSEMBLY ANNULUS PUMP PIT 241-AN-01B THRU –07B

H-14-104135 SH 1&2	PUMP ASSEMBLY ANNULUS PUMP PIT 241-AP-01B THRU –08B
H-14-104136 SH 1&2	PUMP ASSEMBLY ANNULUS PUMP PIT 241-AW-01B THRU –06B
H-14-104137 SH 1&2	PUMP ASSEMBLY ANNULUS PUMP PIT 241-AY-01F & -02F
H-14-104138 SH 1&2	PUMP ASSEMBLY ANNULUS PUMP PIT 241-AZ-01F & -02F
H-14-104139 SH 1&2	PUMP ASSEMBLY ANNULUS PUMP PIT 241-SY-01B, -02B & -03B
H-14-104140	SUBMERSIBLE PUMP ASSEMBLY MODIFICATIONS

ELECTRICAL

H-14-104119	DST ANNULUS PUMPING UTILITY WIRING DIAGRAM
H-14-104120	DST ANNULUS PUMP SYSTEM – FUSED DISCONNECT SKID ASSY
H-14-104141 SH 1	DST ANNULUS PUMP SYSTEM – FIELD RACK ARRANGEMENT
H-14-104141 SH 2	DST ANNULUS PUMP SYSTEM – FIELD RACK ARRANGEMENT
H-14-104141 SH 3	DST ANNULUS PUMP SYSTEM – FIELD RACK SCHEMATIC
H-14-104141 SH 4	DST ANNULUS PUMP SYSTEM – FIELD RACK ASSEMBLY
H-14-104142	DST ANNULUS PUMP UTILITY ARRANGEMENT 241-AN TANK FARM
H-14-104143	DST ANNULUS PUMP UTILITY ARRANGEMENT 241-AP TANK FARM
H-14-104144	DST ANNULUS PUMP UTILITY ARRANGEMENT 241-AW TANK FARM
H-14-104145	DST ANNULUS PUMP UTILITY ARRANGEMENT 241-AY TANK FARM
H-14-104146	DST ANNULUS PUMP UTILITY ARRANGEMENT 241-AZ TANK FARM
H-14-104147	DST ANNULUS PUMP UTILITY ARRANGEMENT 241-SY TANK FARM

APPENDIX C

IDENTIFICATION AND LOCATION OF DST PUMPS AND JUMPERS THAT WOULD BE USED FOR EMERGENCY PUMPING

Facility Location	Pump Pit	Pump Use	Pump # Currently Installed	Pump Length	Fab DWG	Pump Pit Clearance **	Pump Flange to Bottom of Tank	Jumpers install for transfer	Jumper DWG	Comments
241-AN Tank Farm										
TK-101	01A	Transfer	202P-TX1	48'-11"	H-2-91943	4'-5 3/32"	49'-9"	Yes	H-2-72026	Spare is 25 HP, 49'-03/8 long. Property # FA 25586. Manufacture S/N 91-02164
	01B	Annulus	Open	46'2 1/2"	H-14-104134	8'-2 7/32"	46'-5 1/4"	No, w/isolation blanks	H-14-104128	
TK-102	02A	Transfer	65P-TX4	49'-0 1/2"	H-2-46205	4'-5 3/32"	49'-9"	Yes	H-2-72026	
	02B	Annulus	Open	46'2 1/2"	H-14-104134	8'-2 7/32"	46'-5 1/4"	No, w/isolation blanks	H-14-104128	
TK-103	03A	Transfer	202P-TX1	49'-0 3/8"	H-2-91943	4'-4 23/32"	49'-9 3/8"	No	H-2-94863	
	03B	Annulus	Open	46'2 1/2"	H-14-104134	8'-2 7/32"	46'-5 1/4"	No, w/isolation blanks	H-14-104128	
TK-104	04A	Transfer	64P-TX4	49'-0 1/2"	H-2-91943	4'-4 23/32"	49'-9 31/64"	No	H-2-94863	
	04B	Annulus	Open	46'2 1/2"	H-14-104134	8'-2 7/32"	46'-5 1/4"	No, w/isolation blanks	H-2-104128	
TK-105	05A	Transfer	84P-TX4/SW	49'-0 3/8"	H-2-91943	4'-4 23/32"	49'-9 31/64"	No	H-2-94863	
	05B	Annulus	Open	46'2 1/2"	H-14-104134	8'-2 7/32"	46'-5 1/4"	No, w/isolation blanks	H-14-104128	
TK-106	06A	Transfer	2P-TX1-XCF	49'-0 3/8"	H-2-91943	4'-4 23/32"	49'-9 1/8"	No	H-2-72026	2P-TX1-XCF (20HP) pump installed 3/19/92. Spare 25 HP. Prop # FA 25592 Man. S/N 91-02165
	06B	Annulus	Open	46'2 1/2"	H-14-104134	8'-2 7/32"	46'-5 1/4"	No, w/isolation blanks	H-14-104128	
TK-107	07A	Transfer	Open	49'-0 3/8"	H-2-91943	4'-4 23/32"	49'-9 1/8"	No	H-2-72026	
	07B	Annulus	Open	46'2 1/2"	H-14-104134	8'-2 7/32"	46'-8 3/8"	No, w/isolation blanks	H-14-104128	

** Pump Pit Clearance is taken from face of flange to bottom of cover block

Facility Location	Pump Pit	Pump Use	Pump # Currently Installed	Pump Length	Fab DWG	Pump Pit Clearance **	Pump Flange to Bottom of Tank	Jumpers install for transfer	Jumper DWG	Comments
241-AP Tank Farm										
TK-101	01A	Transfer	Open	33'-0" Flex/Float	H-2-91943	4'-9 13/16"	49'-5 11/16"	Yes	H-2-90725	Spare is expected to be 49'-0 3/8".
	01B	Annulus	Open	46' 2 1/2"	H-14-104135	8'-9 3/4"	46'-4 11/16"	NO, w/isolation blanks	H-14-104129	
TK-102	02B	Annulus	Open	46' 2 1/2"	H-14-104135	8'-9 3/4"	46'-4 11/16"	NO, w/isolation blanks	H-14-104129	
	02D	Transfer	1-TX-XCF	44'-7" w/screen	H-2-91943	9'-3 19/64"	44'-8 13/64"	Yes	H-2-90725	
TK-103	03A	Transfer	2P-AP-3	49'-0 3/8"	H-2-91943	4'-9 25/64"	49'-5 23/32"	Yes	H-2-90725	Spare run -in completed 11/29/89. Has Graphite bearings. 30 HP. 160 GPM at 250' TDH
	03B	Annulus	Open	46' 2 1/2"	H-14-104135	8'-9 3/4"	46'-4 11/16"	NO, w/isolation blanks	H-14-104129	
TK-104	04A	Transfer	4P-AP-3	49'-0 3/8"	H-2-91943	4'-9 27/32"	49'-5 21/32"	Yes	H-2-90725	
	04B	Annulus	Open	46' 2 1/2"	H-14-104135	8'-9 3/4"	46'-4 11/16"	NO, w/isolation blanks	H-14-104129	
TK-105	05A	Transfer	1P-AP-3	49'-0 3/8"	H-2-91943	4'-9 13/16"	49'-5 11/16"	Yes	H-2-90725	
	05B	Annulus	Open	46' 2 1/2"	H-14-104135	8'-9 3/4"	46'-4 11/16"	NO, w/isolation blanks	H-14-104129	
TK-106	06A	Transfer	2P-AP-4	33'-0" Flex Float	H-2-91943	4'-9 53/64"	49'-5 43/64"	Yes	H-2-90725	
	06B	Annulus	Open	46' 2 1/2"	H-14-104135	8'-9 3/4"	46'-4 11/16"	NO, w/isolation blanks	H-14-104129	
TK-107	07A	Transfer	Open	49'-0 3/8"	H-2-91943	4'-9 49/64"	49'-5 47/64"	Yes	H-2-90725	
	07B	Annulus	Open	46' 2 3/8"	H-14-104135	8'-9 3/4"	46'-4 11/16"	NO, w/isolation blanks	H-14-104129	
TK-108	08A	Transfer	Open	49'-0 3/8"	H-2-91943	4'-9 45/64"	49'-5 45/64"	Yes	H-2-90725	
	08B	Annulus	Open	46' 2 1/2"	H-14-104135	8'-9 3/4"	46'-4 11/16"	NO, w/isolation blanks	H-14-104129	
** Pump Pit Clearance is taken from face of flange to bottom of cover block										

Facility Location	Pump Pit	Pump Use	Pump # Currently Installed	Pump Length	Fab DWG	Pump Pit Clearance **	Pump Flange to Bottom of Tank	Jumpers install for transfer	Jumper DWG	Comments
241-AW Tank Farm										
TK - 101	01A	Transfer	BOP-TX4 (Oil Lubed)	49'-0 3/8"	H-2-91943	4'-5 21/32"	49'-5 15/32"	Yes	H-2-70445	
	01B	Annulus	Open	46'-2 1/2"	H-14-104136	8'-3 25/64"	45'-4 15/32"	No, w/isolation blanks	H-14-104130	
TK-102	02B	Annulus	Open	46' 2 1/2"	H-14-104136	8'-3 27/64"	46'-4 13/64"	No, w/isolation blanks	H-14-104130	
TK-103	03A	Transfer	1P-TX1-XCR-1	33'-0" Flex Float	H-2-91943	4'-5 21/32"	49'-5 15/32"	Yes	H-2-70445	
	03B	Annulus	Open	46' 2 1/2"	H-14-104136	5'-3 3/16"	46'-4 7/16"	No, w/isolation blanks	H-14-104130	
TK-104	04A	Transfer	3P-TX1-XCR-1	41'-0"	H-2-91943	4'-5 55/64"	49'-5 45/64"	Yes	H-2-70445	
	04B	Annulus	Open	46' 2 1/2"	H-14-104136	8'-3 3/16"	45'-4 7/16"	No, w/isolation blanks	H-14-104130	
TK-105	05A	Transfer	1P-TX1	33'-0" Flex Float	H-2-91943	4'-5 11/16"	49'-5 7/16"	Yes	H-2-70445	
	05B	Annulus	Open	46' 2 1/2"	H-14-104136	8'-3 13/64"	46'-4 27/64"	No, w/isolation blanks	H-14-104130	
TK-106	06A	Transfer	1P-TX1-XCR-1	49'-0 3/8"	H-2-91943	4'-5 53/64"	49'-5 19/64"	Yes	H-2-70445	
	06B	Annulus	Open	46' 2 1/2"	H-14-104136	8'-3 3/16"	46'-4 7/16"	No, w/isolation blanks	H-14-104130	
** Pump Pit Clearance is taken from face of flange to bottom of cover block										

Facility Location	Pump Pit	Pump Use	Pump # Currently Installed	Pump Length	Fab DWG	Pump Pit Clearance **	Pump, Flange to Bottom of Tank	Jumpers Install for Transfer	Jumper DWG	Comments
241-AY Tank Farm										
TK - 101	01B	Transfer	F64GT	Unknown		5'-10 5/8"	49'-0 1/8"	Yes	H-2-64421	No info availiable on this pump
	01D	Transfer	122P-10	47'-3 3/8"	H-2-65054	5'-10 5/8"	48'-0 1/8"	Tes	H-2-64421	
	01F	Annulus	Open	46'-1 9/16"	H-14-104137	8'-3 1/2"	46'-4 1/2"	No	H-14-104131	
TK-102	02D	Transfer	57P-TX-4/9PTX6	47'-3 3/8"	H-2-93179	5'-10 5/8"	48'-0 1/8"	Yes	H-2-64421	
	02E	Transfer	PO621/PO622	Adjustable	H-2-818494	5'-10 5/8"	48'-0 1/8"	Yes	H-2-818503	W-320 Project
	02F	Annulus	Open	46'-1 9/16"	H-14-104137	8'-3 1/2"	46'-4 1/2"	No	H-14-104131	

** Pump Pit Clearance is taken from face of flange to bottom of cover block

Facility Location	Pump Pit	Pump Use	Pump # Currently Installed	Pump Length	Fab DWG	Pump Pit Clearance **	Pump Flange to Bottom of Tank	Jumpers Install for Transfer	Jumper DWG	Comments
241-AZ Tank Farm										
TK - 101	01C	Transfer	74-TX4/1P-TX5	47'-3 3/8"	H-2-93179	7'-2 49/64"	47'-11 63/64	Yes	H-2-68427	
	01F	Annulus	Open	46'-1 9/16"	H-14-104138	8'-3 31/64"	46'-4 21/64"	No, w/isolation blanks	H-14-104132	
TK-102	02B	Transfer	Open	46'-1 9/16"	H-2-93179	7'-2 49/64"	47'-11 63/64		H-2-68427	
	02F	Annulus	Open	46'-1 9/16"	H-14-104138	8'-3 31/64"	46'-4 21/64"	No, w/isolation blanks	H-14-104132	
** Pump Pit Clearance is taken from face of flange to bottom of cover block.										

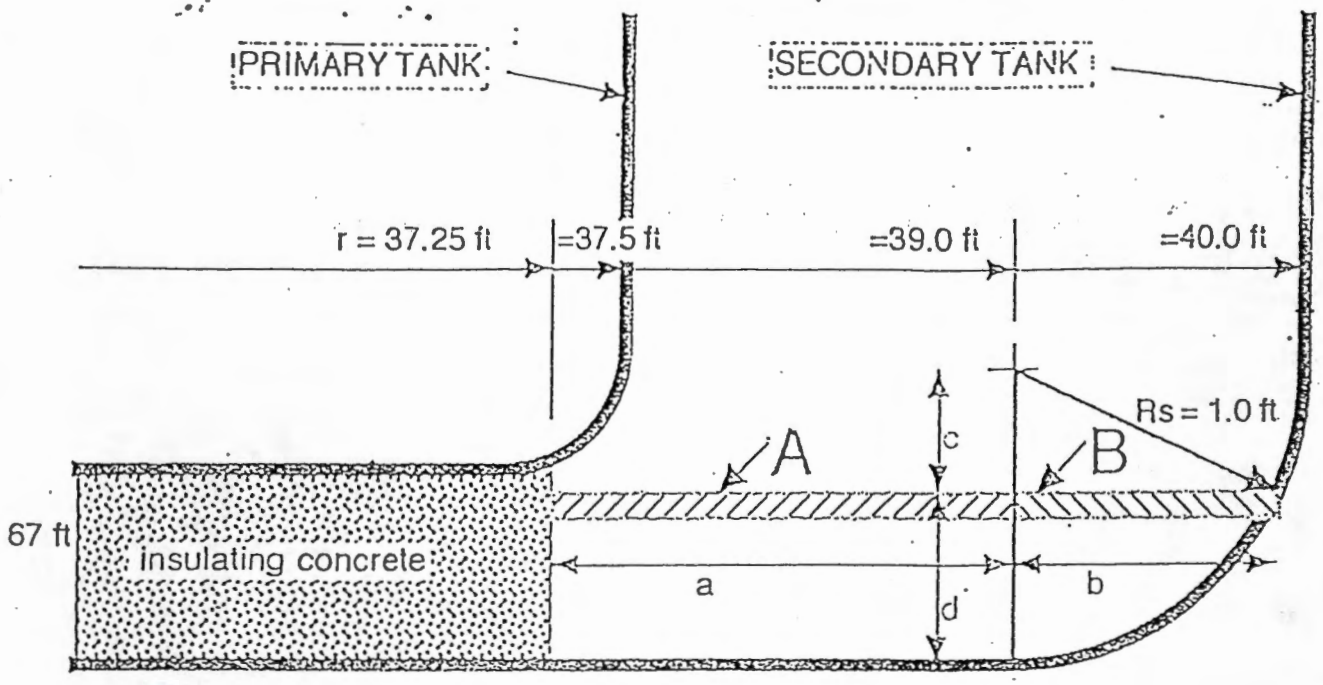
Facility Location	Pump Pit	Pump Use	Pump # Currently Installed	Pump Length	Fab DWG	Spare Pump #	Pump Pit Clearance **	Pump Flange to Bottom of Tank	Jumpers Install for Transfer	Jumper DWG	Comments
241-SY Tank Farm											
TK - 101	01A Riser 3A	Transfer	Open	TBD	H-2-75352 & H-2-46206		4'-5 11/16"	47'-6 9/16"	No	H-2-46215	
	01A Riser 2A	Mixer	N/A	48-1 1/8	H-2-821329	2 each	3'-8 1/4"	50'-2 11/16'	N/A	N/A	One of the spares is located in 400 area(FFTF), and the other is in 2101M
	01B	Annulus	Open	46' 2 1/2"	H-14-104139	No	8'-3 3/16"	46'-4 13/16'	No	H-14-104133	
TK-102	02A	X-Site	SY-02A-3	33' Flex Flo	H-2-75352 & H-2-46205	1P-Sy1-102	4'-5 11/16"	47'-6 9/16"	Yes	H-2-37782	
	02B	Annulus	Open	46' 2 1/2"	H-14-104139	No	8'-3 3/16"	46'-4 13/16'	No	H-14-104133	
	02E	Transfer	49-PTX-4	36'-8"	?	No	8'-4 15/16	45"-8 3/16"	Yes	H-2-37812	35 feet of the old pump broke off in tank
TK-103	03A	Transfer	116P-10	47'-0"	H-2-75352 & H-2-46206	No	4'-5 11/16"	47'-6 9/16"	No	H-2-46215	
	03B	Annulus	Open	46' 2 1/2"	H-14-104139	No	8'-3 3/16"	46'-4 13/16'	No	H-14-104133	

** Pump Pit Clearance is taken from face of flange to bottom of cover block

APPENDIX D

CROSS SECTION OF ANNULUS OF DOUBLE-SHELL TANK

CROSS-SECTION OF ANNULUS OF DOUBLE-SHELL TANK



PROBLEM: Calculate volume of liquid in annulus at various depths.

ASSUMPTIONS: Reference drawings H-2-37772, and H-2-37705 are accurate.
Insulating concrete absorbs no liquid. SY-101 is representative of all DSTs.
Volume can be approximated by dividing annulus space into relatively simple geometric forms and calculating the volume of those forms.

Forms A & B are squat hollow cylinders where Volume = Pi height ($radius_o^2$ - $radius_i^2$).

a = 1.75 ft from 0 to 8 inches above bottom; a = 1.50 ft above 8 inches above bottom.

$Rs^2 = b^2 + c^2$; or b = square root ($Rs^2 - c^2$)

$Volume_{insulating\ concrete}$ = Pi*height ($radius^2$) = Pi(0.67)$(37.25)^2$ = 2,908 ft3 =21,780 gal.

Volume per inch in annulus above 12 inches above bottom is constant at 380 gal/inch.

	A	B	C	D	E	F	G	H	I
1	d (inches)	a (ft)	c (ft)	b (ft)	Vol A (ft3)	Vol B (ft3)	Vol A+B (ft3)	Vol (gal)	Vol cum(gal)
2	1	1.75	0.92	0.40	34.9	8.2	43	323	323
3	2	1.75	0.83	0.55	34.9	11.4	46	347	670
4	3	1.75	0.75	0.66	34.9	13.6	49	364	1,034
5	4	1.75	0.67	0.75	34.9	15.4	50	377	1,410
6	5	1.75	0.58	0.81	34.9	16.8	52	387	1,797
7	6	1.75	0.50	0.87	34.9	17.9	53	396	2,193
8	7	1.75	0.42	0.91	34.9	18.8	54	402	2,595
9	8	1.75	0.33	0.94	34.9	19.5	54	408	3,003
10	9	1.50	0.25	0.97	30.0	20.0	50	375	3,378
11	10	1.50	0.17	0.99	30.0	20.4	50	378	3,756
12	11	1.50	0.08	1.00	30.0	20.6	51	379	4,135
13	12	1.50	0.00	1.00	30.0	20.7	51	380	4,515
14	13	1.50	0.00	1.00	30.0	20.7	51	380	4,895

APPENDIX E

PROPOSED ANNULUS EMERGENCY PUMPING TRANSFER ROUTES TO DESIGNATED RECEIVER TANK

APPENDIX E

The proposed route for emergency pumping of the annulus will be from the Annulus Pump Pit through rigid/flex jumpers to an encased, below-grade pipeline to the Central Pump Pit. The route would be jumpered through the central pump pit to the same route used for transferring waste from the primary tank to the designated receiver tank as outlined in Appendix B. The transfer pipelines from the Annulus Pump Pit to the Central Pump Pit for all DST tanks are pipe-in-pipe or encased pipelines except for 241AY-101, 241-AY-102 and 241-AZ-102. The two tanks in AY farm have direct-buried, unencased pipelines from the annulus pump pits to the central pump. Tank 241-AZ-102 also has a direct-buried unencased pipeline from the annulus pump pit to the central pump pit.

TRANSFER ROUTES FROM 241-AN ANNULUS TO DESIGNATED RECEIVER
Tank 241-AP-108

Tank 241-AN-101 Annulus Transfer Route to Designated Receiver Tank	
241-AN-01B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-471
241-AN-01A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AN-101 primary route listed in Appendix A.	
Tank 241-AN-102 Annulus Transfer Route to Designated Receiver Tank	
241-AN-02B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-472
241-AN-02A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AN-102 primary route listed in Appendix A.	
Tank 241-AN-103 Annulus Transfer Route to Designated Receiver Tank	
241-AN-03B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-473
241-AN-03A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AN-103 primary route listed in Appendix A.	
Tank 241-AN-104 Annulus Transfer Route to Designated Receiver Tank	
241-AN-04B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-474
241-AN-04A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AN-104 primary route listed in Appendix A.	

TRANSFER ROUTES FROM 241-AN ANNULUS TO DESIGNATED RECEIVER Tank 241-AP-108

Tank 241-AN-105 Annulus Transfer Route to Designated Receiver Tank	
241-AN-05B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-475
241-AN-05A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AN-105 primary route listed in Appendix A.	
Tank 241-AN-106 Annulus Transfer Route to Designated Receiver Tank	
241-AN-06B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-476
241-AN-06A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AN-106 primary route listed in Appendix A.	
Tank 241-AN-107 Annulus Transfer Route to Designated Receiver Tank	
241-AN-07B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-477
241-AN-07A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AN-107 primary route listed in Appendix A.	

TRANSFER ROUTES FROM 241-AP ANNULUS TO DESIGNATED RECEIVER TANK 241-AP-108

Tank 241-AP-101 Annulus Transfer Route to Designated Receiver Tank	
241-AP-01B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-811
241-AP-01A Central Pump Pit	Nozzle C through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AP-101 primary route listed in Appendix A.	
Tank 241-AP-102 Annulus Transfer Route to Designated Receiver Tank	
241-AP-02B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-812
241-AP-02A Central Pump Pit	Nozzle C through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AP-102 primary route listed in Appendix A.	

TRANSFER ROUTES FROM 241-AP ANNULUS TO DESIGNATED RECEIVER TANK 241-AP-108

Tank 241-AP-103 Annulus Transfer Route to Designated Receiver Tank	
241-AP-03B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-813
241-AP-03A Central Pump Pit	Nozzle C through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AP-103 primary route listed in Appendix A.	
Tank 241-AP-104 Annulus Transfer Route to Designated Receiver Tank	
241-AP-04B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-814
241-AP-04A Central Pump Pit	Nozzle C through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AP-104 primary route listed in Appendix A.	
Tank 241-AP-105 Annulus Transfer Route to Designated Receiver Tank	
241-AP-05B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-815
241-AP-05A Central Pump Pit	Nozzle C through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AP-105 primary route listed in Appendix A.	
Tank 241-AP-106 Annulus Transfer Route to Designated Receiver Tank	
241-AP-06B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-816
241-AP-06A Central Pump Pit	Nozzle C through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AP-106 primary route listed in Appendix A.	
Tank 241-AP-107 Annulus Transfer Route to Designated Receiver Tank	
241-AP-07B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-817
241-AP-07A Central Pump Pit	Nozzle C through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AP-107 primary route listed in Appendix A.	
Tank 241-AP-108 Annulus Transfer Route to Alternate Receiver Tank	
241-AP-08B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-818
241-AP-08A Central Pump Pit	Nozzle C through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AP-108 primary route listed in Appendix A.	

TRANSFER ROUTES FROM 241-AW ANNULUS TO DESIGNATED RECEIVER TANK 241-AP-108

Tank 241-AW-101 Annulus Transfer Route to Designated Receiver Tank	
241-AW-01B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-471
241-AW-01A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AW-101 primary route listed in Appendix A.	
Tank 241-AW-102 Annulus Transfer Route to Designated Receiver Tank	
241-AW 02B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-472
241-AW-02A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle V to line SN 609
Remaining route is the same as 241-AW-102 primary route listed in Appendix A.	
Tank 241-AW-103 Annulus Transfer Route to Designated Receiver Tank	
241-AW-03B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-473
241-AW-03A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AW-103 primary route listed in Appendix A.	
Tank 241-AW-104 Annulus Transfer Route to Designated Receiver Tank	
241-AW-04B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-474
241-AW-04A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AW-104 primary route listed in Appendix A.	
Tank 241-AW-105 Annulus Transfer Route to Designated Receiver Tank	
241-AW 05B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW 475
241-AW-05A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AW-105 primary route listed in Appendix A.	
Tank 241-AW-106 Annulus Transfer Route to Designated Receiver Tank	
241-AW-06B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-476
241-AW-06A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle A
Remaining route is the same as 241-AW-106 primary route listed in Appendix A.	

TRANSFER ROUTES from 241-AY ANNULUS TO DESIGNATED RECEIVER Tank 241-AP-108

Tank 241-AY101 Annulus Transfer Route to Designated Receiver Tank	
241-AY-01F Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle to Line PW-4531
241-AY-01A Central Pump Pit	Nozzle U10 through Rigid/Flex Jumper to nozzle U12 to Line SL-505
241-AY-01D	Nozzle U3 through Rigid/Flex Jumper to Nozzle U2 to line SL-504
Remaining route is the same as 241-AY-101 primary route listed in Appendix A.	
Tank 241-AY-102 Annulus Transfer Route to Designated Receiver Tank	
241-AY-02F Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle to Line PW-4532
241-AY-02A Central Pump Pit	Nozzle U10 through Rigid/Flex Jumper to Nozzle U3 to line SL-503
Remaining route is the same as 241-AY-102 primary route listed in Appendix A.	

TRANSFER ROUTES from 241-AZ ANNULUS TO DESIGNATED RECEIVER Tank 241-AP-108

Tank 241-AZ-101 Annulus Transfer Route to Designated Receiver Tank	
241-AZ-01F Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle to Line PW-4623
241-AZ-01A Central Pump Pit	Nozzle U3 through Rigid/Flex Jumper to Nozzle U10 to Line SL-501
241-AZ-02A Central Pump Pit	Nozzle U11 through Rigid/Flex Jumper to Nozzle U10 to line SL-500
241-AX-A Valve Pit	Nozzle L5 through Rigid/Flex Jumper to Nozzle L1to Line SN-201/214
Remaining route is the same as 241-AZ-101 primary route listed in Appendix A.	
Tank 241-AZ-102 Annulus Transfer Route to Designated Receiver Tank	
241-AZ-02F Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle U1 to Line PW-4609
241-AZ-02A Central Pump Pit	Nozzle U11 through Rigid/Flex Jumper to Nozzle U10 to line SL-500
241-AX-A Valve Pit	Nozzle L5 through Rigid/Flex Jumper to Nozzle L1 to Line SN-201/214
Remaining route is the same as 241-AZ-102 primary route listed in Appendix A.	

TRANSFER ROUTES FROM 241-SY ANNULUS TO DESIGNATED RECEIVER TANK 241-AP-108

Tank 241-SY-101 Annulus Transfer Route to Designated Receiver Tank	
241-SY-01B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW -478
241-SY-01A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle A to Line SN-278
241-SY-B Valve Pit	Nozzle R16 through Rigid/Flex jumper to Nozzle R19 to line SN-280
241-SY-A Valve Pit	Nozzle L19 through Rigid/Flex jumper to Nozzle L16 via H to Line 277
241-SY-02A Pump Pit	Nozzle A through Rigid/Flex Jumper to Nozzle G into Tank 241-SY-102
Waste would then be pumped from 241-SY-102 to 241-AP-108 per Appendix A route.	

Tank 241-SY-102 Annulus Transfer Route to Designated Receiver Tank	
241-SY-02B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-475
241-SY-02A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle A to Line SN-277
241-SY-A Valve Pit	Nozzle L16 through Rigid/Flex jumper to nozzle I via Overground Line to Pre-fabricated Pump Pit
Pre-Fabricated Pump Pit	Overground line nozzle through rigid jumper to nozzle in riser-007 into Tank 241-SY-101
Waste would then be pumped from 241-SY-101 to 241-AP-108 per Appendix A route.	

Tank 241-SY-103 Annulus Transfer Route to Designated Receiver Tank	
241-SY 03B Annulus Pump Pit	Transfer Pumps through Rigid/Flex Jumper to Nozzle A to Line PW-479
241-SY-03A Central Pump Pit	Nozzle E through Rigid/Flex Jumper to nozzle A to line SN-279
241-SY-B Valve Pit	Nozzle R14 through Rigid/Flex jumper to Nozzle R19 to line SN-280
241-SY-A Valve Pit	Nozzle L19 through Rigid/Flex jumper to Nozzle L16 via H to line SN-277
241-SY-02A Central Pump Pit	Nozzle A through Rigid jumper to Nozzle G into Tank 241-SY-102
Waste would then be pumped from 241-SY-102 to 241-AP-108 per Appendix A route.	

Annulus Pumping Riser Availability

Annulus Pump Pit	Riser
241-AN-01B	12 inch
241-AN-02B	12 inch
241-AN-03B	12 inch
241-AN-04B	12 inch
241-AN-05B	12 inch
241-AN-06B	12 inch
241-AN-07B	12 inch
241-AP-01B	12 inch
241-AP-02B	12 inch
241-AP-03B	12 inch
241-AP-04B	12 inch
241-AP-05B	12 inch
241-AP-06B	12 inch
241-AP-07B	12 inch
241-AP-08B	12 inch
241-AW-01B	12 inch
241-AW-02B	12 inch
241-AW-03B	12 inch
241-AW-04B	12 inch
241-AW-05B	12 inch
241-AW-06B	12 inch
241-AY-01F	12 inch
241-AY-02F	12 inch
241-AZ-01F	12 inch
241-AZ-02F	12 inch
241-SY-01B	12 inch
241-SY-02B	12 inch
241-SY-03B	12 inch

APPENDIX F

APPLICABLE ANNULUS EQUIPMENT

APPENDIX F

FLEX JUMPERS FOR ANNULUS PUMPING

Jumper Identification	Drawing	Quantity	Location
9900-4254-2001 (599325)	H-2-92058 SH. 1	3	2101-M: E-B-P-G03C/G05C/G05D
9900-4254-2002 (599326)	H-2-92058 SH. 5	2	2101-M: E-B-P-F06A
9900-4254-2003 (599327)	H-2-92058 SH. 9	1	2101-M: E-B-P-F06C

ANNULUS PUMPING EQUIPMENT

Equipment	Storage Location
Components for 2 Complete Jumpers	Trailer HO-64-07008
4 Submersible Pumps	Trailer HO-64-07008
2 Reciprocating Pumps	Trailer HO-64-07008
Components for Pump Assemblies	Trailer HO-64-07008
Skid for Air and Electrical	Trailer HO-64-07008