RMIS Viewprint Document Cover Sheet

This document was retrieved from the Records Management Information System (RMIS). It is intended for information only and may not be the most recent or updated version.

Accession #: **D5042811**

Document #: **SD-WM-OCD-015**

Title/Desc:
TANK FARMS WASTE TRANSFER COMPATIBILITY PROGRAM

Pages: **50**

S

CH2M HILL ENGINEERING CHANGE NOTICE

Page 1 of 3 ☒ DM ☐ FM ☐ TM

1a. **ECN** 721835 **R** 0

1b. **Proj. ECN** - - R

2. **Simple Modification** ☒ Yes ☐ No	3. **Design Inputs** – For full ECNs, record information on the ECN-1 Form (not required for Simple Modifications)		4. **Date** 5/25/04
5. **Originator's Name, Organization, MSIN, & Phone No.** M.A. Knight, Engineering Standards, R1-14, 373-1199		6. **USQ Number** **No.** TF-04-0235-D Rev.5 ☐ **N/A** ☐ **Refer to Work Package**	7. **Related ECNs** N/A
8. **Title** Tank Farms Waste Transfer Compatibility Program Revision for AY farm time to LFL	9. **Bldg. / Facility No.** N/A	10. **Equipment / Component ID** N/A	11. **Approval Designator** E
12. **Engineering Documents/Drawings to be Changed** (Incl. Sheet & Rev. Nos.) HNF-SD-WM-OCD-015, Rev.11		13. **Safety Designation** ☐ SC ☐ SS ☐ GS ☒ N/A	14. **Expedited/Off-Shift ECN?** ☐ Yes ☒ No
15a. **Work Package Number** N/A	15b. **Modification Work Completed** N/A Responsible Engineer / Date	15c. **Restored to Original Status (TM)** N/A Responsible Engineer / Date	16. **Fabrication Support ECN?** ☐ Yes ☒ No

17. **Description of the Change** (Use ECN Continuation pages as needed)

The following change is made by this ECN to HNF-SD-WM-OCD-015, Rev.11, *Tank Farms Waste Transfer Compatibility Program* :

Page 10 .Section 3.1.2.1. Changed the minimum time for the flammable gas concentration to increase by 25% of the LFL in tanks 241-AY-101 and 241-AY-102 from ≥ 8 days to ≥ 6 days.

Page 11. Sections 3.1.2.2 and 3.1.2.3. Added requirement for evaluation of SST time to LFL and SST Waste group re-evaluation following waste transfers into an SST to match requirements in HNF-IP-1266, Section 5.10. Noted that these evaluations are included in the process control plan for those activities and not normally in the waste compatibility assessment.

A minor change to the compatibility DQO will be required due to this change, which will be completed in Revision 1 to this ECN or via a separate document change request. This change is to be processed as a simple modification and does not involve rework.

18. **Justification of the Change** (Use ECN Continuation pages as needed)
The change is an approved safety basis amendment to revise the surveillance requirements in AY tank farms based on a re-evaluation of the anticipated time to reach 25% of the LFL. Approval of the safety basis amendment was granted in the letter from R.J. Schepens/ORP to E.S. Aromi/CH2M, DOE-ORP: 04-TED-034, "Contract No. DE-AC27-99RL14047 - Approval of the Tank Farms Safety Basis Amendment - 005 (To Change Surveillance Times in the AY Tank Farm)," dated April 29, 2004.

19. **ECN Category**
☒ **Direct Revision**
☐ **Supplemental**
☐ **Void/Cancel**
ECN Type
☐ **Supercedure**
☐ **Revision**

20. **Distribution**

Name	MSIN	Name	MSIN
See document distribution sheet			

Release Stamp

MAY 27 2004
DATE:
HANFORD RELEASE
STA: 4
ID: 8

CH2M HILL ENGINEERING CHANGE NOTICE	1a. ECN 721835 R 0
Page 2 of 3 ☒ DM ☐ FM ☐ TM	1b. Proj. ECN - - R

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

See Continuation Sheet, page 3, for description of revisions planned.

Note: All revisions shall have the approvals of the affected organizations as identified in block 11 "Approval Designator," on page 1 of this ECN.

22. Design Basis Documents

☐ Yes ☒ No

23. Commercial Grade Item Dedication Numbers (associated with this design change)

N/A

24. Engineering Data Transmittal Numbers (associated with this design change, e.g., new drawings, new documents)

N/A

25. Other Non Engineering (not in HDCS)documents that need to be modified due to this change

Type of Document	Document Number	Type of Document	Document Number
Environmental Permit Application	DOE/RL-90-39, Rev. 0b		

26. Field Change Notice(s) Used?

☐ Yes ☒ No

If Yes, Record Information on the ECN-2 Form, attach form(s), include a description of the interim resolution on ECN Page 1, block 17, and identify permanent changes.

NOTE: ECNs are required to record and approve all FCNs issued. If the FCNs have not changed the original design media then they are just incorporated into the design media via an ECN. If the FCN did change the original design media then the ECN will include the necessary engineering changes to the original design media.

27. Design Verification Required?

☐ Yes ☒ No

If Yes, as a minimum attach the one page checklist from TFC-ENG-DESIGN-P-17.

28. Approvals

Facility/Project Signatures		Date	A/E Signatures	Date
Design Authority			Originator/Design Agent	
Resp. Engineer	M.A. Knight	5/25/04	Professional Engineer	
Resp. Manager	M.A. Fish	5/25/04	Project Engineer	
Quality Assurance			Quality Assurance	
IS&H Engineer			Safety	
NS&L Engineer			Designer	
Environ. Engineer	P. Miller	5/26/04	Environ. Engineer	
Engineering Checker	J.A. Lechelt	5/25/04	Other	
Other	T.M. Horner	5/26/04	Other	
Other			DEPARTMENT OF ENERGY / OFFICE OF RIVER PROTECTION	
Other			Signature or a Control Number that tracks the Approval Signature	
Other				
Other			ADDITIONAL SIGNATURES	
Other				

Continued from Block 21. Revisions Planned.

The following revisions are planned to this ECN.

The criteria contained in HNF-SD-WM-OCD-015 which is revised by this ECN are reflected in the *Data Quality Objectives for Tank Farms Waste Compatibility Program*, HNF-SD-WM-DQO-001, which also requires revision to reflect the changes to the program. HNF-SD-WM-DQO-001, Rev. 10, will be revised in the next revision to this ECN or may be released using a separate Document Change Request.

Since HNF-SD-WM-DQO-001 is included as an appendix to the *Double-Shell Tank System Waste Analysis Plan*, HNF-SD-WM-EV-053, that document also requires revision to reflect these changes. HNF-SD-WM-EV-053, *Double-Shell Tank System Waste Analysis Plan,* will be revised using a revision to this ECN or using a separate Document Change Request to include HNF-SD-WM-DQO-001, Rev. 9, when prepared, as an appendix to the document.

HNF-SD-WM-EV-053 is included as part of the Hanford Facility Dangerous Waste Permit Application Double-Shell Tank System, DOE/RL-90-39, Rev. 0b, which may also require revision to reflect the revised document.

Note: Since the Hanford Facility Dangerous Waste Permit Application Double-Shell Tank System, DOE/RL-90-39, Rev. 0b, is a non-engineering document, its revision, if necessary, will be handled outside the ECN process.

Note: An AutoCAD page may be used in place of this form (the header section items must be included on the AutoCAD page).

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	Engineering Standards	Date 5/25/04
Project Title/Work Order		EDT No. N/A
HNF-SD-WM-OCD-015, Rev.12, "Tank Farms Waste Transfer Compatibility Program"		ECN No. 721835 R0

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
CH2M HILL Hanford Group, Inc.					
D.L. Banning	R2-12	x			
P.J. Certa	R2-12	x			
C. Defigh-Price	R2-58	x			
K.D. Fowler	S5-08	x			
J.M. Grigsby	S7-90	x			
T.M. Horner	S5-08	x			
T.A. Hu	S5-08	x			
J. Jo	S5-08	x			
N.W. Kirch	R2-58	x			
M.A. Knight	R1-14	x			
J.A. Lechelt	S5-08	x			
S.M. Mackay	R2-58	x			
J.E. Meacham	R2-58	x			
P.C. Miller	R1-51	x			
T.C. Oten	S5-07	x			
M.J. Sutey	S7-24	x			
T.A. Wooley	H6-03	x			
R.S. Popielarczyk	R2-58	x			
V.S. Toole	S5-08	x			
T.M. Blaak	S5-08	x			
^CH2M EQRG	R1-14	x			
TCSRC	R1-10	H			
D.J. Washenfelder	H6-03	x			

Tank Farms Waste Transfer Compatibility Program

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

EDT/ECN: 721835 R0 UC: 2070
Cost Center: 7G110 Charge Code: 113710
B&R Code: EW3120074 Total Pages: 46

Key Words: Waste, Transfer, Compatibility

Abstract:
This document specifies decision rules relating to waste transfers within the Hanford Site Double-Shell Tank (DST) Farm System, to waste and chemical additions to the DST System. It defines consistent means of applying safety, operational, regulatory, and programmatic criteria and specifies considerations necessary to assess waste transfers and chemical additions.

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

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

MAY 27 2004
DATE:
HANFORD RELEASE
STA: 4
ID: 8

Leann Tot 5-27-04
Release Approval Date

Release Stamp

Approved For Public Release

RECORD OF REVISION	(1) Document Number HNF-SD-WM-OCD-015	Page A

(2) Title
Tank Farms Waste Transfer Compatibility Program

Change Control Record

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) EDT - 131532	NA	NA
1	Total revision per ECN - 623160	K.D.Fowler	W.B.Barton
2	Total revision per ECN - 653238	K.D.Fowler	N.W.Kirch
3	Total revision per ECN - 657005	K.D.Fowler	N.W.Kirch
3a	Replace pages 20, 25, A-2 and A-3	K.D.Fowler	N.W.Kirch
4	Total revision per ECN - 667137	K.D. Fowler	M.A. Knight
4A	Page Change incorportes pH control per ECN - 657004	K.D. Fowler	M.A. Knight
4B	Page change to update PCB detection limit per ECN-657011	K.D. Fowler	M.A. Knight
4C	Correct reference and revise TFRG applicability per ECN-657008	K.D. Fowler	M.A. Knight
4D	Remove System Engineering review/approval requirement per ECN-672501	K.D. Fowler	M.A. Knight
5	Incorporated per ECN - 720248	K.D. Fowler	M.A. Knight
6	Removed criteria for AWF Waste Chemistry, DCRT Corrosion Control, Waste Envelope, and Waste		
	Segregation. Created separate compliance tables for intra-tank farm transfers and transfers from		
	external waste generators per ECN 720916 R0	M.A. Knight	M.A. Fish
7	Total revision to align with Documented Safety Analysis per ECN 720916 R1	M.A. Knight	M.A. Fish
8	Added requirements from JCO for SY-102 per ECN 721230 R0	M.A. Knight	M.A. Fish
9	Revised phosphate waste rule and line plugging criteria per ECN - 721462 R0	M.A. Knight	M.A. Fish
10	Revised waste feed delivery configuration control criteria per ECN 721517 R0	M.A. Knight	M.A. Fish
10A	Clarified water addition exemption and corrected feed control list per ECN 721517 R2	M.A. Knight	M.A. Fish
11	Clarified TRU Waste Segregation Control, Issue 6, Control 2, in Feed Control List per ECN 721517 R3	M.A. Knight	M.A. Fish
R8 12	Revised time to LFL for AY tank farm. Added time to LFL and waste group re-evaluation for SST	M.A. Knight	M.A. Fish 5/25/04
	Waste Transfers Per ECN 721835 R0		

HNF-SD-WM-OCD-015
Rev. 12

TANK FARM WASTE TRANSFER COMPATIBILITY PROGRAM

M.A. Knight
CH2M HILL Hanford Group, Inc.

Date Published
May 2004

CH2MHILL
Hanford Group, Inc.

Prepared for the U.S. Department of Energy
Office of River Protection

Approved for public release; distribution unlimited

TABLE OF CONTENTS

1.0 INTRODUCTION 5
1.1 SCOPE 5
1.1.1 SCOPE OF DECISION RULES 5
1.1.2 SCOPE OF TRANSFERS 6
1.1.3 EXEMPTIONS 7

2.0 REQUIREMENTS 8
2.1 DOCUMENTATION REQUIREMENTS 8
2.2 DATA REQUIREMENTS 8
2.3 WASTE TRANSFERS FROM NON-TANK FARM FACILITIES 8

3.0 DECISION RULES 9
3.1 TANK FARMS ADMINISTRATIVE CONTROL DECISION RULES 9
3.1.1 AC 5.9, SOURCE TERM CONTROLS 9
3.1.2 AC 5.10, FLAMMABLE GAS CONTROLS 10
3.1.3 AC 5.11, TRANSFER CONTROLS 13
3.1.4 AC 5.16, CORROSION MITIGATION PROGRAM 14
3.2 242-A ADMINISTRATIVE CONTROL DECISION RULES 16
3.2.1 AC 5.6.1.5, NUCLEAR CRITICALITY SAFETY 16
3.2.2 AC 5.6.1.6, EVAPORATOR FEED VERIFICATION 17
3.3 SAFETY DECISION RULES 18
3.3.1 CRITICALITY SAFETY CONTROL 18
3.3.2 ORGANICS/ENERGETIC REACTIONS 20
3.3.3 CORROSION PREVENTION CONTROLS 21
3.4 REGULATORY DECISION RULES 22
3.4.1 WASTE ANALYSIS PLAN REQUIREMENTS 22
3.4.2 PCB MANAGEMENT 25
3.5 PROGRAMMATIC DECISION RULES 26
3.5.1 WASTE FEED DELIVERY CONFIGURATION CONTROL 26
3.6 OPERATIONAL DECISION RULES 28
3.6.1 PHOSPHATE WASTE 28
3.6.2 LINE PLUGGING 29

4.0 REFERENCES 31

APPENDICIES

A - WASTE FEED DELIVERY CONTROL SUITE AND CONTROL SUITE CHANGE PROCESS A-1

LIST OF TABLES

Table 3-1. Bounding ULD (Sv/L) 9

Table 3-2. Bounding (TEEL-3) SOFs for Toxic Chemical Evaluation 10

Table 3-3. DST Waste Chemistry Limits 15

Table 3-4. Pu-Equivalent Inventory Limits 18

Table 3-5. Criticality Limits for Transfers from Non-Tank Farms Facilities. 19

Table 3-6. Minimum Absorber/Pu Mass Ratios 19

Table 3-7. Chemical and Water Addition Limits 20

Table 3-8. DCRT Waste Chemistry Limits 22

Table 3-9. Waste Reactivity Group Compatibility Matrix 24

Table 3-10. Notifications and Approvals for Non-Conforming Transfers 28

Table A-1. Feed Control List A-5

LIST OF FIGURES

Figure A-1. Levels of Control A-3

Figure A-2. Waste Feed Control Evaluation and Notification Pathway A-4

LIST OF TERMS

AC	Administrative Control
BBI	Best Basis Inventory
Btu/hr	British thermal units per hour
CFR	Code of Federal Regulations
CPS	Criticality Prevention Specification
CSER	Criticality Safety Evaluation Report (RPP-7475)
CSR	Criticality Safety Representative
DCRT	double-contained receiver tank
DSA	Documented Safety Analysis
DST	double-shell tank
EPA	U.S. Environmental Protection Agency
g	grams
g/L	grams per liter
in.	inches
kg	kilograms
LFL	lower flammability limit
M	molarity or moles per liter
NCRW	neutralized cladding removal waste
ORP	U.S. Department of Energy, Office of River Protection
PCB	polychlorinated biphenyl
ppm	parts per million
SOF	Sum of Fractions
SpG	specific gravity
SST	single-shell tank
Sv/L	Sievert per liter
TEEL	temporary emergency exposure limit
TFC	Tank Farm Contractor
TSCA	*Toxic Substance Control Act*
TSR	Technical Safety Requirement
ULD	unit liter dose
WAP	Double-Shell Tank Waste Analysis Plan (HNF-SD-WM-EV-053)
WCA	waste compatibility assessment
WSPS	Waste Stream Profile Sheet
wt%	weight percent
°F	degrees Fahrenheit

1.0 INTRODUCTION

Mixed wastes are stored at the Hanford Site on an interim basis until they can be treated, as necessary, for final disposal. The Tank Farm Waste Transfer Compatibility Program is implemented to help ensure continued safe and prudent storage and handling of these wastes within the Tank Farms Facility.

The Tank Farms Waste Transfer Compatibility Program is a Safety Management Program described in the *Tank Farms Documented Safety Analysis* (DSA), RPP-13033, Chapter 17.0, and provides a formal process for determining waste compatibility through the preparation of documented Waste Compatibility Assessments for waste transfers. The primary purpose of the program is to ensure that sufficient controls are in place to prevent the formation of incompatible mixtures during waste transfer operations. The program defines a consistent means of evaluating compliance with certain Administrative Controls, safety, operational, regulatory, and programmatic criteria and specifies considerations necessary to assess waste transfers and chemical additions.

1.1 SCOPE

1.1.1 SCOPE OF DECISION RULES

This document describes decision rules relating to waste transfers within the Hanford Site Double-Shell Tank (DST) Farm System and to waste and chemical additions to the DST System. Only requirements and limits affected by the transfer or receipt of waste or chemicals are addressed.

Requirements for tank piping, leak detection, ventilation systems, effluent emission limits, concrete temperature limits, and physical system requirements for waste transfer (e.g., transfer routing, line testing, etc.) are outside the scope of this document. These systems and limits are evaluated using other administrative procedures and control documents.

In general, the decision rules for DSTs apply to all of the DSTs. The only exception is where a certain tank(s), is (are) specifically excluded, or a separate decision rule governing the same parameter(s) is given for a specific tank(s).

The decision rules contained in this document are divided into the following categories:

- Tank Farms Administrative Controls,
- 242-A Evaporator Administrative Controls,
- Safety,
- Regulatory,
- Programmatic, and
- Operational.

The Tank Farms Administrative Control (AC) decision rules implement specific aspects of the following ACs:

- AC 5.9, "Source Term Controls,"
- AC 5.10, "Flammable Gas Controls,"
- AC 5.11, "Transfer Controls," and
- AC 5.16, "Corrosion Mitigation Program."

The 242-A Evaporator Administrative Control decision rules implement the following ACs:

- AC 5.6.1.5, "Nuclear Criticality Safety," and
- AC 5.6.1.6, "Evaporator Feed Verification."

The safety decision rules include:

- Criticality Safety,
- Organic/Energetic Reactions, and
- Corrosion Prevention.

The regulatory decision rules include requirements from the *Double-Shell Tank Waste Analysis Plan*, HNF-SD-WM-EV-053,-including:

- Waste Stream Profile Sheet,
- Chemical Compatibility, and
- PCB Management.

Programmatic decision rules include:

- Waste Feed Delivery Configuration Control

Operational Decision Rules include:

- Phosphate Waste, and
- Line Plugging.

For each decision rule in this document, the 'Basis' section(s) contains the technical basis for the rule(s), or the reference document(s) that contains the technical basis for the rule(s).

1.1.2 SCOPE OF TRANSFERS

The decision rules of this document apply to all liquid and solid phase waste transfers except as specified in Section 1.1.3 (Exemptions) of this document. The operations encompassed include:

1. combining the wastes within the DST System,
2. transferring waste between the tanks and the 242-A Evaporator,

3. receiving waste from Tank Farms facilities outside of the DST System,
4. receiving waste from non-Tank Farms Facilities, and
5. adding bulk chemicals to the DST system.

1.1.3 EXEMPTIONS

Certain additions to tanks are unlikely to cause any waste compatibility problems. These types of addition may occur on a regular basis and conducting waste compatibility assessments each time is neither feasible nor technically justified.

Therefore, the following types of additions to DSTs are exempt from waste compatibility assessments when originating within the Tank Farm Contractor (TFC) facilities or the 242-A Evaporator:

- Less than 10,000 gallons of potentially contaminated water (e.g., process condensate from tanks on active ventilation, cooling water, rain water, snow melt, pipeline flush water, line drainbacks, pipeline pressure test water, de-entrainer flush water, airlift circulator flush water, 242-A Evaporator process condensate and water/flush water in the evaporator vessel) with no chemicals added except for those used for tank corrosion control (i.e., sodium hydroxide and sodium nitrite).

- Small volumes (< 5 gallons) of non-waste liquids with pH $\geq$ 7 added for a useful purpose such as cleaners, lubricants, and decontaminants.

- Previously evaluated fixatives listed in TFC-ESHQ-RP_RWP-C-03, *ALARA Work Planning*,

- Saltwater used for conductivity testing.

- Small volumes (i.e., $\leq$ 0.25% of the existing receiver tank waste volume) of essentially organic-free aqueous Tank Farm facility waste containing only any of the major inorganic sodium salts (i.e., aluminate, nitrate, nitrite, carbonate, sulfate, phosphate, fluoride, and chloride), sodium hydroxide, trace metals, or radionuclides.

- Small water volumes (<500 gallons) such as used for Enraf[1]™ flushes, sample rinses, etc.

- Water additions of up to 10,000 gallons to any DST that were previously evaluated for a transfer under Revision 7 or later revision of the compatibility program.

---

[1] Enraf is a trademark of Enraf-Nonius, Inc., Houston, Texas

2.0 REQUIREMENTS

2.1 DOCUMENTATION REQUIREMENTS

Prior to acceptance of a waste transfer or chemical addition, the proposed transfer or addition shall be evaluated to ensure that the transfer will comply with the decision rules as specified in this document. The evaluation is documented in a Waste Compatibility Assessment (WCA) prepared and formatted in accordance with TFC-ENG-CHEM-P-13, *Tank Waste Compatibility Assessments*.

A summary of the compliance status of the proposed transfer against each decision rule is provided in a Compliance Table included in the assessment.

2.2 DATA REQUIREMENTS

The data required to evaluate waste compatibility are discussed in *Data Quality Objectives for Tank Farms Waste Compatibility Program*, HNF-SD-WM-DQO-001. Table 4-1 of that document provides the analytes that are required for evaluation of the various types of transfer. The data used for a specific assessment may be taken from a variety of sources including the Best Basis Inventory (BBI), laboratory testing, sample analysis not yet included in the BBI, or other waste compatibility assessments. Where insufficient data are available to provide an adequate representation of the waste, sampling and analysis in accordance with HNF-SD-WM-DQO-001 shall be requested prior to transfer.

2.3 WASTE TRANSFERS FROM NON-TANK FARM FACILITIES

In order to meet tank farms acceptance requirements, non-tank farm waste generators must meet requirements specified in the current revision of RPP-10726, *Requirements for Discharge from Non-Tank Farm Waste Generators into the DST System*. This document includes sampling and analysis requirements from the latest revision of *Data Quality Objectives for Tank Farms Waste Compatibility Program*, HNF-SD-WM-DQO-001, and documentation requirements from the latest revision of *Double-Shell Tank Waste Analysis Plan*, HNF-SD-WM-EV-053.

For waste transfers from non-Tank Farm facilities into the DST system, pre-transfer requirements listed in the Waste Compatibility Assessment must be dispositioned by the responsible actionee(s) and verified by Engineering prior to transfer. Verification is documented via signature on the transfer control checklist of the transfer procedure.

Some requirements cannot be verified prior to transfer. Post-transfer requirements, requirements that describe how the transfer is to be carried out, and requirements contingent upon verification of other requirements do not require verification prior to transfer.

3.0 DECISION RULES

3.1 TANK FARMS ADMINISTRATIVE CONTROL DECISION RULES

The Tank Farms Waste Transfer Compatibility Program implements specific requirements of the *Tank Farms Technical Safety Requirements* (TSR), HNF-SD-WM-TSR-006, Administrative Controls (AC), as described in HNF-IP-1266, *Tank Farm Operations Administrative Controls*. The specific requirements implemented by this program are described in the following sections.

3.1.1 AC 5.9, SOURCE TERM CONTROLS

This program meets the requirements for evaluation of radiological and toxicological source term for wastes transferred from non-tank farm waste generators.

These requirements do not apply to slurry returned to the tank farms from the 242-A Evaporator.

3.1.1.1 Radiological Unit Liter Dose Evaluation

Information provided by the non-tank farm generators shall be evaluated to verify that the radiological unit liter doses (ULD) of newly generated waste are bounded by the source term assumptions used in the DSA. This verification is performed by evaluating ^{90}Sr, ^{137}Cs, and gross alpha using the methodology described in HNF-IP-1266, Section 5.9, "Source Term Controls," and comparing the total calculated onsite and offsite ULDs to the bounding ULDs for DST Liquids and DST Solids provided in Table 3-1.

Table 3-1. Bounding ULD (Sv/L)

Waste	On-Site Receptor	Off-Site Receptor
DST Liquids	1.0E+03	1.5E+03
DST Solids	1.9E+05	2.9E+05

3.1.1.2 Toxic Chemical Sum-of-Fractions Evaluation

Information provided by non-tank farm waste generators shall be evaluated to verify that the toxicological sum-of-fractions (SOF) of newly generated waste are bounded by the source term assumptions used in the DSA. This evaluation is performed using the methodology described in HNF-IP-1266, Section 5.9, "Source Term Controls," and comparing the calculated total SOF for the liquid and solids phases of the waste stream to the bounding SOFs provided in Table 3-2.

Table 3-2. Bounding (TEEL-3) SOFs for Toxic Chemical Evaluation

Waste	SOF
DST Liquids	1.16E+07
DST Solids	8.06E+07

Note: SOF Sum of Fractions
TEEL temporary emergency exposure limit

3.1.1.3 Basis

The bases for the waste source term controls are documented in HNF-IP-1266, Chapter 5.9, "Source Term Controls."

3.1.2 AC 5.10, FLAMMABLE GAS CONTROLS

This program meets the requirements for the flammable gas controls associated with evaluating the time to lower flammability limit (LFL) for transfers and additions into the DSTs and for re-evaluating the Waste Group of the receiving tank prior to transfers and additions.

3.1.2.1 DST Time to LFL Determination

HNF-IP-1266, Section 5.10,"Flammable Gas Controls" requires that the end state of the receiving DST be evaluated to verify that the minimum time for the flammable gas concentration to increase by 25% of the LFL in the tank headspace remains:

- $\geq$ 6 days for tanks 241-AY-101 and 241-AY-102, and
- $\geq$ 13 days for all other DSTs.

Using the methodology in RPP-5926, *Steady-State Flammable Gas Release Rate Calculation and Lower Flammability Level Evaluation for Hanford Tank Waste*, prior to the following operations:

- Planned waste transfers into DSTs (receiving tank).
- Large water additions (>10,000 gallons) to DSTs.
- Large chemical additions (>10,000 gallons of sodium hydroxide and sodium nitrite) required to manage the DST waste chemistry.

The verification shall assume (1) zero ventilation, (2) the addition of 10,000 gallons of water, and (3) a bulk waste temperature increase of 9 °F subsequent to the operation.

Note: The time to increase by 25% of the LFL is determined by calculating the time to increase from zero to 25% of the LFL using the methodology of RPP-5926.

3.1.2.2 SST Time to LFL Determination

HNF-IP-1266, Section 5.10, requires that prior to (a) waste additions to single-shell tanks (SST), or (b) large water additions to SSTs (>10,000 gallons in 100-series SSTs or 1,000 gallons in 200-series SSTs), Engineering verify that the minimum time for the flammable gas concentration to increase by 25% of the LFL in the tank headspace remains ≥ than the surveillance frequencies in Table 3.2.2-1 of LCO 3.2.2 "SST Passive Ventilation Systems," using the methodology in RPP-5926. The verification shall assume (1) zero ventilation, and (2) the addition of 10,000 gallons of water (100-series SSTs) or 1,000 gallons of water (200-series SSTs).

Note: Because the focus of the WCA is on transfers to DSTs and the evaluation of large water additions to SSTs requires knowledge of the dissolution properties of the SST solids, this evaluation will not normally be conducted as part of the WCA but rather will be addressed as part of flowsheet development for SST retrieval projects and included in the Process Control Plan for those projects.

3.1.2.3 Waste Group Re-evaluation Requirements

HNF-IP-1266, Section 5.10, requires that the final state (Waste Group) of the receiving tank be evaluated using the methodology described in RPP-10006 prior to the following operations:

a. Waste transfers into DSTs that are Waste Group B and C (receiving tank).
b. WASTE additions to SSTs that are either WASTE Group B or WASTE Group C
c. Large water additions (>10,000 gallons) to DSTs that are Waste Group C.
d. Large water additions (>10,000 gallons) to SSTs that are Waste Group B and C.
e. Large chemical additions (>10,000 gallons of sodium hydroxide or sodium nitrite) to DSTs that are Waste Group B and C.

Note: Because the focus of the WCA is on transfers to DSTs and the evaluation of waste additions and large water additions to SSTs requires knowledge of the dissolution properties of the SST solids, items b) and d) will not normally be evaluated as part of the WCA but rather will be addressed as part of flowsheet development for SST retrieval projects and included in the Process Control Plan for those projects.

The requirements section of the WCA shall identify the re-evaluated Waste Group of the receiving tank following the transfer and the applicable Ignition Control set to be applied to the tank, so that the controls applicable to the new Waste Group designation can be applied to the tank during and after the operation.

Based on the re-evaluation, Engineering shall notify Nuclear Safety and Licensing of the need to update Table 5.10-1 [of HNF-IP-1266, Section 5.10] and the Senior Shift Manager. If the actual operation deviates from the evaluated operation, Engineering and Nuclear Safety and Licensing

shall ensure that Table 5.10-1 reflects the actual condition of the receiving tank.

3.1.2.4 Waste Group Prohibitions

Operations that would result in re-designation of a Waste Group B or C tank as a Waste Group A tank are prohibited without prior written approval from the U.S. Department of Energy, Office of River Protection (ORP) manager.

3.1.2.5 Basis

The basis for the time to LFL determination, Waste Group re-evaluation, and Waste Group Prohibition are documented in HNF-IP-1266, Chapter 5.10, "Flammable Gas Controls."

3.1.3 AC 5.11, TRANSFER CONTROLS

TSR Key element 5.11.2.c, End State Analysis, includes the following requirement:

1. Evaluate receiving DSTs prior to waste transfers to verify final waste conditions are bounded by approved DSA safety analyses.

This evaluation is primarily performed as part of AC 5.10 and AC 5.16. The following additional requirements are required by HNF-IP-1266, Section 5.11, "Transfer Controls."

3.1.3.1 Insoluble Solids Content

Transferring waste with an insoluble solids content >25% by volume [in the source waste] is prohibited unless an evaluation is performed to determine that the proposed transfer is within the analyzed safety basis. This control protects an assumption in the waste transfer leak accident analysis. The insoluble solids content of the source waste shall be evaluated for compliance with this limit.

3.1.3.2 Tank Bump Controls

Prior to waste transfers into DSTs, Engineering shall evaluate the end state of the receiving tank to verify that at least one of the following criteria is met.

a. Total tank heat load is $\leq$ 38,000 Btu/hr

OR b. Non-convective layer thickness is $\leq$ 12 in.

OR c. Supernatant depth is $\leq$ 40 in.

OR d. The non-condensable gas generation rate in the non-convective layer is sufficiently low, such that the ratio of vertical void fraction profile to the neutral buoyant void fraction is < 1.0 (RPP-6213, Addendum 1, Table 4-2).

If none of the criteria are met, then the waste transfer into the receiving DST is prohibited. The first three criteria will be evaluated automatically as part of the WCA. If the first three criteria are not met, then further evaluation of criteria d will be undertaken.

3.1.3.3 Basis

The evaluation protects the DSA assumption that tank bump is not a credible accident. (See RPP-6213, *Hanford Waste Tank Bump Accident and Consequence Analysis*, and RPP-13438, *Technical Basis for Tank Bump Representative Accident and Associated Hazardous Conditions*).

The basis for the requirements for insoluble solids content and tank bump are provided in HNF-IP-1266, Section 5.11, "Transfer Controls."

3.1.4 AC 5.16, CORROSION MITIGATION PROGRAM

This program meets the requirements that the final state of source and receiver DSTs must be evaluated for compliance with tank chemistry controls. If a DST is identified to be outside of tank chemistry control limits, Recovery Actions as specified in AC 5.16 must be followed.

3.1.4.1 DST Waste Chemistry Controls

The receipt or transfer of waste that does not meet chemistry control limits can occur only if the receiving DST will remain within specification limits after the transfer or as part of actions for the mitigation of out-of-specification waste.

The evaluation that the final state of the source and receiver DSTs meet the chemistry control limits shall include an assumption of a water addition of 10,000 gallons to allow for line flushes and equipment rinses.

Waste transferred from a non-tank farm waste generator through a double-contained receiver tank (DCRT) (222-S Laboratory and Plutonium Finishing Plant) shall be adjusted to meet the DST waste chemistry specifications PRIOR to transfer. The DCRTs have corrosion chemistry limits that are the same as the DST chemistry limits.

Pumping of an SST whose contents do not meet corrosion prevention specification limits is permitted provided that the bulk composition of the receiving DST remains within waste chemistry control limits following the transfer. Necessary chemical additions, if any, must be made to ensure the receiving DST is maintained within tank waste chemistry limits.

No waste transfer shall make an in-specification DST out-of-specification.

DST waste chemistry limits are given in Table 3-3.

Table 3-3. DST Waste Chemistry Limits.

FOR $[NO_3^-]$ RANGE	VARIABLE	FOR WASTE TEMPERATURE (T) RANGE		
		T < 167 °F	167 °F ≤ T ≤ 212 °F	T > 212 °F
$[NO_3^-] \leq 1.0\underline{M}$	$[OH^-]$	$0.010\underline{M} \leq [OH^-] \leq 8.0\underline{M}$	$0.010\underline{M} \leq [OH^-] \leq 5.0\underline{M}$	$0.010\underline{M} \leq [OH^-] < 4.0\underline{M}$
	$[NO_2^-]$	$0.011\underline{M} \leq [NO_2^-] \leq 5.5\underline{M}$	$0.011\underline{M} \leq [NO_2^-] \leq 5.5\underline{M}$	$0.011\underline{M} \leq [NO_2^-] \leq 5.5\underline{M}$
	$[NO_3^-] / ([OH^-] + [NO_2^-])$	< 2.5	< 2.5	< 2.5
$1.0\underline{M} < [NO_3^-] \leq 3.0\underline{M}$	$[OH^-]$	$0.1\ ([NO_3^-]) \leq [OH^-] < 10\underline{M}$	$0.1\ ([NO_3^-]) \leq [OH^-] < 10\underline{M}$	$0.1\ ([NO_3^-]) \leq [OH^-] < 4.0\underline{M}$
	$[OH^-] + [NO_2^-]$	$\geq 0.4\ ([NO_3^-])$	$\geq 0.4\ ([NO_3^-])$	$\geq 0.4\ ([NO_3^-])$
$[NO_3^-] > 3.0\underline{M}$	$[OH^-]$	$0.3\underline{M} \leq [OH^-] < 10\underline{M}$	$0.3\underline{M} \leq [OH^-] < 10\underline{M}$	$0.3\underline{M} \leq [OH^-] < 4.0\underline{M}$
	$[OH^-] + [NO_2^-]$	$\geq 1.2\underline{M}$	$\geq 1.2\underline{M}$	$\geq 1.2\underline{M}$
	$[NO_3^-]$	$\leq 5.5\underline{M}$	$\leq 5.5\underline{M}$	$\leq 5.5\underline{M}$

3.1.4.2 Justification for Continued Operation of DST 241-SY-102

ORP has approved a Justification for Continued Operation (JCO) to allow operation of DST 241-SY-102 while in an out-of-specification condition with the WASTE chemistry limits of Table 3-3 (ORP 2003). The out-of-specification condition will be allowed for a period not to exceed 12 months to support planned WASTE transfers from 200 West Area storage facilities into DST 241-SY-102.

For transfers into tank 241-SY-102 only, the waste compatibility assessment shall evaluate the final state of the waste in tank 241-SY-102 to verify compliance with the following compensatory measures specified in ORP (2003), in addition to the waste chemistry limits provided in Table 3-3.

- Supernatant pH $\geq$ 11, AND
- Supernatant temperature $\leq$ 122 °F, AND
- Total solids height $\leq$ 143 in.

If the waste compatibility assessment shows that the proposed transfer will cause the waste in tank 241-SY-102 to be out-of-specification with the waste chemistry limits of Table 3-3 but that the transfer complies with the compensatory measures specified above, then the transfer is allowed.

Transfers that would result in non-compliance with the limits of Table 3-3 and the above limits are prohibited.

The initial assessment that shows the final state of the waste in 241-SY-102 does not meet the limits of Table 3-3 but is in compliance with the compensatory measures will clearly state that the JCO will be entered at the start of the evaluated transfer.

3.1.4.3 Basis

The basis for tank waste chemistry controls is documented in HNF-IP-1266, Section 5.16, "Corrosion Mitigation Program," together with additional details of the JCO of DST 241-SY-102. The basis for the JCO is documented in CH2M HILL (2003) and ORP (2003).

3.2 242-A ADMINISTRATIVE CONTROL DECISION RULES

3.2.1 AC 5.6.1.5, NUCLEAR CRITICALITY SAFETY

Transfers involving waste staging for 242-A Evaporator feed shall meet the following limit and shall be based on laboratory analysis of the waste to be sent to the 242-A Evaporator:

Pu-equivalent concentration in feed:	< 0.005 g/L (0.019 g/gallons)

3.2.1.1 Basis

The basis for the nuclear criticality safety requirements are contained in the *242-A Evaporator Documented Safety Analysis*, Section 5.5.2.6 (HNF-14755). This administrative control ensures that feed introduced to the 242-A Evaporator is within the assumptions of *CSER-03-008, Criticality Safety Evaluation Report for the 242-A Evaporator Facility* (HNF-15000). This limit is also contained in *Criticality Safety Evaluation of Hanford Tank Farms Facility* (RPP-7475) and implemented in the *Criticality Prevention Specification* (CPS) for tank farm operations (CPS-T-149-00012). Other limits from the CPS, because they are not TSR limits are discussed under safety decision rules in Section 3.3.1.

3.2.2 AC 5.6.1.6, EVAPORATOR FEED VERIFICATION

Transfers involving waste staging for the 242-A Evaporator feed require verification based on laboratory analysis that the feed:

- contains no separable organics
- exotherm/endotherm < 1.

3.2.2.1 Basis

The basis for the feed verification requirements are contained in the *242-A Evaporator Documented Safety Analysis*, Section 5.5.2.5 (HNF-14755). Implementing the control elements listed above protects the assumptions in the DSA that no separable flammable or combustible organics are present in the feed. This reduces hazards to personnel and property from a fire. The controls will also limit property destruction, and minimize delays to important U.S. Department of Energy (DOE) programs as a result of fire damage.

3.3 SAFETY DECISION RULES

3.3.1 CRITICALITY SAFETY CONTROL

Criticality Safety is a Safety Management Program described in the DSA, Chapter 6.0 (RPP-13033). The program is defined and documented in RPP-14330, *Criticality Safety Manual.* The waste compatibility program ensures that the pH, the fissile material concentration, and the amount of insoluble neutron absorbers in waste receipts from facilities interfacing with the tank farm facilities are controlled to ensure the margin of subcriticality is maintained via the form and distribution of the wastes.

Nuclear criticality safety controls for Tank Farms are implemented in the CPS. Fissile materials of concern are ^{239}Pu, ^{233}U, and ^{235}U. Limits are stated for Pu-equivalents. Each gram of ^{235}U, each gram of ^{233}U, and each gram of ^{239}Pu shall be equivalent to one plutonium-equivalent gram unless otherwise restricted by a specification. To conservatively account for the potential presence of other fissile isotopes, the total amount of ^{239}Pu and ^{240}Pu (generally reported together as $^{239/240}$Pu) are treated as ^{239}Pu.

Under some conditions, ^{235}U may be excluded in accordance with the Tank Farms CPS. Exclusion of ^{235}U shall be on a case-by-case basis with approval of the Tank Farms Criticality Safety Representative (CSR)/Alternate.

Acceptance of waste streams where the ^{235}U enrichment is $\geq$ 1.03 wt% shall be evaluated on a case-by-case basis and must be approved by the Tank Farms CSR/Alternate. The evaluation shall determine if receipt and storage of the enriched uranium is within the current Tank Farms nuclear criticality safety basis.

3.3.1.1 Plutonium Inventory Limits

CSR/Alternate approval is required for waste transfers when the plutonium (Pu-equivalent) inventory of tanks exceeds or will exceed the limits provided in Table 3-4 below:

Table 3-4. Pu-Equivalent Inventory Limits

Tank	Limit (kg)
Double Contained Receiver Tank (DCRT)	2
Receiving DST	10

3.3.1.2 Transfers from Non-Tank Farm Facilities

Waste transfers into the DST system from non-Tank Farm facilities, other than the 242-A Evaporator, must comply with the following criticality prevention limits provided in Table 3-5 or a criticality safety evaluation must be completed documenting that the waste may be received and stored safely in the DST system.

Table 3-5. Criticality Limits for Transfers from Non-Tank Farms Facilities.

Criteria	Limit
Minimum pH of source waste:	≥ 8.0
Minimum pH of non-radioactive chemicals or water without written approval by CSR/Alternate:	≥ 7.0
Maximum Pu-equivalent concentration in source waste:	< 0.04 g/L.
Maximum Pu-equivalent concentration in source waste without considering absorber/Pu-equivalent ratio:	≤ 0.001 g/L
If the Pu-equivalent concentration > 0.001 g/L the absorber/Pu-equivalent mass ratio must be greater than at least one of the minimum values specified in Table 3-6.	
If the Pu content of a single waste batch exceeds 50 g, the sum of component subcritical mass fractions shall be ≥ 2.	

The sum of subcritical mass fractions is calculated by summing the division of the actual mass of absorber to fissile material to the subcritical mass of absorber.

i.e., [(Cr/Pu)actual/(Cr/Pu)subcritical] + [(Fe/Pu)actual/(Fe/Pu)subcritical)] + ... ≥ 2

Table 3-6. Minimum Absorber/Pu Mass Ratios

Neutron Absorber (X)	Minimum Neutron Absorber/Pu Subcritical Mass Ratio (X/Pu)
Iron (Fe)	160
Manganese (Mn)	32
Nickel (Ni)	105
Chromium (Cr)	135
Uranium (^{238}U)	770

Requirements in Table 3-5 do not apply to transfers made between Tank Farm facilities or to transfers from the 242-A Evaporator facility during an evaporation campaign.

3.3.1.3 Chemical and Water Additions

Non-radioactive chemical and water additions shall meet the limits of Table 3-7.

Table 3-7. Chemical and Water Addition Limits

Criteria	Limit
Minimum pH of non-radioactive chemicals or water without written approval by CSR/Alternate.	≥ 7.0

3.3.1.4 Basis

The basis for nuclear criticality safety limits and controls in Tank Farms is documented in RPP-7475, *Criticality Safety Evaluation of Hanford Tank Farms Facility* (CSER).

The composition of each waste stream entering the DST system is documented on a Waste Stream Profile Sheet (WSPS) as required by the DST Waste Analysis Plan (HNF-SD-WM-EV-053). The bounding values from the WSPS are used to assess waste compatibility. Prior to discharge into the DST system, each new or revised WSPS from non-Tank Farms waste generators is reviewed by the Tank Farms CSR/Alternate (see Section 3.3.1.1). The review is necessary to ensure that the bounding composition of the waste stream is/remains in compliance with the boundaries of the evaluation documented in the CSER (RPP-7475).

3.3.2 ORGANICS/ENERGETIC REACTIONS

3.3.2.1 Total Fuel Concentration

Waste with any net exotherm must be evaluated for safe storage before acceptance into or transfer within the DST system.

Waste designated as feed for the 242-A Evaporator shall exhibit no exotherms below 168°C.

3.3.2.2 Separable Organic Material

Separable organic waste shall require evaluation and approval on a case-by-case basis prior to acceptance for receipt into or transfer within the DST system. The evaluation shall determine whether the waste may be safely received and stored in the DST system, and other potential impacts to the DST system.

Written documentation of evaluations for the receipt of separable phase organic material into the DST System must be approved by Process/Waste Transfer Engineering, Environmental Services, and Nuclear Safety and Licensing.

3.3.2.3 Basis

The Basis for precluding the transfer of wastes with a net exotherm into the DST System is documented in HNF-SD-WM-DQO-001.

The basis for precluding transfer of waste displaying exothermic reactions below 168°C is provided in the *Hanford Facility RCRA Permit, Attachment 35, 242-A Evaporator, Waste Analysis Plan* (Ecology and EPA 1994).

If separable organics are allowed into underground storage tanks, there is a potential that organic vapors or distillates could accumulate in the tanks, in the overhead systems, or in condensate collection tanks. An organic liquid fire or vapor explosion could result from the accumulations.

3.3.3 CORROSION PREVENTION CONTROLS

3.3.3.1 DCRT Corrosion Prevention Controls

The receipt or transfer of waste that does not meet corrosion prevention specification limits can occur only if the receiving DCRT will remain within specification limits after the transfer or sufficient chemical adjustment is made to the DCRT contents such that the limits are met. Corrosion prevention limits for DCRTs are given in Table 3-8.

Pumping of an SST whose contents do not meet corrosion prevention specification limits is permitted if analytical results from samples of that SST are used to determine what chemical additions (if any) are necessary to maintain the receiving DCRT within corrosion prevention specification limits. Necessary chemical additions, if any, must be made to ensure the receiving DCRT is maintained within corrosion prevention limits.

3.3.3.2 Basis

The basis for the DCRT corrosion prevention specification limits is documented in OSD-T-151-00011, *Operating Specifications for the Active Double Contained Receiver Tanks*.

Table 3-8. DCRT Waste Chemistry Limits

FOR $[NO_3^-]$ RANGE	VARIABLE	FOR WASTE TEMPERATURE (T) RANGE	
		T < 167 °F	167 °F ≤ T ≤ 200 °F
$[NO_3^-] \leq 1.0\underline{M}$	$[OH^-]$	$0.01\ \underline{M} \leq [OH^-] \leq 8.0\underline{M}$	$0.01\ \underline{M} \leq [OH^-] \leq 5.0\underline{M}$
	$[NO_2^-]$	$0.011\underline{M} \leq [NO_2^-] \leq 5.5\underline{M}$	$0.011\underline{M} \leq [NO_2^-] \leq 5.5\underline{M}$
	$[NO_3^-] / ([OH^-] + [NO_2^-])$	< 2.5	< 2.5
$1.0\underline{M} < [NO_3^-] \leq 3.0\underline{M}$	$[OH^-]$	$0.1\ ([NO_3^-]) \leq [OH^-] < 10\underline{M}$	$0.1\ ([NO_3^-]) \leq [OH^-] < 10\underline{M}$
	$[OH^-] + [NO_2^-]$	$\geq 0.4\ ([NO_3^-])$	$\geq 0.4\ ([NO_3^-])$
$[NO_3^-] > 3.0\underline{M}$	$[OH^-]$	$0.3\underline{M} \leq [OH^-] < 10\underline{M}$	$0.3\underline{M} \leq [OH^-] < 10\underline{M}$
	$[OH^-] + [NO_2^-]$	$\geq 1.2\underline{M}$	$\geq 1.2\underline{M}$
	$[NO_3^-]$	$\leq 5.5\underline{M}$	$\leq 5.5\underline{M}$

3.4 REGULATORY DECISION RULES

3.4.1 WASTE ANALYSIS PLAN REQUIREMENTS

3.4.1.1 Waste Stream Profile Sheet

A completed, current WSPS is required for each waste stream entering the DST system, even if there will be only a single transfer of the waste. The WSPS form can be found in the most current revision of the *DST Waste Analysis Plan* (WAP) (HNF-SD-WM-EV-053). Each WSPS shall expire 1 year from its approval date. The WSPS must be updated, resubmitted, and approved each year for ongoing transfers.

For each batch transfer into the DST system, the DST customer must provide written certification that the waste conforms to the approved information in the WSPS.

To ensure the assumptions of the *Criticality Safety Evaluation of Hanford Tank Farms Facilities* (RPP-7475) are protected, each new or revised WSPS from a non-Tank Farms waste generator shall be reviewed by the Tank Farms CSR/Alternate. Disposition of this compatibility compliance item shall be documented by the signature/initial of the Tank Farms CSR or Alternate on each WCA for non-Tank Farm facility transfers as specified in Section 3.2.1.4. CSR or Alternate approval is not required for Tank Farm facility transfers.

3.4.1.2 Chemical Compatibility

Wastes entering the DST system must be categorized according to Reactivity Group (USEPA 1994) as a part of the WSPS (Section VI). The Reactivity Group numbers are used to identify potential chemical compatibility hazards prior to waste acceptance into the DST system. Source wastes shall be categorized according to Table 3-9 and potential chemical compatibility hazards identified by waste generators.

If no potential hazard is identified for mixing of wastes in the identified reactivity groups with the receiver tank waste, the transfer may be allowed.

If a potential hazard is identified, a technical justification explaining how the waste may be safely transferred and stored in light of the potential hazard will be required before allowing the transfer.

3.4.1.3 Basis

The basis for the WSPS and Chemical Compatibility is documented in the *Double-Shell Tank System Waste Analysis Plan,* HNF-SD-WM-EV-053.

Table 3-9. Waste Reactivity Group Compatibility Matrix

Reactivity Group No.	Reactivity Group Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	101	102	103	104	105	106	107
1	Acids, Mineral, Nonoxidizing	1																																								
2	Acids, Mineral, Oxidizing		2																																							
3	Acids, Organic		I,H	3																																						
4	Alcohols and Glycols	H	H,F	H,F	4																																					
5	Aldehydes	H,F	H,F	H,F		5																																				
6	Amides	H	H,T				6																																			
7	Amines, Aliphatic and Aromatic	H	H,T	H		H		7																																		
8	Azo, Diazo Compounds and Hydrazines	H,I	H,T	H,I	H,I	H			8																																	
9	Carbamates	H,I	H,T						H,I	9																																
10	Caustics	H	H	H		H				H,I	10																															
11	Cyanides	T,G	T,G	T,G					I			11																														
12	Dithiocarbamates	H,G,F	H,G,F	H,G,T		G,T		U	H,I				12																													
13	Esters	H	H,F						H,I		H			13																												
14	Ethers	H	H,F												14																											
15	Fluorides, Inorganic	T	T	T												15																										
16	Hydrocarbons, Aromatic		H,F														16																									
17	Halogenated Organics	H,T	H,F,T					H,T	H,I		H,F	H						17																								
18	Isocyanates	H,I	H,F,T	H,I	H,F			H,F	H,I		H,F,I	H,I	U						18																							
19	Ketones	H	H,F						H,I		H	H								19																						
20	Mercaptans and Other Organic Sulfides	F,G	H,F,T						H,I									H	H	H	20																					
21	Metals, Alkali and Alkaline Earth, Elemental	G,H,F	G,H,F	G,H,F	G,H,F	G,H,F	G,H	G,H	G,H	G,H	G,H	G,H	G,T,H	G,H				H,E	G,H	G,H	G,H	21																				
22	Metals, as Powders, Vapors or Sponges	G,H,F	G,H,F	I,F					H,F,T	U	G,H							H,E	G,H		H,G,F		22																			
23	Metals, as Sheets, Rods moldings, etc.	G,H,F	G,H,F						H,F,I									H,F						23																		
24	Metals and Metal Compounds, Toxic	S	S	S			S	S			S														24																	
25	Nitrides	G,H,F	H,F	H,G	G,H,E	G,H			U	H,I	U	G,H	G,H	G,H				G,H	U	G,H	G,H	E				25																
26	Nitrites	H,T,G	H,T,F	H							U											H,F			S	G,H	26															
27	Nitro Compounds, Organic		H,F,T			H					H,E											H,G,F				H,G,F		27														
28	Hydrocarbons, Aliphatic Unsaturated	H	H,F			H																	H,E						28													
29	Hydrocarbons, Aliphatic Saturated		H,F																											29												
30	Peroxides and Hydroperoxides, Organic	H,I	H,E		H,F	H,I		H,T	H,F,E	H,F,T		H,E,T	H,E,T					H,E	H	E	H,F,T	H,E	H,I		H,I	H,G,F	H,F,T		H,F		30												
31	Phenols and Cresols	H	H,F						H,I										H,F			G,H				G,H					H	31										
	Organophosphates, Phosphothioates, Phosphodithioates	H,T	H,T						U		H,E											H									U		32									
	Sulfides, Inorganic	T,G	H,F,T	T		H			E										H							H,T								33								
34	Epoxides	H,F	H,F	H,F	H,F	U		H,F	H,F		H,F	H,F	U								H,F	H,F	H,F		H,F	H,F					H,F	H,F	U	H,F	34							
101	Combustibles, Flammable Materials, Misc.	H,I	H,F,T																			H,I,F				H,G,F					H,F,T					101						
102	Explosives	H,E	H,E	H,E					H,E		H,E			H,E								H,E	H,E	H,E	E	E					H,E	H,E		H,E	H,E	H,E	102					
103	Pleymentable Compounds	F,H	F,H						F,H		F,H	F,H	U									F,H	F,H	F,H	F,H	F,H					F,H	F,H		F,H			H,E	103				
104	Oxidizing Agents, Strong	H,T		H,T	H,F	H,F	H,F,T	H,F,T	H,E	H,F,T		H,F,T	H,F,T	H,F	H,F		H,F	H,T	H,F,T	H,F	H,F,T	H,F,E	H,F,E	H,F		H,F,E	H,F,T	H,E	H,F	H,F	H,I	H,F	H,F,T	H,F,T	H,F,I	H,F,I	H,E	H,P,T	104			
105	Reducing Agents, Strong	H,G	H,F,T	H,G	H,G,F	G,H,F	G,H	H,G	H,I				H,T	H,F				H,E	G,H	G,H	G,H						H,G	H,E			H,E	G,H	T,G,H		H	G,H	H,E	H,P,G	H,F,E	105		
106	Water and Mixtures Containing Water	H	H																H,I			G,H	G,H		S	G,H								T,G							G,T	106	
107	Water Reactive Substances																																									107

Reactivity Code	Consequences
H	Heat Generation
F	Fire
I	Innocuous
T	Toxic gas generation
G	Flammable gas generation
E	Explosion
P	Violent Polymerization
S	Solubilization of toxic substances
U	May be hazardous but unknown

3.4.2 PCB MANAGEMENT

Waste entering the DST system from non-tank farm sources, waste transfers from the SST system into the DST system, and waste transfers within the DST system must meet the following polychlorinated biphenyl (PCB) criteria.

3.4.2.1 Criteria for Wastes from Non-Tank Farms Sources

Waste transfers that do not meet the criteria below require approval by the ORP prior to transfer.

Waste entering the DST system from non-tank farm sources that contain PCBs must be able to demonstrate that the waste is not subject to *Toxic Substance Control Act* (TSCA) or meet the following requirements:

1. Wastes must be classified as PCB remediation waste (as defined in 40 CFR 761.3), analytical waste (as regulated under 40 CFR 761.64), or research and development (R&D) waste (as defined in 40 CFR 761.3) if they have detectable PCB concentrations.

2. Waste to be accepted into the DST system must contain $\leq$ 450 ppm (dry weight basis) PCBs in the solids and $\leq$ 2.9 ppm in the liquid. Wastes exceeding these levels must have ORP approval in advance of the transfer.

3. The waste shall be analyzed so that total PCB concentration can be determined. Analysis of Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260 may be used to determine total PCBs. PCB detection limits for each Aroclor or total PCB shall be as low as reasonably possible but must be $\leq$ 5 ppm for solids and $\leq$ 20 ppb for liquids.

4. If a sample contains $\geq$ 0.5% solids by weight, separate analyses shall be required for both solids and liquids.

5. The analysis for PCBs shall be done using approved U.S. Environmental Protection Agency (EPA) standard methods or an alternative procedure approved by EPA.

6. Incoming waste shall meet specified limits irrespective of any dilution other than the normal mixing and dilution that occurs as part of the waste accumulation for treatment.

7. A waste transfer will not be accepted into the DST system if the transfer causes the receiving tank to exceed the PCB inventory concentration limit of 50 ppm in the solid or 2.9 ppm in the liquid. Wastes exceeding these levels must have ORP approval in advance of the transfer.

8. Waste shall meet all other DST System waste acceptance criteria.

3.4.2.2 Criteria for Intra-Tank Farm (DST and SST) Transfers

Waste transfers that do not meet the criteria below require approval by ORP prior to transfer.

1. Transfers between DSTs shall have credible PCB concentration estimates or other appropriate inventory controls. Methods for tracking PCB concentrations are discussed in RPP-6623, *Management of the Polychlorinated Biphenyl Inventory in the Double-Shell Tank System*.

2. Waste cannot be transferred within the DST system if the transfer would cause the receiving tank to exceed the PCB inventory concentration limit of 50 ppm in the solid or 2.9 ppm in the liquid. If a tank is found to exceed the limit, no transfers of incoming waste containing PCBs in excess of the limit will be allowed into that tank. It is allowable to transfer waste with a PCB concentration below the limit into a tank that exceeds the limit.

3. PCB analysis shall be in accordance with the analytical requirements specified in RPP-7614, *Data Quality Objectives to Support PCB Management in the Double-Shell Tank System* and in individual Tank Sampling and Analysis Plans (TSAP).

If no PCB analytical data are available for DST or SST waste, an estimate of 25 ppm for solids and 0.2 ppm for liquids will be used.

3.4.2.3 Basis

The PCB waste criteria are based on ensuring that the Waste Treatment Plant can adequately treat any PCBs in the waste. The basis for PCB management is documented in RPP-6623.

3.5 PROGRAMMATIC DECISION RULES

3.5.1 WASTE FEED DELIVERY CONFIGURATION CONTROL

A feed control suite has been developed to ensure maintenance of DST space, timely characterization of adequate feed for the Waste Treatment and Immobilization Plant (WTP) hot commissioning and operating phases, and that supports accelerated SST retrieval activities. Full details of the feed control suite are provided in Appendix A. Part of the feed control suite is implemented through this waste compatibility program as described below.

All waste transfers and chemical additions will be screened against the Feed Control List (FCL) provided in Table A-1 of Appendix A. The screening will initially review the proposed transfer to determine whether either the Source or the Receiver tank is contained on the FCL. If neither the Source nor the Receiver tank is on the FCL, no further evaluation is required and the transfer may proceed if the other waste compatibility program decision rules are satisfied. If either the Source or the Receiver

tank is contained on the FCL, further evaluation and disposition of the criteria will be required as follows (a flowchart of the process is provided in Figure A-2):

1. The transfer will be evaluated against the specific controls outlined in the feed control list, Table A-1.
2. If the transfer is compliant with the specified controls, the transfer may proceed if the other program decision rules are satisfied. A disposition to the criteria will be provided in the waste compatibility assessment providing an explanation of how the transfer is compliant with the required feed controls.
3. For proposed transfers that do not conform to Level 2 controls in Table A-1, internal notifications will be made to the personnel identified in Table 3-10. An evaluation of the transfer will be undertaken by Flowsheets and Process Models and Strategic Planning & Mission Analysis to determine the acceptability of the transfer. CH2M HILL management for the strategic and technical functions as identified in Table 3-10 will be required to concur prior to approving a non-conforming transfer.
4. For proposed transfers that do not conform to Level 1 controls in Table A-1, internal notifications will be made to personnel in Table 3-10 as for Level 2 controls. In addition, the ORP personnel identified in Table 3-10 will be informally notified that a Level 1 exception is to be evaluated and invited to participate in the evaluation. The ORP will have five days to indicate whether the wish to participate in the evaluation. The ORP will be notified of the evaluation outcome regardless of their participation. If the ORP chooses to be involved, their concurrence with the path forward is required prior to approving a non-conforming transfer.
5. For approved non-conforming transfers, the disposition of the program criteria will reference documentation of the evaluation that was performed.

3.5.1.1 Basis

Adoption of this feed control suite allows for management of the WTP feed by the Tank Farm Contractor (TFC) in its role as the River Protection Project (RPP) integrator. The TFC is responsible for maintaining double-shell tank space and inventory that ensures timely characterization of feed for WTP hot commissioning and operating phases, and supports accelerated SST retrieval activities.

Key objectives include protecting the integrity of the WTP hot commissioning feed; maintaining or improving overall compliance with waste feed envelope specifications; addressing processability of waste through the WTP; achieving acceptable product volumes (high level waste [HLW] glass, low activity waste [LAW] glass, and the various supplemental products); and achieving an acceptable treatment end date.

The basis for the control suite is provided in CH2M HILL (2004)

Table 3-10. Notifications and Approvals for Non-Conforming Transfers

Internal	External (ORP)
Notifications	**Notifications for Level 1 Controls**
Flowsheet & Process Models Manager	Retrieval-Closure Program/Tank Farm Planning Manager[2]
Process/Waste Transfer Engineering Manager	Tank Farms Programs and Projects Division Director
Process Analysis Director	WTP Engineering Division Director
Technical Baseline Strategic Planning Director	WTP Facility Engineering Team Leader
Waste Feed Operations Field Deployment Director	
Approvals for Non-Conforming Transfers	**Concurrence for Non-Conforming Transfers with Level 1 Controls[3]**
Flowsheet & Process Models Manager	Retrieval-Closure Program/Tank Farm Planning Manager
Technical Baseline Strategic Planning Director	

3.6 OPERATIONAL DECISION RULES

3.6.1 PHOSPHATE WASTE

Wastes with a high phosphate concentration, $[PO_4^{-3}]$, > 0.1 M, require further evaluation prior to transfer to ensure that unacceptable or unexpected precipitation and/or gelling of the waste does not occur either during transfer, on evaporation and cooling, or on mixing with the waste in the receiver tank.

Evaluation of wastes containing high phosphate concentrations should compare the source waste and receiver tank compositions at estimated operating temperatures to data on phosphate solubility provided in the documents referenced in the basis section. Software such as Environmental Simulation Program, ESP[4], may also be beneficial in evaluating the risk of precipitation. If the risk of precipitation is considered high,

---

[2] The ORP Retrieval-Closure Program/Tank Farm Planning Manager is the point-of-contact for Level 1 notifications, with notification copies to the other identified ORP personnel.
[3] The ORP's concurrence with the path forward for non-conforming transfers with Level 1 controls is required only if they have expressed a wish to be involved in the evaluation.
[4] ESP is a trademark of OLI Systems Inc., Morris Plains, New Jersey

laboratory tests of dilution, cooling, and/or mixing may also be warranted.

3.6.1.1 Basis

The solubility of sodium phosphate is strongly temperature dependent and has been shown to display a linear relationship between phosphate solubility and total sodium ion concentration at temperatures above about 40°C. The solubility of phosphate at 40°C is in the range 0.10 M to 0.15 M PO_4^{-3}. At 20°C, the solubility of phosphate is in the range 0.03 M to 0.08 M. The dependence of phosphate solubility on temperature at constant solution composition is not linear. The solubility change between 40°C and 50°C is greater than between 50°C and 60°C. Evaporation of solutions containing high concentrations of sodium phosphate has been shown to result in gelling of the waste on cooling, due to the precipitation of needle-like crystals of $Na_3PO_4 \cdot 12H_20$. Care is also required in transferring wastes containing high phosphate concentrations to ensure that cooling of the waste during transfer does not result in precipitation and gelling in the transfer line that could lead to line plugging. Dilution of high phosphate wastes prior to transfer may be required to prevent precipitation and plugging. Care must also be taken in mixing high phosphate wastes with other waste types to ensure that precipitation and gelling of phosphate solids does not result in gelling due to an increase in the ionic strength of the solution. In the past, mixing of very high phosphate concentration waste, known as concentrated customer waste, with cladding removal wastes resulted in solidification of the waste solids due to phosphate precipitation.

The basis for the phosphate waste rule is provided in summaries of laboratory work conducted on phosphate solubility and documented in Herting (1980) and Herting (1987); discussion of waste mixing issues is provided in Herting and Patterson (1982). An overall discussion of phosphate solubility issues is provided in RPP-17247, *Dilution and Flushing Requirements to Avoid Solids Precipitation and Deposition during Tank Waste Transfers.*

3.6.2 LINE PLUGGING

For waste streams with $\leq$ 5% settled solids by volume and a specific gravity SpG $\leq$ 1.35, no evaluation is required.

Specific considerations to be addressed to prevent line plugging including discussions of the risks of aluminum and phosphate precipitation during transfer are provided in RPP-17247, *Dilution and Flushing Requirements to Avoid Solids Precipitation and Deposition during Tank Waste Transfers*. Dilution and flushing requirements to prevent transfer line plugging during saltwell pumping will be included in the WCA documentation or will be transmitted in a separate memo from Process Engineering.

For 242-A Evaporator slurry, transfer line plugging is addressed in the process control plan for each campaign.

For other waste streams where it is planned or suspected that solids will be entrained in or formed during transfer, an analysis of the system flow conditions must be performed to assess a probability that line plugging can be avoided. This analysis should include a comparison of the anticipated transfer conditions, primarily flow velocity, to the critical deposition velocity. This will be accomplished by obtaining and/or analyzing the following parameters:

1. The expected carrier liquid density.
2. The expected particulate solids density.
3. The expected slurry density during transfer.
4. The anticipated system flow rate.
5. The particle size mass distribution or some other analytical measure such as the unhindered solids settling velocity from which an effective particulate solid diameter or diameter distribution can be obtained.
6. The expected carrier liquid viscosity or some other analytical measure such as the maximum expected slurry temperature during transfer from which the carrier liquid viscosity can be determined.

A methodology for evaluation of critical velocity during tank waste transfers is provided in RPP-19221, *Critical Flow Velocity Calculations for Waste Transfer Piping*. This methodology, or similar, should be employed for evaluation of transfers of waste containing >5 weight % settled solids by volume or a specific gravity SpG > 1.35.

For slurry waste transfers associated with retrieval projects, the specific guidance or requirements for avoiding settling and plugging will be addressed in the process control plan for the project and the key requirements contained in the waste compatibility assessment.

3.6.2.1 Basis

The basis for the line plugging decision rule is documented in HNF-2728, *Flow Velocity Analysis for Avoidance of Solids Deposition during Transport of Hanford Tank Waste Slurries*. Additional discussion of critical velocity, pressure drop, and the methodology for their calculation is provided in RPP-5346, *Waste Feed Delivery Transfer System Analysis*.

The basis for avoidance of solids precipitation, primarily during saltwell transfers, is addressed in RPP-17247, *Dilution and Flushing Requirements to Avoid Solids Precipitation and Deposition during Tank Waste Transfers*.

4.0 REFERENCES

40 CFR 761, 2003, *Protection of Environment*, "PART 761--Polychlorinated Bi&Chyph; Phenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Code of Federal Regulations*, Washington, D.C.

CH2M HILL, 2004, "Contract Number DE-AC27-99RL14047; Request for the U.S. Department of Energy, Office of River Protection to Rescind Direction on "Configuration Control of Waste Feed Delivery Tank Contents"," letter from E.S. Aromi, CH2M HILL, to R.J. Schepens, ORP, CH2M-0304844, dated February 11, 2004, CH2M HILL Hanford Group, Inc., Richland, Washington.

CH2M HILL, 2003, "Contract No. DE-AC27-99RL14047 – Justification for Continued Operation for Tank 241-SY-102," letter from E.S. Aromi, CH2M HILL, to R.J. Schepens, ORP, CH2M-0304014, dated November 6, 2003, CH2M HILL Hanford Group, Inc., Richland, Washington.

CPS-T-149-00012, 2004, *Criticality Prevention Specification*, as amended, CH2M HILL Hanford Group, Inc., Richland, Washington.

Ecology and EPA, 1994, *Hanford Facility Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste*, Permit Number WA7890008967, Attachment 35, 242-A Evaporator, Waste Analysis Plan, Washington State Department of Ecology, Olympia, Washington and U.S. Environmental Protection Agency Region 10, Seattle, Washington.

Herting, D. L., 1980, "Solubility of Phosphate in Defense Waste," (internal letter, October 29), Rockwell Hanford Operations, Richland, Washington.

Herting, D. L., 1987, "Phosphate Solubility in Simulated Defense Waste," (internal letter, March 6), Rockwell Hanford Operations, Richland, Washington.

Herting, D. L., and K. J. Patterson, 1982, "Effects of Mixing Waste Types - Concentrated Streams," (internal letter, August 26), Rockwell Hanford Operations, Richland, Washington.

HNF-2728, 1998, *Flow Velocity Analysis for Avoidance of Solids Deposition During Transport of Hanford Tank Waste Slurries*, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.

HNF-14755, 2003, *242-A Evaporator Documented Safety Analysis*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-15000, 2003, *CSER-03-008, Criticality Safety Evaluation Report for the 242-A Evaporator Facility*, Fluor Hanford, Richland, Washington.

HNF-IP-1266, 2003, *Tank Farms Operations Administrative Controls*, Chapter 5.9, "Source Term Controls," as amended, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-IP-1266, 2004, *Tank Farms Operations Administrative Controls*, Chapter 5.10, "Flammable Gas Controls," as amended, CH2M HILL Hanford Group, Inc., Richland, Washington.

.HNF-IP-1266, 2004, *Tank Farms Operations Administrative Controls*, Chapter 5.11, "Transfer Controls", as amended, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-IP-1266, 2003, *Tank Farms Operations Administrative Controls*, Chapter 5.16, "Corrosion Mitigation Program," as amended, CH2M HILL Hanford Group, Inc., Richland, Washington

HNF-SD-WM-DQO-001, 2004, *Data Quality Objectives for Tank Farms Waste Compatibility Program*, as amended, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-SD-WM-EV-053, 2003, *Double-Shell Tank System Waste Analysis Plan*, as amended, CH2M HILL Hanford Group, Inc, Richland, Washington.

HNF-SD-WM-TSR-006, 2004, *Tank Farms Technical Safety Requirements*, as amended, CH2M HILL Hanford Group, Inc, Richland, Washington.

ORP, 2003, "Contract No. DE-AC27-99RL14047 – Approval of Justification for Continued Operation (JCO) for Double-Shell Tank (DST) 241-SY-102," letter from R.J. Schepens, ORP, to E.S. Aromi, CH2M HILL, DOE-ORP: 03-TED-117, CTS No: 0304360, dated November 19, 2003, U.S. Department of Energy, Office of River Protection, Richland, Washington.

OSD-T-151-00011, 2003, *Operating Specifications for the Active Double Contained Receiver Tanks*, Rev. D-3, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-5346, 2002, *Waste Feed Delivery Transfer System Analysis*, Rev. 2, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-5926, 2004, *Steady-State Flammable Gas Release Rate Calculation and Lower Flammability Level Evaluation for Hanford Tank Waste*, as amended, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-6213, 2003, *Hanford Waste Tank Bump Accident and Consequence Analysis,* Rev. 3, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-6623, 2001, *Management of the Polychlorinated Biphenyl Inventory in the Double-Shell Tank System*, Rev. 2, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-7475, 2004, *Criticality Safety Evaluation of Hanford Tank Farms Facility*, as amended, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-7614, 2002, *Data Quality Objectives to Support PCB Management in the Double-Shell Tank System*, Rev. 3, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-10006, 2004, *Methodology and Calculations for the Assignment of Waste Groups for the Large Underground Waste Storage Tanks at the Hanford Site*, as amended, CH2M HILL Hanford Group, Inc.

RPP-10726, 2004, *Requirements for Discharge from Non-tank Farm Waste Generators into the DST System*, as amended, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-13033, 2004, *Tank Farms Documented Safety Analysis*, as amended, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-13438, 2003, *Technical Basis for Tank Bump Representative Accident and Associated Hazardous Conditions*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-14330, 2003, *Criticality Safety Manual*, as amended, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-17247, 2003, *Dilution and Flushing Requirements to Avoid Solids Precipitation and Deposition during Tank Waste Transfers*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-19221, 2004, *Critical Velocity Calculations for Waste Transfer Piping*, Rev.0, CH2M HILL Hanford Group, Inc., Richland, Washington.

TFC-ENG-CHEM-P-13, 2003, *Tank Waste Compatibility Assessments*, CH2M HILL Hanford Group, Inc., Richland, Washington.

TFC-ESH-RP_RWP-C-03, 2003, *ALARA Work Planning*, CH2M HILL Hanford Group, Inc., Richland, Washington.

USEPA, 1994, *Waste Analysis at Facilities that Generate, Treat, Store, and Dispose of Hazardous Wastes: A Guidance Manual*, PB94-963603, OSWER, 9938.4-03.

APPENDIX A

WASTE FEED DELIVERY CONTROL SUITE AND CONTROL SUITE CHANGE PROCESS

Details of the Control Suite and the Control Suite Change Process

The dynamic nature of the mission necessitates the use of a feed control suite to ensure maintenance of double-shell tank (DST) space, timely characterization of adequate feed for the Waste Treatment and Immobilization Plant (WTP) hot commissioning and operating phases, and that supports accelerated single-shell tank (SST) retrieval activities.

Key objectives include protecting the integrity of the WTP hot commissioning feed; maintaining or improving overall compliance with waste feed envelope specifications; addressing processability of waste through the WTP; achieving acceptable product volumes (high level waste [HLW] glass, low activity waste [LAW] glass, and the various supplemental products); and achieving an acceptable treatment end date.

The feed control will be provided by three elements:

1. The use of a River Protection Project (RPP) mission system model to define and refine the mission's baseline and conduct what-if assessments. The system model monitors for global or macro-scale changes; such as increases in immobilized waste volumes, and conformance to the WTP feed envelope, feed balance, and forward feed inventory requirements.

   Figure A-1 illustrates the global role of the system model. In this illustration, the system model has created the mission baseline. The day-to-day waste transfers and tank additions (shown in goldenrod) exist within the approved mission baseline.

2. The use of a comprehensive waste compatibility assessment process to evaluate day-to-day waste transfers and tank additions that are identified as mission-sensitive. The process specifically checks for compliance with the Feed Control List. The Feed Control List is the set of active waste management practices used to ensure waste processability in accordance with the mission baseline. The waste compatibility assessment process is documented in *Tank Farm Waste Transfer Compatibility Program*, HNF-SD-WM-OCD-015.

   Table A-1 presents the Feed Control List that the Tank Farm Contractor (TFC) will implement. Graphically, the Feed Control List is bounded by the goldenrod area in Figure A-1.

3. The use of a tiered evaluation process to evaluate proposed waste activities that are exceptions to the Feed Control List. The same tiered evaluation process is invoked when changes to the Feed Control List Level 1 controls are proposed.

   The Figure A-2 flowchart shows the evaluation and exception process. The goldenrod region, corresponding to the similar area in Figure 1 shows the pathway for planned activities that are evaluated by the waste compatibility assessment process program and found to be in accordance with the Feed Control List.

The remainder of the flowchart illustrates the process for evaluating planned activities that take an exception to the Feed Control List. Level 2 exceptions are evaluated and dispositioned by the TFC. Most exceptions are expected to be Level 2 exceptions.

The U.S. Department of Energy, Office of River Protection (ORP) will be notified informally when a Feed Control List Level 1 exception is to be evaluated and invited to participate in the evaluation. The point-of-contact will be the ORP Retrieval-Closure Program/Tank Farm Planning Manager, with notification copies provided to the Tank Farms Programs and Projects Division Director, the WTP Engineering Division Director, and the WTP Facility Engineering Team Leader. The evaluation will start five days later. The ORP will be notified of the evaluation outcome regardless of their participation.

Figure A-1. Elements of Feed Control

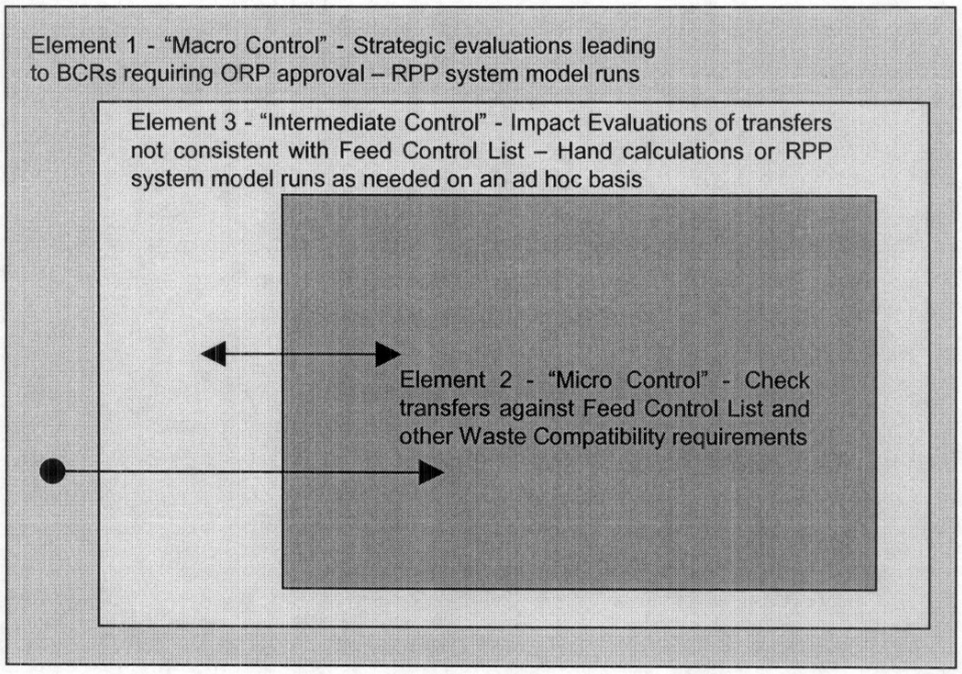

Figure A-2. Waste Feed Control Evaluation and Notification Pathway

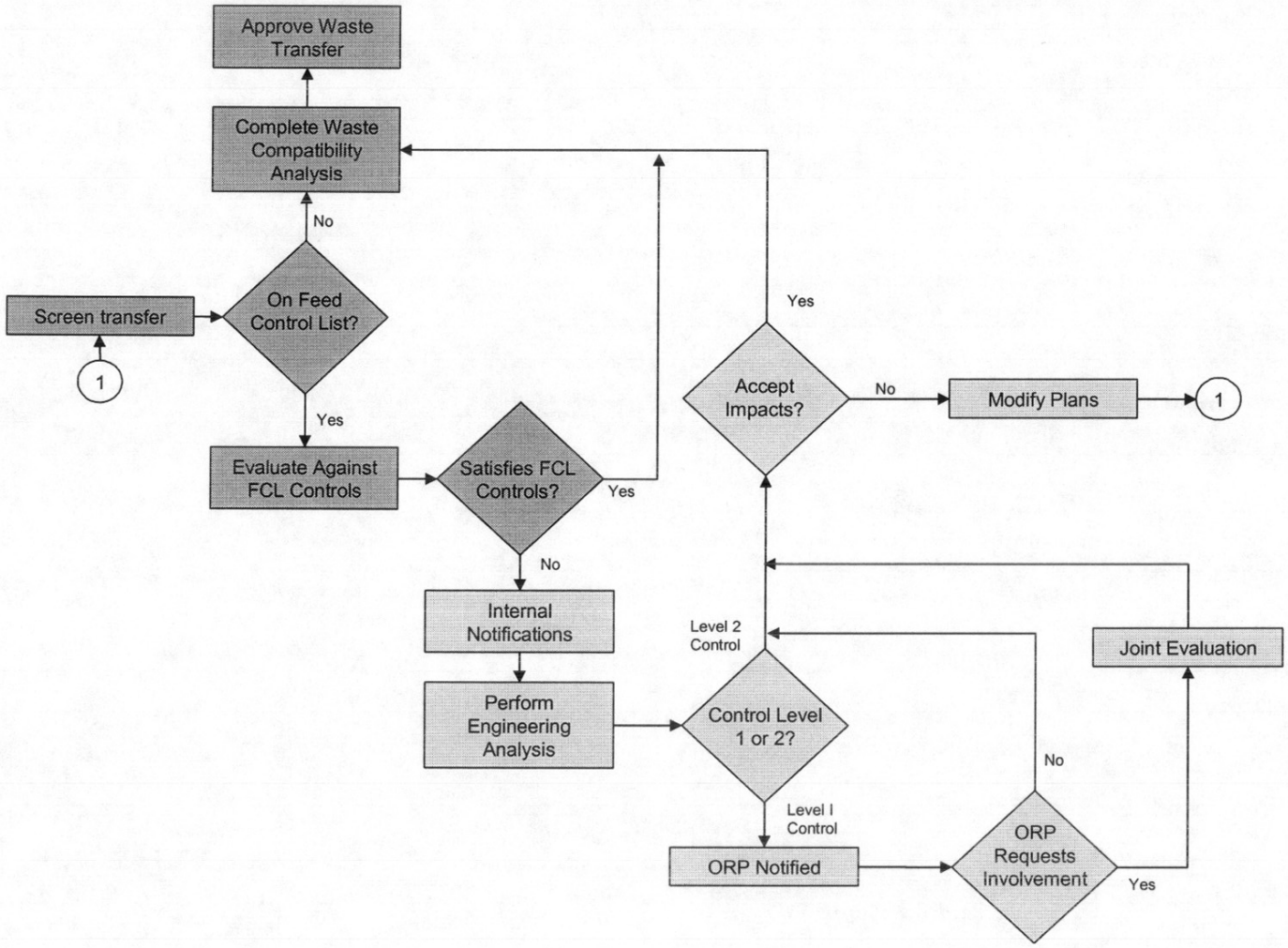

Table A-1. Feed Control List

	Feed Control Issue	Tanks	Controls
1.	Blend-off high-sulfate supernate	241-AZ-102	1. A portion of the supernate from 241-AZ-102 tank will be decanted and blended with lower [SO_4] supernate, so that the final [SO_4]:[Na] ratio in 241-AZ-102 and in any other tank receiving significant quantities of the high [SO_4] supernate will be less than a target level of 0.048 mole SO_4/mole Na after blending and any evaporator campaigns are completed. [**Level 1**] Note: In letter 02-REQ-038, the ORP requested a blend case be evaluated in which the liquid in 241-AZ-102 be blended with other DST waste to yield a [SO_4]:[Na] ratio that does not exceed the ratio that would result from blending 241-AZ-101 with 241-AZ-102 liquids. The target level is taken from the calculated blend provided in letter CHG-0203592 R2. The TFCOUP and system plan blend-off the 241-AZ-102 liquids.
2.	Blend off high ^{233}U solids	241-C-104 241-AY-101	1. The solids from 241-C-104 will be blended with solids in 241-AY-101 so that the resulting [^{233}U] is less than a target level of 2.0E-04 Ci/100 grams equivalent of waste oxides. The two source tanks and the resulting blend will be kept segregated from other sources of solids. [**Level 1**] Note: Target level is taken from Table TS-8.3, Specification 8, Appendix C of the BNI Contract (Mod A029) for a hypothetical blend of AY-101 and C-104. The maximum limit from Table TS-8.3, Specification 8, Appendix C of the BNI Contract (Mod A029) for all other solids is 4.50E-06 Ci/100 grams equivalent of waste oxides. The TFCOUP Rev 5 is consistent with this control. Note: CH2M HILL may propose to relax this control to allow blending of the solids from 241-C-104 with other C-Farm solids to further reduce the peak ^{233}U concentration. This would require more waste to exceed the 4.5E-06 Ci/100 grams specification.

	Feed Control Issue	Tanks	Controls
3.	Prepare and protect hot commissioning feed	241-AY-102 241-AP-101	1. The following controls are in place until released by the special process described below [**Level 1**]: a. No waste shall be added to or removed from 241-AY-102 with the exception of condensate additions from tank 241-AZ-151. b. No waste shall be added to or removed from 241-AP-101. **Special process to release controls:** A. CH2M HILL Hanford Group, Inc. (CH2M HILL) will prepare a case for the consolidation of the supernate in 241-AP-101 with the solids in 241-AY-102. The scenario analyzed in the case will attempt to meet the following targets after all staging transfers and optional evaporator evolutions are completed: a. The resulting liquid phase in 241-AY-102 should meet Envelope A limits. b. A minimum of 190 MT Na will be deliverable to the waste treatment plant in decanted supernate as LAW feed. c. Sufficient solids should be deliverable to the waste treatment plant in slurry as HLW feed so that a minimum of 84 MTG of glass equivalent can be produced after pretreatment solids. d. Solids should be deliverable as slurry containing between 10 g and 200 g of unwashed solids per liter of slurry. e. Any changes in the bulk solids composition should be minor so that water washing will produce an acceptable glass volume (i.e., that caustic leaching is not required during hot commissioning). B. When the ORP approves the case, the above controls (1.a and 1.b) will be replaced by a new set of controls consistent with the case. Note: Table C.6-5.2 of BNI Contract (Mod A029) requires production of 1280 MTG equivalent of pretreated LAW feed. This corresponds to 190 MT Na at conservative assumptions of 20-wt% Na2O loading in glass, no process or leaching additions, and no contributions from HLW feed. The contract also requires production of 84 MTG equivalent of pretreated HLW feed. Note: Section 8.2.2.1, Specification 8, Appendix C of the BNI Contract requires that the HLW feed be delivered between 10 g and and 200 g unwashed solids per liter. Note: The TFCOUP and BCR-04-001 already include consolidation of AP-101 into AY-102 as baseline and is believed to satisfy all constraints with the exception of 1.e, which has not yet been evaluated.

	Feed Control Issue	Tanks	Controls
4.	Segregate Envelope C (complexed TRU & Sr, NRC agreements)	241-AN-102 241-AN-107	1. The waste in 241-AN-102 and 241-AN-107 shall be segregated from all other wastes until it has been delivered to the Waste Treatment Plant. [**Level 1**] Note: In Paperiello, 1997, the NRC requires that complexed TRU will be removed from 241-AN-102 and 241-AN-107 per the approved technical basis report (WHC-SD-WM-TI-699 Revision 2) in order for the LAW fraction to be disposable on-site without being subject to NRC licensing authority. In addition, Section C.7(d)(1)(ii) of the BNI Contract requires removal of Sr and TRU from waste in order to meet ILAW product specifications. This waste is segregated to reduce processing costs and mission duration.
5.	Segregate TRU sludge from complexed waste.	241-AW-103 241-AW-105 241-SY-102	1. Envelope C waste or other waste capable of complexing TRU shall not be stored with the insoluble solids currently in 241-AW-103, 241-AW-105 or 241-SY-102. For purposes of this control, waste will be considered to be Envelope C if [TRU]:[Na] ratio exceeds 13.0 μCi/mole or the [^{90}Sr]:[Na] ratio exceeds 1.19E+03 μCi/mole in the liquid phase. [**Level 1**] Note: The values are taken from Table TS-7.2, Specification 7, Appendix C of the BNI contract for the maximum TRU and ^{90}Sr allowed in Envelope A and B feeds.

	Feed Control Issue	Tanks	Controls
6.	Segregate waste destined for TRU or LLW packaging	<u>List 1:</u> 241-AW-103 241-AW-105 List 1a: 241-SY-102 <u>List 2:</u> 241-B-201 241-B-202 241-B-203 241-B-204 241-T-201 241-T-202 241-T-203 241-T-204 <u>List 3:</u> 241-B-107 241-B-110 241-B-111 241-T-104 241-T-105 241-T-107 241-T-110 241-T-111 241-T-112	1. No additional waste shall be added or stored with the insoluble solids currently in 241-AW-103, 241-AW-105. [**Level 2**] 2. Addition of waste to 241-SY-102 shall be done in a manner to avoid mixing of the existing TRU sludge with other solids. The settling of other solids on top of the existing TRU sludge in 241-SY-102 is allowed if needed to support 200-West area interim stabilization and retrieval activities provided (1) no attempt is made to mechanically mix the settled solids with the TRU sludge and (2) transfers of waste into or out of 241-SY-102 are performed in such a manner to avoid disturbing the TRU sludge layer. [Level 2] 3. Waste from the tanks in "List 2" contains TRU sludge and "List 3" contains potentially TRU sludge suitable for packaging – this TRU sludge waste shall not be transferred into the DST system or mixed with HLW. [**Level 2**] Note: The sludge in these tanks (List 1, 1a, 2 and 3) are candidates for packaging as TRU sludge and therefore are being protected from inadvertent change. All but 241-B-107, 241-T-105 and 241-T-107 are included as part of our baseline plans as modeled and documented in the TFCOUP Revision 5. The sources of the waste in these three tanks are documented in RPP-17702, RPP-16764 and RPP-16765, respectively.

	Feed Control Issue	Tanks	Controls
7.	Segregate low-cesium SST waste for non-WTP supplemental treatment (shielding, NRC agreements).	<u>List 1:</u> 241-B-101 241-B-103 241-B-105 241-B-107 241-B-108 241-B-109 241-BX-110 241-BX-111 241-BY-102 241-BY-105 241-BY-108 241-BY-111 241-BY-112 241-S-105 241-S-109 241-T-109 241-TX-113 241-TX-116 241-TX-117 241-TX-118 241-TY-102 241-TY-103 <u>List 2:</u> 241-BY-103 241-TX-105 241-TX-106 241-TX-112 241-TX-114 241-TX-115	1. Waste from the listed SSTs potentially contains low-cesium waste suitable for non-WTP supplemental treatment – waste should be managed to maximize the amount of low-cesium (less than 0.05 Ci/liter ^{137}Cs when normalized to 7 M Na) available for delivery to non-WTP supplemental treatment. The low-cesium fraction shall be kept separate from any high-cesium fraction. **[Level 2]** Note: The list of candidate tanks in "List 1" is taken from internal memo 7G400-03-MEJ-004, "Candidate Low-Activity Waste Feed to Supplemental Treatment Demonstration", May 21, 2003. Tank 241-S-112 has been removed as a low-Cs waste candidate since its retrieval is ongoing. Note: The tanks in "List 2" are additional low-Cs tanks predicted to contain greater than 400 MT soluble sodium each and less than 5% sludge by volume.

Table Notes

Level 1 – If a proposed transfer is determined to not conform with the controls in the Feed Control List, the ORP will be notified and have five working days to indicate if they wish to become involved in the evaluation. If they choose to be involved, we will need to receive their agreement with our path forward prior to approving a non-conforming transfer.

Level 2 – If a proposed transfer is determined to not conform with the controls in the Feed Control List, only internal notifications will be made. Appropriate CH2M HILL management for the strategic and technical functions will be required to concur prior to approving a non-conforming transfer.

Table References:

1. HNF-SD-WM-SP-012, "Tank Farm Contractor Operation And Utilization Plan," Revision 5, dated December 18, 2003.

2. Interoffice Memorandum, D. W. Hamilton to K. D. Boomer, et al., "Candidate Low-Activity Waste Feed to Supplemental Treatment Demonstration," 7G400-03-MEJ-004, May 21, 2003.

3. RPP-17702, "Origin of Waste in Single-Shell Tank 241-B-107," Revision 0, CH2M HILL Hanford Group, Inc., Richland, Washington, dated January 8, 2004.

4. RPP-16764, "Origin of Waste in Single-Shell Tank 241-T-105," Revision 0, CH2M HILL Hanford Group, Inc., Richland, Washington, dated January 8, 2004.

5. RPP-16765, "Origin of Waste in Single-Shell Tank 241-T-107," Revision 0, CH2M HILL Hanford Group, Inc., Richland, Washington, dated July 11, 2003.

6. Contract No. DE-AC27-01RV14136, Modification Number A029, dated April 24, 2003.

7. Letter, R. J. Schepens, ORP, to E. S. Aromi, CH2M HILL, "Contract No. DE-AC27-99RL14047 – Feed Blending and Delivery Case for the Tank 241-AZ-102 Liquid," 02-REQ-038, dated August 9, 2002.

8. Letter, E. S. Aromi, CH2M HILL, to R. J. Schepens, ORP, "Contract No. DE-AC27-99RL14047 – Feed Blending and Delivery Case for the Tank 241-AZ-102 Liquid," CHG-0203592 R2, August 26, 2002.