S

ENGINEERING CHANGE NOTICE

Page 1 of 23

1. ECN 667137

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersedure ☐ Cancel/Void ☐	KD Fowler, Process Control, 7G300 R2-11, 373-5930	☐ Yes ☒ No	September 27, 2001
	6. Project Title/No./Work Order No. TF Waste Transfer Compatibility Program	7. Bldg./Sys./Fac. No. Tank Farms	8. Approval Designator ES
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) HNF-SD-WM-OCD-015, Rev. 3a	10. Related ECN No(s). 657006, 657005	11. Related PO No. NA

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☐ Yes (fill out Blk. 12b) ☒ No (NA Blks. 12b, 12c, 12d)	NA	NA Design Authority/Cog. Engineer Signature & Date	NA Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

13b. Design Baseline Document? ☐ Yes ☐ No

Total document revision for program updated to reflect current waste compatibility criteria.

14a. Justification (mark one)	14b. Justification Details
Criteria Change ☒ Design Improvement ☐ Environmental ☐ Facility Deactivation ☐ As-Found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐	Documentation required update to reflect current waste compatibility criteria

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

See attached distribution sheet.

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1. ECN (use no. from pg. 1): 667137

16. Design Verification Required	17. Cost Impact		18. Schedule Impact (days)
	ENGINEERING	CONSTRUCTION	
☐ Yes	Additional ☐ $ _____	Additional ☐ $ _____	Improvement ☐ _____
☒ No	Savings ☐ $ _____	Savings ☐ $ _____	Delay ☐ _____

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

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

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

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

21. Approvals

	Signature	Date		Signature	Date
Design Authority			Design Agent		
Cog. Eng.	KD Fowler	9/24/01	PE		
Cog. Mgr.	MA Knight	10/19/01	QA		
QA			Safety		
Safety	JM Grigsby	10/18/01	Design		
Environ.	CH Mulkey	9/24/01	Environ.		
Other			Other		
	TC Oten	9/24/01			
	MR Koch	9/24/01			
	TM Blaak	9/24/01	DEPARTMENT OF ENERGY		
	JN Doeler	9/24/01	Signature or a Control Number that tracks the Approval Signature		
	LA Fort	9/24/01			
	JA Lechelt	9/24/01	ADDITIONAL		

Nuclear Safety & Licensing Review Criteria:
Please focus your review of Revision 4 on the following sections.

2.1 Criticality Control: Section revised to reflect implementation of new criticality prevention specifications (CPS-T-149-00012) and revision to AC 5.7.

2.2 Source Term Controls: Section revised to reflect updated ULD calculations (AC 5.8).

2.5 DST Waste Chemistry: Section added to reflect new AC for DST tank chemistry (AC 5.15).

Decision Rule requirements/limits for other sections of the document are unchanged from Revision 3a of this document.

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	Process Control	Date 9/28/01
Project Title/Work Order		**EDT No.** NA
Tank Farm Waste Transfer Compatibility Program, Rev. 4		**ECN No.** 667137

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
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Tank Farm Waste Transfer Compatibility Program

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Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

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Abstract: The compatibility program described in this document formalizes the process for determining waste compatibility. The primary goal of the program is to ensure that sufficient controls are in place to prevent the formation of incompatible mixtures during future operations. The process described involves characterizing waste, comparing characteristics with criteria, resolving potential incompatibilities and documenting the process.

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Page A

(2) Title: Tank Farm Waste Transfer Compatibility Program

Change Control Record

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LIST OF TERMS

AC	Administrative Control
AWF	Aging waste facility
Bq	Becquerel
Btu	British thermal unit
CC	concentrated complexed waste
CHG	CH2M Hill Hanford Group
CPS	Criticality Prevention Specification
CSER	Criticality Safety Evaluation Report (Weiss, et al. 2001)
CSR	Criticality Safety Representative
DC	dilute complexed waste
DCRT	double-contained receiver tank
DOE	U. S. Department of Energy
DSSF	double-shell slurry feed
DST	double-shell tank
EDCF	effective dose conversion factor
EPA	U.S. Environmental Protection Agency
FRG	fraction of risk guide
LFL	lower flammability limit
NCRW	neutralized cladding removal waste
ORP	Office of River Protection
PCB	Polychlorinated biphenyl
RPP	River Protection Project (formerly TWRS)
SpG	specific gravity
SST	Single-shell tank
TA	total alpha (analysis)
TFC	Tank Farm Contractor
TFRG	total fraction of risk guide
TOC	total organic carbon
TRU	transuranic
TT LFL	Time to 25% LFL determination
ULD	unit liter dose
WAP	Double-Shell Tank Waste Analysis Plan (Mulkey 2001a)
WCA	waste compatibility assessment
WFD	Waste Feed Delivery
WIC	Waste Inventory Control Group
WSPS	Waste Stream Profile Sheet

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 assure continued safe and prudent storage and handling of these wastes within the Tank Farms Facility.

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

1.1 PURPOSE

This document specifies decision rules for waste transfers within and for the receipt of waste into Tank Farms DST System[1]. Only Tank Farm requirements and limits affected by the transfer or receipt of waste are addressed.

Requirements for tank piping, leak detection and ventilation systems have been omitted from this document because continual monitoring is generally required for systems in use. Operation of these systems is controlled by other administrative procedures and control documents. For similar reasons, effluent emission limits, concrete temperature limits and physical system requirements for waste transfer (e.g., transfer routing, line testing, etc.) also have been omitted.

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

1.2 SCOPE

The decision rules of this document apply to all waste transfers except as specified in Section 1.4 (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 and
4) receiving waste from non-Tank Farms Facilities.

In general, the decision rules for double-shell tanks (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 specific a tank(s).

[1] The definition of DST System is taken from the DST Part B Permit in the Double-Shell Tank Waste Analysis Plan

1.3 WASTE COMPATIBILITY ASSESSMENTS

As required by HNF-IP-1266, Section 5.12, *Transfer Controls*, prior to acceptance of a waste transfer, the proposed transfer shall be evaluated as specified in this document. The evaluation is necessary to ensure that the sending and receiving tanks will still meet the controls for criticality (Section 2.1), tank bumps (Section 6.1), flammable gas deflagrations (Section 2.4), organic solvent fires (Section 3.2), and tank chemistry (Section 2.5) after the transfer. The waste compatibility assessment (WCA) will compare compositions of the proposed waste source(s), waste receiver(s), and transfer conditions to the decision rules given in Sections 2 through 6 of this document.

1.3.1 Documentation

If it is determined, via the WCA, that a proposed transfer is acceptable, the WCA is documented along with a recommendation for proceeding with the proposed waste transfer. The documented WCA must be reviewed and signed by Double-Shell Tank System Engineering or Single-Shell Tank Engineering, Process Control and CHG Environmental Services before it is issued. In addition, for waste transfers from non-Tank Farm facilities, the WCA must be reviewed and approved by the RPP Criticality Safety Representative (CSR) or alternate to verify compliance with criticality prevention limits.

Assessment documentation shall include, as a minimum, disposition of each applicable decision rule as listed in the Compatibility Compliance Table (Appendix A), transfer requirements (if any) and WCA expiration date (see 1.3.2 below).

In accordance with the requirements for Engineering Calculations (HNF-IP-0842, Chapter IV, Section 3.6), calculations used in completing the WCA must be signed by the originator and an independent checker. The signed calculations must be included with documentation of the WCA along with a list of references used and other pertinent information as necessary.

If it is determined that a proposed transfer is not acceptable, the WCA may be issued to formally document issues of non-acceptability.

1.3.2 WCA Expiration

Tank Farm Contractor (TFC) requirements which affect waste compatibility may change over time. To assure that ongoing transfers are periodically reviewed for compliance with the most recent requirements and consider current tank conditions an expiration date is established for each assessment.

The expiration date established for an assessment shall consider the following guidelines:

- Each WCA shall expire in a time period not to exceed 1 year from issuance.
- Assessments for the receipt of waste into the DST System shall expire before or upon expiration of the waste stream profile sheet (WSPS) used to complete the assessment.
- Assessments for one-time transfers shall expire upon completion of the transfer and any associated transfer line flushing.

1.4 EXEMPTIONS

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

Therefore, the following types of waste additions to DSTs are exempt from waste compatibility assessments (**see note below**).

- Potentially contaminated water (e.g., cooling water, rain water, snow melt, pipeline flush water, pipeline pressure test water, deentrainer flush water, airlift circulator flush water) with no chemicals added except for those required for tank corrosion control (i.e., sodium hydroxide and sodium nitrite).

- 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.

Note: Though exempt from compatibility assessments, the exempt waste additions described above **must** comply with the Administrative Control Implementation and Safety decision rules in Sections 2 and 3 of this document. To verify compliance, with Section 2 and 3 decision rules, exempt waste additions will require written concurrence from Process Engineering. To ensure regulatory requirements are not violated, exempt waste additions require written concurrence from CHG Environmental Services prior to acceptance into the DST system.

Evaluation of water additions to DSTs is addressed in Fowler 2001.

1.5 WASTE TRANSFERS FROM NON-TANK FARM FACILITIES

In order to meet tank farms acceptance requirements, non-tank farm waste generators must meet sampling and analysis requirements specified in the current revision of the *Data Quality Objectives for Tank Farms Waste Compatibility Program*, HNF-SD-WM-DQO-001, and in the current revision of the *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 WCA must be dispositioned by the responsible actionee(s) and verified by Process Control prior to transfer. Written verification will be issued by Process Control in an interoffice memorandum.

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

2.0 ADMINISTRATIVE CONTROL IMPLEMENTATION DECISION RULES

2.1 CRITICALITY CONTROL (AC 5.7)

Nuclear criticality safety controls for Tank Farms are implemented in CHG 2001a, Criticality Prevention Specification (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. If it is suspected that a waste stream contains a significant amount of ^{241}Pu, it must be included as Pu equivalents on a gram per gram basis.

Under some conditions a portion of the ^{235}U may be excluded in accordance with the tank farms CPS. Exclusion of a portion of ^{235}U shall be on a case-by-case basis with approval of the RPP 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 RPP CSR/Alternate. The evaluation shall determine if receipt and storage of the enriched uranium is within the current Tank Farms nuclear criticality safety basis and what portion, if any, of the ^{235}U may be exempted from inclusion in the determination of Pu equivalents.

Note: When $^{239/240}$Pu analysis is performed the entire concentration is considered to be ^{239}Pu. In cases where Pu isotopic analysis is performed and ^{240}Pu is not counted in the Pu equivalent inventory, any ^{241}Pu present must be considered.

2.1.1 Transfers from non-Tank Farm facilities

Waste transfers into the DST system from non-Tank Farm facilities must comply with the following criticality prevention limits or a criticality safety evaluation must be completed documenting that the waste may be received and stored safely in the DST system.

Minimum pH of source waste:	$\geq$ 8.0
Minimum pH of non-radioactive chemicals or water without written approval by CSR/Alt.	$\geq$ 7.0
Maximum Pu concentration in source waste:	< 0.04 g/l.
Maximum Pu concentration in source waste without considering absorber/Pu ratio:	$\leq$ 0.001 g/l

Minimum absorber/Pu mass ratios are specified in Table 2-1.

Table 2-1. 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

If the Pu content of a single waste batch exceeds 50g, the sum of component subcritical mass fractions shall be $\geq$ 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

Requirements on pH, Pu concentration and subcritical mass ratio of neutron absorbers to Pu do not apply to transfers made between Tank Farm facilities or to transfers from the 242-A Evaporator facility during an evaporation campaign.

2.1.2 242-A Evaporator operations

Transfers involving waste staging for 242-A Evaporator feed shall meet the following limit:

Pu concentration in feed: < 0.005 g/l (0.019 g/gal)

2.1.3 Basis

The basis for nuclear criticality safety limits and controls in Tank Farms is documented in (Weiss, et al. 2001).

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 (Mulkey 2001a). 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 Criticality Safety Representative (CSR) or Alternate CSR (see Section 4.1.1). 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 Criticality Safety Evaluation Report (Weiss, et al. 2001).

2.2 SOURCE TERM CONTROLS (AC 5.8)

2.2.1 Unit Liter Dose Limits - Liquid

For transfers from non-Tank Farm facilities, Process Control shall review generator provided data to assure unit liter dose (ULD) values do not exceed the values in the following table. Instructions for completing Table 2-2 are given below.

Table 2-2. Source Term Limits for DST Liquids

DST Liquid	Concentration		Conversion	Concentration	Dose Conversion	OnSite ULD	OffSite ULD
(A) **isotope**	(B) **µCi/ml**	(C) **µCi/L**	(D) **Bq/uCi**	(E) **Bq/L**	(F) **Sv/Bq**	(G) **Sv/L**	(H) **Sv/L**
Sr^{90}			3.70E+04		3.00E-08		
Y^{90}			3.70E+04		1.70E-09		
Cs^{137}			3.70E+04		6.70E-09		
Gross alpha			3.70E+04		4.50E-05		
					Total ULD		
Total ULD must be less than or equal to allowable ULD					Allowable ULD	797	845

Instructions for Table 2-2:

1. Enter generator provided data in µCi/ml in the appropriate row of column (B) for each isotope.
2. Multiply column (B) concentration values by 1,000 and enter each product in the appropriate row of column (C).
3. Multiply column (C) by the conversion factor in column (D) and enter each product in the appropriate row of column (E).
4. Multiply the concentration in column(E) by the dose conversion in column (F) and enter each product in the appropriate row of column (G).
5. Multiply the on-site ULD values in column (G) by 1.1 and enter each product in the appropriate row of column (H).
6. Sum the values in column (G) for a Total on-site ULD and compare to the allowable on-site ULD.
7. Sum the values in column (H) for a Total off-site ULD and compare to the allowable off-site ULD.
8. If the total on-site ULD is ≤ the allowable on-site ULD **AND** the total off-site ULD is ≤ the allowable off-site ULD, the waste may be transferred. Otherwise, an evaluation must be completed by Nuclear Safety & Licensing to determine if the transfer is within Authorization Basis limits.

2.2.2 Unit Liter Dose Limits – Solid

For transfers from non-Tank Farm facilities that contain ≥ 5 % solids by volume, Process Control shall review generator provided solid phase data to assure unit liter dose (ULD) values do not exceed the values in the following table. Instructions for completing Table 2-3 are given below.

Table 2-3. Source Term Limits for DST Solids

DST Solid	Conc.	Density	Concentration		Conversion	Conc.	Dose Conversion Factor	OnSite	OffSite
(A) Isotope	(B) uCi/gm	(C) gm/ml	(D) uCi/ml	(E) uCi/L	(F) Bq/uCi	(G) Bq/L	(H) Sv/Bq	(I) ULD Sv/L	(J) ULD Sv/L
Sr90					3.70E+04		3.00E-08		
Y90					3.70E+04		1.70E-09		
Cs137					3.70E+04		6.70E-09		
G Alpha					3.70E+04		4.50E-05		
							Total ULD		
Total ULD must be less than or equal to allowable ULD							Allowable ULD	1.07E+05	1.84E+05

Instructions for Table 2-3:

1. Enter generator provided data in μCi/gm in the appropriate row of column (B) for each isotope
2. Enter generator provided data in gm/ml in the appropriate row of column (C) for each isotope
3. Multiply column (B) concentration values by column (C) values and enter each product in the appropriate row of column (D).
4. Multiply column (D) concentration values by 1,000 and enter each product in the appropriate row of column (E).
5. Multiply column (E) by the conversion factor in column (F) and enter each product in the appropriate row of column (G).
6. Multiply the concentration in column(G) by the dose conversion in column (H) and enter each product in the appropriate row of column (I).
7. Multiply the on-site ULD values in column (I) by 1.1 and enter each product in the appropriate row of column (J).
8. Sum the values in column (I) for a Total on-site ULD and compare to the allowable on-site ULD.
9. Sum the values in column (J) for a Total off-site ULD and compare to the allowable off-site ULD.
10. If the total on-site ULD is ≤ the allowable on-site ULD **AND** the total off-site ULD is ≤ the allowable off-site ULD, the waste may be transferred. Otherwise, an evaluation must be completed by Nuclear Safety & Licensing to determine if the transfer is within Authorization Basis limits.

2.2.3 Total Fraction of Risk Guide Limits

For transfers from non-Tank Farm facilities, Engineering shall review generator provided data to assure chemical total fraction of risk guide (TFRGs) do not exceed the values in the following table. Instructions for completing Table 2-4 are given below.

Table 2-4. Bounding Limits for 5 analytes form DST Liquids

	DST Liquids		**Incoming Waste Liquids**			
Analyte	(A) **FRG**	(B) **% TFRG**	(C) **Conc.**	(D) **Conversion**	(E) **FRG**	(F) **% TFRG**
		FRG	**g/l**	**factor**		**FRG**
NH3	530	4.78		74.13		
NaOH	3600	32.44		17.05		
Na	6000	54.07		28.42		
TOC	450	4.05		11.37		
U	370	3.33		34.1		
Total	11096.61	98.67			Total	

Instructions for Table 2-4:

1. Enter generator provided analyses data in the appropriate row of column (C).
2. Multiply column (C) concentration values by column (D) conversion factors and enter product in appropriate row of column (E).
3. Once all individual Fraction of Risk Guide(FRG) (column (E)) values are calculated and entered, divide each FRG (column (E)) by the total of column (A) and multiply by 100 to find the percent of Total Fraction of Risk Guide (TFRG) of the incoming waste. Enter percent value in the appropriate row of column (F).
4. If all the percentages in column (F) for the incoming waste are $\leq$ the corresponding % provided in column (B), the waste may be transferred.
5. If any of the percentages in column (F) are $\geq$ the corresponding percentage provided for that analyte in column (B), then add the values in column (F) to calculate the total percentage. If the total percentage of column (F) is $\leq$ the total percentage provided in column (B), the waste may be transferred.
6. If the total percent (column (F) of the incoming waste is $\geq$ the total percent provided in column (B), engineering must complete an engineering evaluation to determine if the source term would be violated by accepting the waste, or the waste must be adjusted by the generator to comply before transfer.

2.2.4 Basis

The bases for the waste source term controls are documented in CHG 2000e, and in Cowley, et al. 2000.

2.3 BULK CHEMICAL RUNAWAY (AC 5.12)

2.3.1 Bulk Chemical Runaway Reaction

Prior to waste transfers into the DST system, the receiving tank shall be evaluated to determine whether waste temperature controls are required to prevent a bulk chemical runaway reaction. Controls are not required if the receiving tank will meet the following conditions after transfer.

Receiver tank heat load < 21,700 W (74,000 Btu/hr)

AND

Receiver tank total organic carbon (TOC) concentration < 52 g/l (3.8 wt %).

Controls are also not required if a further evaluation performed per the method described in Meacham 1998 has determined that a bulk chemical runaway reaction is not possible.

2.3.2 Basis

The basis for bulk chemical runaway reaction is documented in CHG 2001c.

2.4 TIME TO 25% LFL DETERMINATION (AC 5.12)

2.4.1 DST Time to 25% LFL

Prior to any planned waste transfer/addition to any DST, it must be verified that the minimum time to reach 25% of the lower flammability limit (LFL) for the tank vapor space, assuming loss of the primary tank ventilation, will remain greater than 7 days, using the methodology specified in HNF-SD-WM-CN-117 (Hu, et al. 1997).

2.4.2 Basis

The bases for the DST LFL determination is documented in CHG 2001c.

2.5 DST AND AWF WASTE CHEMISTRY (AC 5.15)

The final state of source and receiver DSTs or Aging Waste Facility (AWF) tanks must be evaluated for compliance with tank chemistry controls. If a DST or AWF tank is identified to be outside of tank chemistry control limits, Recovery Actions as specified in AC 5.15 must be followed.

2.5.1 DST and AWF Waste Chemistry Controls

The receipt or transfer of waste that does not meet chemistry control limits can occur only if the receiving DST or AWF tank will remain within specification limits after the transfer or as part of actions for the mitigation of out-of-specification waste. Waste chemistry control limits for DSTs and specific limits for AWF tanks are given in Table 5-2.

Waste may be adjusted to meet waste chemistry control limits at the 204-AR Waste Unloading Facility.

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 DST or AWF tank within waste chemistry control limits. Necessary chemical additions, if any, must be made to ensure the receiving DST or AWF tank is maintained within tank waste chemistry limits.

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

DST and AWF tank waste chemistry controls are given in Table 2-5.

2.5.2 Basis

Tank waste chemistry control basis and requirement are documented in Administrative Control 5.15 (CHG 2000a).

2.5.3 DST and AWF Waste Chemistry Limits

Table 2-5. DST and AWF Tank Waste Chemistry Limits.

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

* Waste temperature in the DSTs and AWF tanks is limited to ≤ 195 °F in the top 15 ft of the WASTE and ≤ 215 °F in the WASTE below 15 ft.

3.0 SAFETY DECISION RULES

3.1 FLAMMABLE GAS CONTROLS

3.1.1 Flammable Gas Generation/Retention

The tank weighted mean specific gravity (SpG) for commingled waste in the receiver DST must be ≤ 1.41 after the transfer. If the weighted mean SpG will be > 1.41, the transfer must be evaluated on a case-by-case basis to determine the potential of the commingled waste to trap gas.

After transfer, the product of the non-convective waste (solids) height in inches and the specific gravity of convective waste (supernate) shall remain < 148 for the DST receiver tank. Otherwise, the transfer must be evaluated on a case-by-case basis for potential to trap gas.

The non-convective waste height may be obtained from the most recent Process Engineering DST Waste Inventory, or from the most recent Waste Tank Summary Report (HNF-EP-0182, Rev. XXX).

3.1.2 Basis

The basis for maintaining the tank SpG ≤ 1.41 is documented in Reynolds 1994.

The basis for the product of the non-convective waste and specific gravity of convective waste is documented in Mulkey, et al. 1999.

3.2 ORGANICS/ENERGETIC REACTIONS

3.2.1 Total Fuel Concentration

Source Waste Maximum Total Fuel Concentration: 480 joules/g

If free water < 20 wt.%, TOC(dry basis) $< 4.5 + 0.17 *$ (wt.% free water)

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

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. As a minimum the evaluation must address Authorization Basis compliance, regulatory impacts and RPP programmatic impacts.

Written documentation of evaluation must be approved by RPP Process Engineering, Environmental Management Services, and Nuclear Safety & Licensing.

3.2.3 Basis

The total fuel concentration limit is set for compliance with CHG 2000b and the basis for the free water criterion is documented in Meacham 1998.

The Basis for screening out wastes with a net exotherm is documented in Mulkey, et al. 1999.

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 DCRT CORROSION PREVENTION

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 Section 3.3.2.

Waste must meet the 204-AR Facility corrosion prevention limits prior to transfer into the facility. Corrosion prevention limits for the 204-AR Facility are given in Section 3.3.3.

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.

3.3.2 DCRT Waste Composition Limits

For WASTE temperatures $\leq$ 100°C (212°F):

Variable	Specification Limit
For $[NO_3^-] \leq 1.0\underline{M}$:	
$[OH^-]$	$0.010\underline{M} \leq [OH^-] \leq 5.0\underline{M}$
$[NO_2^-]$	$0.011\underline{M} \leq [NO_2^-] \leq 5.5\underline{M}$

For WASTE temperatures below 75°C (167°F), the $[OH^-]$ limit is $8.0\underline{M}$

For $1.0\underline{M} < [NO_3^-] \leq 3.0\underline{M}$:	
$[OH^-]$	$0.1\ [NO_3^-] \leq OH^- < 10\underline{M}$
$[OH^-] + [NO_2^-]$	$\geq 0.4\ [NO_3^-]$
For $[NO_3^-] > 3.0\underline{M}$:	
$[OH^-]$	$0.3\underline{M} \leq [OH^-] < 10\underline{M}$
$[OH^-] + [NO_2^-]$	$\geq 1.2\underline{M}$
$[NO_3^-]$	$\leq 5.5\underline{M}$

3.3.3 204-AR Facility Limits

- $7 < pH < 14$ $\{10^{-7} < [OH^-] < 0.1\ \underline{M}\}$
- $[Cl^-] < 0.035\ \underline{M}$ (tank trailer)

3.3.4 Basis

The basis for the DCRT corrosion prevention specification limits is documented in CHG 2001b.

The basis for 204-AR Facility corrosion prevention specification limits is documented in CHG 2000c.

4.0 REGULATORY DECISION RULES

4.1 WASTE ANALYSIS PLAN REQUIREMENTS

4.1.1 Waste Stream Profile Sheet

A completed, current Waste Stream Profile Sheet (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) (Mulkey 2001a). 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 assure the assumptions of the Tank Farms Criticality Safety Evaluation Report (Weiss, et al. 2001) are protected, each new or revised WSPS from a non-Tank Farms waste generator shall be reviewed by the Tank Farms CSR or the Tank Farms Alternate CSR. 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 1.3.1. This is not required for Tank Farm facility transfers.

4.1.2 Basis

The basis for the WSPS is documented in Mulkey 2001a.

4.1.3 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 4-1 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.

Table 4-1. Waste Reactivity Group Compatibility Matrix

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

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,P	4
5	Aldehydes	H,F	H,F	H,P		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	Carbonates	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,P			H,F	H,I		H,P,I	H,I	U						18
19	Ketones	H	H,F						H,I		H	H								19
20	Mercaptans and Other Organic Sulfides	T,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 mouldings, 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	Nitriles	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,P	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, Phosphothionates, Phosphodithionates	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,P	H,P	H,P	H,P	U		H,P	H,P		H,P	H,P	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	P,H	P,H						P,H		P,H	P,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,E,T	H,F,T	H,F	H,F		H,F	H,T	H,F,T	H,F	H,F,T	H,F,E	H,P,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
		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

4.1.4 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 PCB criteria.

4.1.4.1 Criteria For Wastes From Non-Tank Farms Sources

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

Waste entering the DST system from non-tank farm sources that contains PCBs must be able to demonstrate that the waste is not subject to 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 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 $\leq$ 0.29 ppm 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 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.

4.1.4.2 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 Section 4.0.

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 "Interim Basis for PCB Sampling and Analyses" (Banning 2001) and in individual Tank Sampling and Analysis Plans (TSAP).

4.1.5 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 Mulkey 2001b.

5.0 PROGRAMMATIC DECISION RULES

5.1 WASTE FEED DELIVERY

5.1.1 Configuration Control

No waste is to be added to the following tanks without prior written approval from the ORP Assistant Manager for System Acquisition. Written requests to transfer waste into these tanks shall include, at a minimum: (1) tank the waste is transferred from (source), (2) waste description (i.e., waste type and any chemical analysis), 3) volume of transfer by waste type, 4) description of all other options considered, and 5) reason for selecting the preferred option.

Table 5-1. Tank Usage Restrictions

Tank	Tank
241-AN-102	241-AW-101
241-AN-103	241-AW-103
241-AN-104	241-AY-101[1]
241-AN-105	241-AY-102
241-AN-107	241-AZ-101
241-AP-101	241-AZ-102
241-AP-104	241-SY-103

Notes:

1. Tank 241-C-104 waste may be added to tank 241-AY-101

5.1.2 Basis

The bases for DST tank waste transfer restrictions are documented in Boston 2000.

5.2 WASTE FEED ENVELOPE

5.2.1 Envelope A specification limits

To the extent practical, retrieval and storage of liquids in DSTs shall be performed such that the stored waste meets the following limits;

- The TOC in the waste is less than Envelope A specification limit, currently 0.5 moles of TOC per mole of Na

- The concentration of Sr^{90} is less than the Envelope A specification limit, currently 4.4E+07 Becquerels (Bq) per mole of Na.

- The concentration of TRU is less than the Envelope A specification limit, currently, 4.8E+05 Bq per mole of Na.

- Complexed concentrate (CC) waste should be stored with other CC waste if practical.

5.2.2 Basis

The basis for feed Envelope screening is documented in Kinzer 1998.

5.3 WASTE INVENTORY CONTROL GROUP APPROVAL

Transfers into and within the DST system must be approved by voting members of the DST Waste Inventory Control Group (WIC).

5.3.1 Basis

The DST WIC reviews proposed waste transfers and discusses technical issues affecting the waste inventory in the tank farms. Approval by the WIC ensures that Operations, Waste Feed Delivery, Process Engineering and Environmental concerns associated with a particular waste transfer that are not routinely addressed in a WCA are addressed prior to transfer.

6.0 OPERATIONAL DECISION RULES

6.1 HEAT LOAD

The sum of the receiving tank waste and the source waste heat generation rates (usually estimated from the mean Sr^{90} and Cs^{137} concentrations) must remain $\leq$ the limit for the receiving tank. The limits for tanks are given in Table 6-1.

Table 6-1 Tank Farm Heat Generation Rate Limits

Tank Farm	Max. Heat Gen. Rate Per Tank (Btu/hr)
241-AN 241-AP 241-AW	70,000
241-AY 241-AZ	4,000,000
241-SY	50,000

6.1.1 Basis

The heat generation rate in tanks is limited to prevent localized boiling from occurring. The ventilating systems for the 241-AN, -AP, -AW and -SY Tank Farms were not designed for boiling, which could cause a release of contamination should it occur. The heat content limit for the 241-SY Tank Farm is based on a design criterion that is more restrictive than the point at which internal boiling occurs.

Ventilation systems for the 241-AY and –AZ Tank Farms are designed for boiling. The 4,000,000 BTU/hr per tank limit is a maximum anticipated heat load, on which other design analyses have been based.

6.2 AWF SODIUM (5 MOLAR RULE)

Maximum sodium concentration in AWF tanks

Tank 101-AZ:	5.5 moles/L (M)*
Other AWF tanks:	5.0 M

* Through concentration of wastes already stored in the tank

6.2.1 Basis:

The basis for the 5 molar sodium rule is documented in CHG 2000d.

6.3 PHOSPHATE WASTE

Waste with a phosphate concentration, $[PO_4^{-3}]$, > 0.1 M, is not to be mixed with:

- waste with sodium concentration, $[Na^+]$, > 8 M
- neutralized cladding removal waste (NCRW).

6.3.1 Basis

The basis for the phosphate waste segregation rule is documented in Herting 1987; and in Herting and Patterson 1982.

6.4 LINE PLUGGING

For waste streams with < 5% solids by volume and a SpG ≤ 1.35 no evaluation is required.

For saltwell pumping of SSTs, line plugging has been evaluated in Kirch 1999. Alternative or additional 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 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.

6.4.1 Basis

The basis for the line plugging decision rule is documented in Estey 1998.

6.5 WASTE SEGREGATION

6.5.1 Waste Segregation

To the extent practicable, complexed wastes shall be segregated from non-complexed wastes in the DST system. However, if complexed waste is to be commingled with non-complexed waste, evaluate waste volume reduction effects of mixing. Complexed status of a waste is determined by one of the following methods:

- Use of the PREDICT model (Allison 1984) to estimate TOC concentration at DSSF composition showing [TOC] $\leq$ 10 g/L indicates that the waste is non-complexed.
- If concentration of the waste exhibits a rapid viscosity increase upon crystallization or the formation of small non-settling crystals the waste is complexed.
- Complexed status of DST wastes may be obtained from the most recent DST Waste Inventory from Process Engineering, Flowsheet & Inventory.
- Complexed status of SST wastes may be obtained from the most recent Waste Tank Summary Report (HNF-EP-0182, Rev. XXX).

To the extent practicable, complexed wastes shall be segregated from transuranic (TRU) wastes[2] in the DST system. However, if complexed waste is to be commingled with TRU waste, evaluate whether additional TRU waste will be created as a result.

To the extent practicable, TRU wastes shall be segregated from non-TRU wastes in the DST system. However, if TRU waste is to be commingled with non-TRU waste, evaluate whether additional TRU waste will be created as a result.

6.5.2 Basis

Mixing of complexed with non-complexed waste has been authorized by DOE (Kinzer 1998). However, segregation of complexed wastes enables them to be stored with a high water content, nominally > 50% water. A complexed waste is concentrated only to the saturation level of the major soluble salt (normally a nitrate), and formation of solid crystals is avoided. When complexed waste is concentrated it exhibits a rapid viscosity increase upon crystallization or formation of small non-settling crystals upon concentration. A thick gel-like waste matrix with the consistency of petroleum jelly may be formed.

Although ORP has agreed that in-tank TRU waste can be adequately managed under the High-Level Waste provisions of DOE Order 5820.2A (Kinzer 1997), efforts are maintained to avoid forming organic-TRU complexes in the liquid phase. Dissolving precipitated TRU constituents increases the mobility of TRU in the DST system.

[2] TRU waste contains a TRU concentration $\geq$ 100 ηCi/g at time of analysis

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APPENDIX A

WASTE COMPATIBILITY COMPLIANCE TABLE Source Waste with Receiver Tank Waste		
CRITERIA	**PROGRAM REQUIREMENT**	**COMPLIANCE STATUS**
AC IMPLEMENTATION CRITERIA		
Criticality (Pu = plutonium equivalent) (Evaluate non-TF source pre-transfer)	Uranium enrichment ≤ 1.03 and pH ≥ 8 Pu ≤ 0.001 g/l, or 0.001 g/l < Pu < 0.04 g/l, pH ≥ 8, and at least one X/Pu > the corresponding ratio in HNF-SD-WM-OCD-015, Table 2-1 242-A Evaporator feed Pu < 0.005 g/l If Pu content > 50g in a single batch, sum of component subcritical mass fractions ≥ 2	
Disposition (HNF-SD-WM-OCD-015, Section 2.1):		
Radiological Source Term Controls – DST Liquids (Evaluate non-TF source pre- transfer)	Non-tank farm facility waste: Total OnSite and OffSite ULD ≤ limit in HNF-SD-WM-OCD-015, Table 2-2.	
Disposition (HNF-SD-WM-OCD-015, Section 2.2.1):		
Radiological Source Term Controls – DST Solids (Evaluate non-TF source pre-transfer)	Non-tank farm facility waste: Total OnSite and OffSite ULD ≤ limit in HNF-SD-WM-OCD-015, Table 2-3.	
Disposition (HNF-SD-WM-OCD-015, Section 2.2.2):		
Toxic Chemical Source Term Controls (Evaluate non-TF source pre-transfer)	Non-tank farm facility waste: NH_3^- < 4.78% of Total Fraction of Risk Guide (TFRG), NaOH < 32.44% of TFRG, Na^+ < 54.07% of TFRG, TOC – Oxalate < 4.05% of TFRG, U < 3.33% of TFRG. If one parameter exceeds specified TFRG %, then total of TFRGs must be < 98.67%	
Disposition (HNF-SD-WM-OCD-015, Section 2.2.3):		
Bulk Chemical Runaway Reaction (Evaluate receiver post-transfer)	Receiving tank end state heat load < 74,000 Btu/hr <u>and</u> TOC < 52 g/l (3.8 wt%) OR If further evaluation per method in HNF-3588 determines that a bulk chemical runaway is not possible	
Disposition (HNF-SD-WM-OCD-015, Section 2.3):		
Tank Time to LFL Determination (Evaluate receiver post-transfer)	DST and AWF: minimum time to reach 25% of LFL for tank vapor space will remain ≥7 days, assuming loss of primary tank ventilation.	
Disposition (HNF-SD-WM-OCD-015, Section 2.4):		

WASTE COMPATIBILITY COMPLIANCE TABLE Source Waste with Receiver Tank Waste		
CRITERIA	**PROGRAM REQUIREMENT**	**COMPLIANCE STATUS**
DST Waste Chemistry (Evaluate source and receiver post-transfer)	$[NO_3^-] \leq 1M$, $0.01M \leq [OH^-] \leq 8M$, $0.011 \leq [NO_2^-] \leq 5.5M$, $[NO_3^-]/([OH^-] + [NO_2^-]) < 2.5$; If $0.01M < [OH^-] < 0.015M$ and/or $0.011M < [NO_2^-] < 0.015M$, then check RSD. $1.0 < [NO_3^-] \leq 3.0M$, $0.1 \times [NO_3^-] \leq [OH^-] < 10M$, $[OH^-] + [NO_2^-] \geq 0.4 \times [NO_3^-]$ $[NO_3^-] > 3.0M$, $0.3M \leq [OH^-]$ 10M, $[OH^-] + [NO_2^-] \geq 1.2M$, $[NO_3^-] \leq 5.5M$	
Disposition (HNF-SD-WM-OCD-015, Section 2.5):		
SAFETY CRITERIA		
Flammable Gas (Evaluate receiver post-transfer)	(Solids depth (in.) x convective SpG) < 148 If source waste SpG > 1.41, receiver tank average SpG ≤ 1.41 after transfer	
Disposition (HNF-SD-WM-OCD-015, Section 3.1):		
Organic and Energetic Reaction (Evaluate source pre-transfer)	Source Exotherm/Endotherm < 1.0; No separable organic layer Maximum Exotherm = 480 joules/gram If free water < 20%, TOC (dry) < 4.5 + 0.17 (wt% free water)	
Disposition (HNF-SD-WM-OCD-015, Section 3.2):		
DCRT Corrosion Control (Evaluate receiver post-transfer)	$[NO_3^-] \leq 1M$, $0.01M \leq [OH^-] \leq 8M$, $0.011 \leq [NO_2^-] \leq 5.5M$, If $0.01M < [OH^-] < 0.015M$ and/or $0.011M < [NO_2^-] < 0.015M$, then check RSD. $1.0 < [NO_3^-] \leq 3.0M$, $0.1 \times [NO_3^-] \leq [OH^-] < 10M$, $[OH^-] + [NO_2^-] \geq 0.4 \times [NO_3^-]$ $[NO_3^-] > 3.0M$, $0.3M \leq [OH^-]$ 10M, $[OH^-] + [NO_2^-] \geq 1.2M$, $[NO_3^-] \leq 5.5M$	
Disposition (HNF-SD-WM-OCD-015, Section 3.3):		
REGULATORY CRITERIA		
Current WSPS (Evaluate source pre-transfer)	Source Waste from outside the DST System must have a current WSPS on file. New/Revised WSPS reviewed by CSR/Alternate (Non-Tank Farms facility waste streams only)	
Disposition (HNF-SD-WM-OCD-015, Section 4.1.1):		

WASTE COMPATIBILITY COMPLIANCE TABLE Source Waste with Receiver Tank Waste		
CRITERIA	**PROGRAM REQUIREMENT**	**COMPLIANCE STATUS**
Chemical Compatibility (Evaluate source and receiver pre-transfer)	Identify potential hazards for mixing wastes in specific reactivity groups (HNF-SD-WM-OCD-015, Fig. 4-1)	
Disposition (HNF-SD-WM-OCD-015, Section 4.1.3):		
PCB Management (Evaluate source pre-transfer and receiver post-transfer)	If any PCB detected: non-TF waste must be designated as PCB Remediation, Analytical or R&D (see definition requirements in HNF-SD-WM-OCD-015, Section 4.1.4.1) Separate phase analysis required if ≥ 0.5 wt % solids in non-TF source. Non-TF source [PCB]: solids ≤ 450 ppm (dry wt. basis) and liquid ≤ 2.9 ppm Receiver [PCB] must remain: ≤ 50 ppm in solids and ≤ 2.9 ppm in liquid	
Disposition (HNF-SD-WM-OCD-015, Section 4.1.4):		
PROGRAMMATIC CRITERIA		
Configuration Control (Evaluate source and receiver pre-transfer)	Maintain transfers consistent with restrictions given in Table 5-1.	
Disposition (HNF-SD-WM-OCD-015, Section 5.1):		
Waste Feed Envelope (Evaluate source pre-transfer and receiver post-transfer)	Envelope A: < 0.5 moles of organic carbon per mole of sodium; < 4.4E7 Becquerels (Bq) Sr^{90} per mole sodium; < 4.8E5 Bq TRU per mole sodium; Complexed concentrate (CC) stored with other CC waste.	
Disposition (HNF-SD-WM-OCD-015, Section 5.2):		
WIC Group Approval	All waste transfers require WIC Group approval.	
Disposition (HNF-SD-WM-OCD-015, Section 5.3):		
OPERATIONAL CRITERIA		
Heat Generation Rate (Evaluate receiver post-transfer)	AN, AP & AW tanks ≤ 70,000 Btu/hr; SY tanks ≤ 50,000 Btu/hr; AY & AZ tanks ≤ 4,000,000 Btu/hr.	
Disposition (HNF-SD-WM-OCD-015, Section 6.1):		

WASTE COMPATIBILITY COMPLIANCE TABLE Source Waste with Receiver Tank Waste		
CRITERIA	**PROGRAM REQUIREMENT**	**COMPLIANCE STATUS**
AWF 5 Molar Sodium Rule (Evaluate receiver post-transfer)	Max. $[Na^+] = 5.0$ M in AWF tanks	
Disposition (HNF-SD-WM-OCD-015, Section 6.2):		
Phosphate Waste (Evaluate source and receiver pre-transfer)	High phosphate waste ($[PO_4^{-3}] > 0.1$M) not to be mixed with high salt waste ($[Na^+] > 8.0$M).	
Disposition (HNF-SD-WM-OCD-015, Section 6.3):		
Line Plugging (Evaluate source pre-transfer)	< 5 volume % solids and SpG $\leq$ 1.35 or evaluation necessary	
Disposition (HNF-SD-WM-OCD-015, Section 6.4):		
Waste Segregation (Evaluate source and receiver pre-transfer)	Segregate complexed from non-complexed and from TRU wastes to minimize creation of additional TRU waste and minimize adverse impacts to waste volume reduction	
Disposition (HNF-SD-WM-OCD-015, Section 6.5):		

APPENDIX B

Tank Farms Compatibility Program Analytes and Requirements Summary		
Analyte	**Tank Farm Waste Requirement**	**Non-Tank Farm Waste Requirement**
Pu^{239}	Feed Env. (if no TA) Segregation (if no TA) Inventory	Crit.; Segregation
U^{233}	Inventory (if no Total U)	Crit.
U^{235}	Inventory (if no Total U)	Crit.
Total U	Inventory (If no U^{233} and U^{235})	TFRG,
Sr^{90}	Heat load (DST TT LFL) Feed Env.	Source Term, Feed Env. Heat load (DST TT LFL)
Cs^{137}	Heat load (DST TT LFL)	Source Term, Heat load (DST TT LFL)
Am^{241}	Feed Env. (if no TA) Segregation (if no TA)	Segregation
PCBs (Aroclors 1016, 1221, 1232, 1242, 1248, 1254 and 1260	Inventory (if no credible PCB estimate or other inventory control is available)	Inventory
NH_3	None	TFRG
NaOH	None	TFRG
Na	Feed Env. Phosphate Rule AWF transfers	TFRG; Feed Env. Phosphate Rule AWF transfers
TOC	DST TT LFL Feed Env.	TFRG; DST TT LFL Feed Env.
Oxalate	None	TFRG (subtract from TOC if necessary)
NO_2	Corrosion; DST TT LFL	Corrosion; DST TT LFL
NO_3	Corrosion; DST TT LFL	Corrosion; DST TT LFL
Al	DST TT LFL	DST TT LFL
SpG	DST TT LFL Flam Gas Retention	DST TT LFL Flam Gas Retention
$\%H_2O$	DST TT LFL	DST TT LFL
DSC	Energetics Screen	Energetics Screen
Separable Organic	Organic Screen	Organic Screen
OH	Corrosion	Corrosion
pH	Crit.	Crit.

Tank Farms Compatibility Program Analytes and Requirements Summary		
Analyte	**Tank Farm Waste Requirement**	**Non-Tank Farm Waste Requirement**
Total Alpha (TA)	Feed Env. (if no Am^{241}, Pu^{239}) Segregation (if no Am^{241}, Pu^{239})	Feed Env., Source Term Segregation
PO_4	Phosphate Rule PREDICT input (if needed)	Phosphate Rule PREDICT input (if needed)
F	PREDICT input (if needed)	PREDICT input (if needed)
SO_4	PREDICT input (if needed)	PREDICT input (if needed)
Cl	Corrosion (through 204-AR)	Corrosion (through 204-AR)
Cr	None	Absorber Ratio (if needed)
Fe	None	Absorber Ratio (if needed)
Ni	None	Absorber Ratio (if needed)
Mn	None	Absorber Ratio (if needed)

TT LFL = Time to 25% LFL determination