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# Engineering Basis Document Review for Waste Feed Delivery from Single-Shell Tanks

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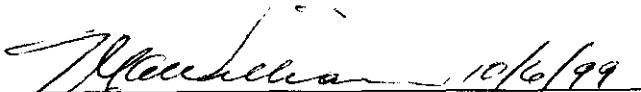
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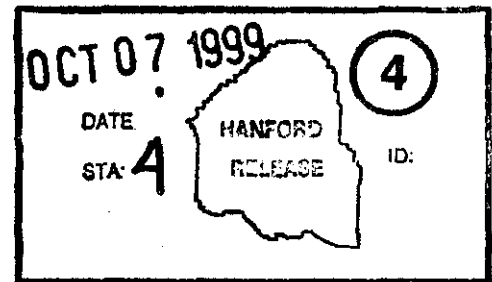
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**Abstract:** This report provides the results of a review conducted on existing operating specifications and safety requirements and provides a summary of applicable design constraints on the Single-Shell Tank System for Waste Feed Delivery.

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**ENGINEERING BASIS DOCUMENT REVIEW FOR  
WASTE FEED DELIVERY FROM  
SINGLE-SHELL TANKS**

September 1999

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**LIST OF TERMS**

DST	Double-shell tank
NFPA	National Fire Protection Association
OSD	Operational Specification Documents
PHMC	Project Hanford Management Contract
SST	Single-shell tank
TSR	Technical Safety Requirements
TWRS	Tank Waste Remediation System
WFD	Waste Feed Delivery

## **ENGINEERING BASIS DOCUMENT REVIEW SUPPORTING THE SINGLE-SHELL TANK SYSTEM SPECIFICATION DEVELOPMENT FOR WASTE FEED DELIVERY**

### **1.0 INTRODUCTION**

This report provides the results of a review conducted on existing operating specifications and safety requirements and provides a summary of applicable design constraints on the Single-Shell Tank (SST) System. The SST System is required to transition from the current waste storage mission to support the Tank Waste Remediation System (TWRS) waste retrieval mission described in the *Tank Waste Remediation System Mission Analysis Report* (Acree 1998). The SST System is also required to support the Project Hanford Management Contract (PHMC) portions of the Waste Feed Delivery (WFD) mission. In Phase 1 the SST System will be required to retrieve waste from selected SSTs (tanks 241-C-102 and 241-C-104) for transfer to the Double-Shell Tank (DST) System (tanks 241-AZ-101, 241-AY-102).

The SST System will include all the systems, structures and components required to safely store, retrieve, and transfer waste in support of the TWRS mission. Operational Specification Documents (OSDs) govern operation of the existing SST System components. However, the system will be highly modified to support the TWRS mission. Therefore OSD requirements may not apply to the new system's design. This document describes the review of existing SST OSDs and provides the rationale for selecting or rejecting requirements as constraints on the SST System design. The selected requirements (or design constraints) will be included in *System Specification for the Single-Shell Tank System*, HNF-3912 (Conrads 1999).

### **2.0 SCREENING PROCESS**

The screening process goal was to capture limits driven by existing 241-C-102/241-C-104 SST subsystem designs, which necessarily constrain SST WFD System designs for Phase 1. The screening process outlined in *Engineering Basis Document Review Supporting the DST System Specification Development*, HNF-3350 (DeLamare 1998) was used with minimal changes to allow for the different systems and system missions. The requirements need to be appropriate for a system-level specification in order to avoid unnecessarily restricting design solutions. OSDs were selected as the primary targets for screening. Table 1 lists the documents that were screened. The *Tank Waste Remediation System Technical Safety Requirements*, HNF-SD-WM-TSR-006, was considered the appropriate reference containing the applicable requirements from the *Tank Waste Remediation System Basis for Interim Operation*, HNF-SD-WM-BIO-001.

Table 1. Engineering Documents Screened for Single-Shell Tank System Constraints.

Number	Title
OSD-T-151-00013, Rev D-16	Operating Specifications for Single-Shell Waste Storage Tanks
OSD-T-151-00031, Rev C-0	Operating Specifications for Tank Farm Leak Detection and Single Shell Tank Intrusion Detection
HNF-SD-WM-TSR-006, Rev 0-S	Tank Waste Remediation System Technical Safety Requirements

Table 2. Criteria for Applicability to the Single-Shell Tank System Specification.

1. The requirement applies to the design of the SST System or subsystem; and
2. The requirement is established for the purpose of system/equipment protection, or defines a SST System level requirement; and
3. The requirement specifically addresses tank structure or another element which cannot/will not be changed to support the TWRS mission; and
4. The requirement value will be unaffected even if active control measures are applied; and
5. The Waste Feed Delivery mission scenarios are not expected to invalidate the relevance of the requirement; and
6. There is not a higher level requirement applicable to the SST system which takes precedence over the requirement in question or from which this requirement can be derived.

### 3.0 CRITERIA

The criteria in Table 2 above will be applied to each requirement to determine its relevance. If a requirement fails *any* of the criteria, it will be rejected from incorporation into the SST System specification. Each criterion that a given requirement fails will be identified in the results. Each criterion is discussed in more detail below.

Criterion 1: *The requirement applies to the design of the SST System or subsystem.*

This criterion will cull requirements that either do not apply to the SST System or apply to non-design aspects of the system. For example, a requirement that governs excavation in the SST Farms would be rejected since it applies to construction of new items rather than the system behavior or required physical limits. Likewise, requirements reflecting operational preferences or administrative limits would also be rejected on this basis.



Criterion 2: *The requirement is established for the purpose of system/equipment protection, or defines a SST System level requirement.*

This criterion will cull all requirements which either do not apply to the SST System as a whole, or do not apply to a SST subsystem for the expressed purpose of equipment protection. (Note: equipment protection requirements are established to protect the equipment from accidental/processing damage during its operational phase, and are a separate concern from requirements intended to protect the system from potential threats or to protect personnel, the public or the environment). Demanding that a requirement apply to the whole system described by a specification (without preconceived ideas of sub-tier architecture) is good systems engineering practice which helps ensure system optimization, supports traceability of decisions, and precludes unnecessary constraints on architectural solutions and operational flexibility. One question that helps bring this issue into focus is, "If we were building the SST System today and knew nothing about its configuration other than that it contains underground storage tanks arranged in the current tank farm configuration, would we specify this requirement?" Alternately, the team could ask if the requirement helps define the SST System functional requirements (defined by the SST Functional Flow Block Diagrams, HNF-2826 [Leonard et al. 1998]) or system-level interface. Section 3.1 of the SST System specification will be used as a guide.

An exception can be allowed for requirements that protect existing subsystems. This part of the criteria recognized that there are existing SST subsystems that must be used to accomplish the Phase 1 mission, and that their physical designs have real limits. This part of the criteria will be further modified by Criterion 3.

Criterion 3: *The requirement specifically addresses tank structure or another element which cannot/will not be changed to support the Phase 1 mission.*

This criterion preserves only those requirements which apply to subsystems which can't be changed, even if it were needed. Examples of these are the SST structural and material designs. The SSTs are made of carbon steel and cannot be changed. The SST tank structure is designed to specific codes and standards. These specific design attributes cannot be changed or modified and thus are considered immutable for the purpose of this screening. They will drive system design considerations. Other immutable attributes will be sought when performing this review. An example of requirements which fail this criteria are those which apply to the ventilation subsystem, which can be modified to suit the mission needs.

An exception can be made to allow for subsystems which won't be changed due either to factors external to TWRS or due to edict.

*Criterion 4: The requirement value will be unaffected even if active control measures are applied.*

This criterion will be used to cull existing requirements which pass the first three criteria, but can be dealt with using active system controls or operational procedures. Such requirements would unnecessarily constrain design solutions, and often are an operational means of dealing with the existing SST subsystems. They do not represent a true system level constraint since control exerted by a subsystem can resolve the issue. An example would be the requirement to maintain a minimum liquid level in the tanks to prevent uplift of the tank bottom. This requirement does protect the tank, an immutable subsystem, but the minimum liquid level can change and can be eliminated if the ventilation system (a changeable subsystem) is operated at lower levels or shut down. This particular requirement could change even to meet the need of the current storage mission. (One could also argue that this is not a design requirement and thus would also fail criteria 1).

*Criterion 5: The TWRS retrieval mission scenarios are not expected to invalidate the requirement's relevance.*

This criterion will cull requirements that are valid for today's SST mission, but would be potentially invalidated by TWRS retrieval mission scenarios. An example of this type of requirement is the requirement that water additions to a SST be limited to 500 gallons per activity with a jet pump. The addition of water (or some other liquid) to supply motive force for waste retrieval could exceed this value, depending on the design of the equipment which performs the removal function.

*Criterion 6: There is not a higher level requirement applicable to the SST system which takes precedence over the requirement in question or from which this requirement can be derived.*

This criterion will cull requirements which are applicable to the SST System, but are driven by a higher precedence requirement or a root issue that should be captured instead. An example of this type of requirement are the flammable gas and organic tank controls for SSTs. These controls do impose some design related constraints such as the use of non-sparking equipment. However, the specific requirements in the OSD are driven by higher level documents such as the National Fire Protection Association (NFPA) codes. These codes apply to system design and take precedence over the specific OSD and Technical Safety Requirements (TSR) derived from these standards.

#### 4.0 RESULTS

See the Attachment for a summary of the results in screening operating specifications for SST System constraints. Each requirement screened received an entry into a matrix that identified the requirement, its disposition as a result of screening and the rationale for the disposition.

#### 5.0 REFERENCES

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- Leonard, M. W., D. F. Smith, and M. A. DeLamare (TRW), and C. P. Shaw and C. E. Grenard (Cogema), 1998, *Single-Shell Tank System Functional Analysis*, HNF-2826, Rev. 0, TRW Systems and Information Technology Group, Richland, Washington.

LMHC, 1998, *Tank Farms Operations Administrative Controls*, HNF-IP-1266, Rev. 1, Lockheed Martin Hanford Company, Richland, Washington.

Noorani, Y. G., 1998, *Tank Waste Remediation System Technical Safety Requirements*, HNF-SD-WM-TSR-006, Rev. 0-S, Fluor Daniel Hanford, Richland, Washington.

Ramble, A. L., 1983, *Single-Shell Waste Tank Load Sensitivity Study*, SD-RE-TI-012, Rev A-0, Rockwell Hanford Operations, Richland, Washington.

RHO, 1995, *Technical Basis for Single-Shell Tank Operating Specifications*, SD-RE-TI-035, Rev. 1, Rockwell Hanford Operations, Richland, Washington.

WAC 173-303-400, "Dangerous Waste Regulations", Washington Administrative Code, Chapter 173-303.

WAC 246-247, "Radiation Protection – Air Emissions", Washington Administrative Code, Chapter 246-247.

WHC, 1996, *Acceptance of Feed Streams for Disposal and Treatment at the LERF/ETF Complex*, WHC-SD-ETF-WAC-001, Rev. 0, Westinghouse Hanford Company, Richland, Washington..

40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities", Code of Federal Regulation.

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**ATTACHMENT A**  
**REVIEW OF OSD-T-151-00013**

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OSD-T-151-00013: Operating Specifications for Single-Shell Waste Storage Tanks, Rev. D-16.

OSD Section	Title/Description	Disposition (re: SST System Spec)	Rationale										
13.2.1	Structural Limitations	N/A	Section title										
13.2.1.A	Section Deleted: Tank Chemistry	N/A. Fails criteria 5.	This requirement was deleted. The SSTs are being interim stabilized and these restrictions apply to storage of liquid waste. This requirement is no longer valid for the SST System.										
13.2.1.B	Waste Level	Applicable.	This requirement bounds the liquid waste level to preclude overflow into connected lines (see SD-RE-TI-035, <i>Technical Basis for Single-Shell Tank Operating Specifications</i> , page 12). These limits do not protect the tank structure, but rather as a system requirement for preventing overflow of waste from specific tanks. (see HNF-4712 <i>Structural Load Requirements for Maintaining Structural Integrity of Single-Shell Tanks During Waste Feed Delivery and Retrieval Activities</i> )										
			The requirements should be as follows for maximum SST Waste Level:  <table border="0"> <tr> <td><u>Tank Identification</u></td> <td><u>Waste Level Limit(max.)</u></td> </tr> <tr> <td>A, AX, SX</td> <td>360 in.</td> </tr> <tr> <td>B, C, T, U (200 series tanks)</td> <td>280 in.</td> </tr> <tr> <td>B, BX, C, T, U (100 series tanks)</td> <td>185 in.</td> </tr> <tr> <td>BY, S, TX, TY</td> <td>275 in.</td> </tr> </table>	<u>Tank Identification</u>	<u>Waste Level Limit(max.)</u>	A, AX, SX	360 in.	B, C, T, U (200 series tanks)	280 in.	B, BX, C, T, U (100 series tanks)	185 in.	BY, S, TX, TY	275 in.
<u>Tank Identification</u>	<u>Waste Level Limit(max.)</u>												
A, AX, SX	360 in.												
B, C, T, U (200 series tanks)	280 in.												
B, BX, C, T, U (100 series tanks)	185 in.												
BY, S, TX, TY	275 in.												
13.2.1.C	Section Deleted: Dome Loading	Applies, but use more complete requirement.	This requirement was deleted. This requirement applies, given the potential scenario that the SST design could potentially load (and thus overstress) the SST tank domes (see SD-RE-TI-035, <i>Technical Basis for Single-Shell Tank Operating Specifications</i> , page 4). However the requirement should, in addition to other loads as called out in HNF-IP-1266, take into account loading of the domes due to adherence of waste on existing in-tank instrumentation and the loss of buoyancy during waste removal. (see HNF-4712										



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OSD Section	Title/Description	Disposition (re: SST System Spec)	Rationale
13.2.1.D	Dome Deflection	Applicable.	<p><i>Structural Load Requirements for Maintaining Structural Integrity of Single-Shell Tanks During Waste Feed Delivery and Retrieval Activities</i></p> <p>The requirement should be as follows: The maximum loading for the SSTs shall be in accordance with HNF-IP-1266, <i>Tank Farms Operations Administrative Controls</i>.</p>
13.2.1.E	Waste Temperatures	Partially applicable.	<p>This requirement identifies a limit for tank dome deflection to prevent possible structural failure from salt cake encrustations or in-tank equipment loading of the dome upon removal of liquids from the tank (see SD-RE-TI-035, <i>Technical Basis for Single-Shell Tank Operating Specifications</i>, page 4).</p> <p>The recommended requirement is as follows: The maximum tank dome deflection shall be 0.02 ft.</p>
			<p>The basis for requirement 13.2.1.E.1 is that temperatures and temperature changes beyond these limits affect tank structural integrity (see SD-RE-TI-012, <i>Single-Shell Waste Tank Load Sensitivity Study</i>, page 18). In reviewing SD-RE-TI-012 design limits, it was noted that the basis for the thermal limits appears weak and should be re-examined (see HNF-4712 <i>Structural Load Requirements for Maintaining Structural Integrity of Single-Shell Tanks During Waste Feed Delivery and Retrieval Activities</i>).</p> <p>Recommend that temperature limits be applied to SST specification as stated within the OSD to satisfy 13.2.1.E and 13.2.1.G as follows;</p>

OSD-T-151-00013: Operating Specifications for Single-Shell Waste Storage Tanks, Rev. D-16.

OSD Section	Title/Description	Disposition (re: SST System Spec)	Rationale
			<p><u>SST Temperatures</u>      <u>Specification Limit</u></p> <ul style="list-style-type: none"> <li>- Maximum 300 °F for waste</li> <li>- Maximum 250 °F for dome</li> <li>- Maximum change 3 °F/day for bulk waste temperature conditions in the tank.</li> </ul> <p>Section 13.2.1.E.2 requirement to install thermocouple trees in any SST that has a heat load greater than 40,000 Btu/hr is a design solution rather than a constraint on the design and is therefore not applicable.</p>
13.2.1.F	Vapor Pressure	Partially applicable.	<p>The basis for this requirement is to limit pressures to prevent structural damage due to excess tension or compression in the tank structure, specifically the tank bottom liner or the tank dome for section 13.2.1.F.1 (see SD-RE-TI-035, Technical Bases for Single-Shell Tank Operating Specifications, pages 15-17). Although the reference allows a pressure range from -15 to +130 in. w.g., the more conservative original limit on the upper end at +60 in. w.g. allows for variations in soil depth above the tank. The lower limit of -15 in. w.g. applies as long as liquid remains in the tank at levels of 15 inches or higher, however the net pressure on the bottom of the tank must remain not be negative to prevent buckling of the tank bottom. (see HNF-4712 <i>Structural Load Requirements for Maintaining Structural Integrity of Single-Shell Tanks During Waste Feed Delivery and Retrieval Activities</i>)</p> <p>Recommend that specific limits for tank pressure be applied to the SST specification as follows for OSD section 13.2.1.F.1:</p>

OSD-T-151-00013: Operating Specifications for Single-Shell Waste Storage Tanks, Rev. D-16.

OSD Section	Title/Description	Disposition (re: SST System Spec)	Rationale
13.2.1.G	Active Ventilation	N/A. Fails criteria 3 and 6.	<p><u>Variable</u> 1) Pressure</p> <p><u>Specification Limit</u> Maximum pressure of +60 in. w.g. Minimum pressure of -15 in. w.g. with a minimum of 15 inches of liquid remaining in the tank. Minimum pressure shall be greater than or equal to 0 in. w.g. for all times when the height of the liquid waste is less than 15 inches.  Subsections 13.2.1.F.2 and 13.2.1.F.3 are design solutions which fail criteria 2 and 3 and therefore not applicable as constraints on the design.</p>
13.2.2	RADIOLOGICAL CONTAINMENT REQUIREMENTS	N/A	<p>This can be changed to support the Phase 1 mission. Active ventilation is maintained (on some tanks) to ensure that the waste temperature is maintained below the specification limit. This is a design solution, for limiting waste temperatures to prevent structural damage due to thermal stresses in the tank structure (see SD-RE-TI-012, <u>Single-Shell Waste Tank Loading Sensitivity</u>, page 18). The system requirements are the same as those stated in 13.2.1.F above. The requirements for temperature limits for waste temperatures are already addressed by OSD requirement 13.2.1.E above.</p> <p>Section title</p>
13.2.2.A	Section Deleted: Waste Liquid Effluent Concentration	N/A. Fails criteria 6. However, this requirement points to a higher level need. Therefore, specify the	Liquid effluent concentration requirements are captured by reference to WHC-SD-ETF-WAC-001 as providing the constraints for liquid effluent destined for the ETF.

OSD-T-151-00013: Operating Specifications for Single-Shell Waste Storage Tanks, Rev. D-16.

OSD Section	Title/Description	Disposition (re: SST System Spec)	Rationale
		upper level requirement.	The SST requirement should be as follows: The system shall comply with the liquid effluent physical, chemical and radionuclide concentration limit requirements given in WHC-SD-ETF-WAC-001, Rev. 0, <i>Acceptance Criteria of Feed Streams for Treatment at the LERF/ETF Complex</i> when discharging liquid effluents to the Liquid Effluent Retention Facility (LERF) or the Effluent Treatment Facility (ETF).
13.2.2.B	Gaseous Effluents Concentrations	N/A. Fails criteria 6. Specify the upper level requirement.	This design constraint is based on by the requirements of WHC-CM-7-5, <i>Environmental Compliance Manual</i> , Appendix). This document is replaced by WAC 173-303-400, 40 CFR 265, and HNF-PRO-2595 (for Non-radioactive Airborne Emissions) and WAC 246-247 (for Radioactive Airborne Emissions).
13.2.2.C	Section Deleted: Active Ventilation Shutdown	N/A. Fails criteria 1.	The previous requirement for Active Ventilation Shutdown. This fails criteria 1 since it is not a design requirement.
13.2.2.D	Gaseous Effluent Filtration	N/A. Fails criteria 2, 3 and 6. Specify the upper level requirement.	This requirement is handled by the requirements of HNF-PRO-2595. See 13.2.2.B above for requirements.
13.2.2.E	Filter Differential Pressure	N/A. Fails criteria 3.	This requirement could change if the ventilation system is changed to include a new HEPA filter vendor. Also, ventilation systems are below the level of concern for the SST System specification.
13.2.2.F	HEPA Filter Temperature	N/A. Fails criteria 3.	As noted above (OSD-0013, 13.2.2.D), this requirement could change with a change in the ventilation system.
13.2.2.G	HEPA Filter Testing and Efficiency	N/A. Fails criteria 3 and 6.	See above (OSD-0013, 13.2.2.D). Note that HNF-PRO-2595 is captured by HNF-3912, section 3.3.6.3.3.
13.2.3	Cross-Connection Requirements	N/A	Section Title
13.2.3.A	Section Deleted: Process	N/A. Fails criteria 3.	This requirement fails criteria 3 since supernatant may be

OSD-T-151-00013: Operating Specifications for Single-Shell Waste Storage Tanks, Rev. D-16.

OSD Section	Title/Description	Disposition (re: SST System Spec)	Rationale
	Transfers		added for the purpose of retrieval. The Wyden Bill prevents the addition of waste to SSTs, however the previous mission was specifically waste storage, rather than waste retrieval which may require the addition of waste (supernatant) to mobilize waste for removal.
13.2.3.B	Water Additions	N/A. Fails criteria 3, and 5.	The requirement is to limit additions of water to 500 gallons per activity for SSTs with a jet pump. This requirement does not specifically address tank structure or another element which can not/will not be changed to support the Waste Feed Delivery mission.  The basis for this requirement is that free liquid within an SST can aggravate the release to the environment should a tank leak occur (see SD-RE-TI-035, <i>Technical Basis for Single-Shell Tank Operating Specifications</i> , page 19). The requirements for tanks regarding allowable leaks are addressed (or will be addressed) in the SST requirement set as constraints from Ecology.
13.2.3.C	Section Deleted: Configuration Control-Interim Isolated SSTs	N/A. Fails criteria 5.	This section fails 5 as not applicable to the SST System. The mission scenarios would invalidate the relevance of this requirement.
13.2.4	Section Deleted: Leak Detection Control	N/A. Fails criteria 3 and 5.	This requirement fails criteria 3 and 5 as applicable to SST Saltwell Jet or Supernatant Pumping during interim stabilization. This does not apply to the SST System during Phase 1 or later.
13.2.5	PSYCHROMETRIC DATA COLLECTION	N/A	Section Title
13.2.5.A	241-C Psychrometric Data Collection	N/A Fails criteria 4 and 5.	This activity only applies to Tank 241-C-106 and Tank 241-C-105 (per Tri-Party Milestone M-05-13-T01 as described in Letter 9205941) and therefore is not applicable to the SST System level requirement set.
13.2.6	WASTE CHEMISTRY NOTIFICATION	N/A	Section Title

OSD-T-151-00013: Operating Specifications for Single-Shell Waste Storage Tanks, Rev. D-16.

OSD Section	Title/Description	Disposition (re: SST System Spec)	Rationale
13.2.6.A	<p><b>REQUIREMENTS</b></p> <p>Section Deleted: Criticality</p>	<p>N/A. Fails criteria 2, 4, and 6. However, specify a different parameter based on the higher precedence requirement or the root issue.</p>	<p>These requirements were established to ensure compliance with CPS-T-149-00010. The CPS is based on specific scenarios analyzed for waste storage and documented in a Criticality Safety Evaluation Report (CSER). The results of this analysis may change due to specific Phase 1 scenarios. Thus, this requirement should not be used as is. Rather, DOE Order 5480.24 and HNF-PRO-334 which drives the limits used in a CSER and the resulting CPS should be called out as the system level requirement. The radionuclide limits on tank waste should be specified in the SST Spec as follows:</p> <p>The SST System Specification section 3.3.8.1 captures this requirement as follows:</p> <p>The system shall store fissionable material in a manner which prevents criticality in accordance with DOE Order 5480.24 and HNF-PRO-334, Rev. 0 <i>Criticality Safety General Requirements</i>.</p>
13.2.6.B	<p>Section Deleted: Heat Generation Rate</p>	<p>N/A. Fails Criteria 2</p>	<p>Tank waste generates heat as a result of both chemical reaction and radioactive decay. This requirement was specified to prevent boiling of waste in non-aging waste tanks. It exists to protect the ventilation systems and prevent releases. These values could change if the ventilation systems were upgraded or additional cooling provided. Thus, these requirements are not valid constraints at the SST system level.</p>
13.2.6.C	<p>Total Fuel Concentration</p>	<p>N/A. Fails criteria 5 and 6. Specify applicable upper level</p>	<p>The specification limits for tank waste total fuel concentration (480 joules/g) were established to identify those tanks which may require an additional level of control.</p>

OSD-T-151-00013: Operating Specifications for Single-Shell Waste Storage Tanks, Rev. D-16.

OSD Section	Title/Description	Disposition (re: SST System Spec)	Rationale
		requirement reference.	<p>The additional level of control is to reduce the hazard of chemical reaction in the waste. Additionally, tanks which exceed the waste chemistry notification limits may meet the criteria to be included on the Watch List (OSD-T-151-00030) (see Tank Safety Screening DQO (Hunt 1995), Organic DQO (Buckley 1995), and the Crust Burn/Flammable Gas DQO (Johnson 1994).</p> <p>The WFD mission may invalidate the relevance of this requirement. Higher level requirements derived through safety analyses (per HNF-PRO-70X series procedures) are expected to determine if there are valid design requirements regarding fuel concentration.</p>

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**ATTACHMENT B**  
**REVIEW OF OSD-T-151-00031**



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OSD-T-151-00031: Operating Specifications for Tank Farm Leak Detection and Single Shell Tank Intrusion Detection, Rev. C-0.

OSD-031 Section	Title/Description	Disposition (re: SST System Spec)	Rationale
31.2.1	Single-Shell Tanks	N/A	
31.2.1.1	General	N/A	Single Shell Tanks subject to requirements are identified.
31.2.1.2	Leak Detection Requirements	N/A. Fails criteria 3, 4, and 5.	<p>Leak Detection limits unspecified for C-104/102. Table 31.2.2 identifies specific SST limits. The basis for this requirement is trend baselines for surface levels based on statistical determination of variance in liquid level readings.</p> <p>This requirement does not specifically address tank structure or another element which can not/will not be changed to support the Phase 1 mission. Active control measures could affect the value shown in Table 31.2-2 (reference). Phase 1 mission scenarios may invalidate the relevance of the requirement.</p>
31.2.1.3	Intrusion Detection Requirements	N/A. Fails criteria 3, 4, and 5.	<p>Intrusion detection limits for C-104/102 is +3.0 in. per 31.2.1.3 and Table 31.2-4. The basis for this requirement is trend baselines for surface levels based on statistical determination of variance in liquid level readings.</p> <p>The requirement does not specifically address tank structure or another element which can not/will not be changed to support the Waste Feed Delivery mission. Active control measures could affect the value. Mission scenarios may invalidate the relevance of the requirement.</p>

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**ATTACHMENT C**  
**REVIEW OF HNF-SD-WM-TSR-006**

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HNF-SD-WM-TSR-006: Tank Waste Remediation System Technical Safety Requirements, Rev. 0-S.

TSR Section	Title/Description	Disposition (re: SST System Spec)	Rationale
2.1.1	Waste Temperature Limits: Safety Limit for max allowable waste temp	N/A. Fails criteria 1, 2 and 6. However, this requirement points to a higher level need. Therefore, specify a different parameter based on that need.	This value is based on a safety limit which is not for equipment protection, but rather to prevent a potential organic salt-nitrate reaction. This safety limit is an operational constraint that is not based on the design of the tank structure. It should not constrain the SST system. More authoritative engineering basis exists.  See resolution to OSD temperature limits. [See Attachment A, 13.2.1.E (waste temperatures)]
3.1.1	Transfer System Covers: Requires seals and doors to be operable and closed.	N/A. Fails criteria 2, 3 and 6. However, this requirement points to a higher level need. Therefore, specify a different parameter based on that need.	Applies to operation of a subsystem whose design can be changed to suit the needs of Phase 1, if needed. The purpose of the requirement is to prevent worker, public and environmental exposure to radiation.  This need is covered by a higher precedence requirement for environmental and worker safety (i.e. HSRM-1 DOE/RL-96-109 and HNF-SD-WM-HSP-002). These requirements are already specified in the SST System Specification (see HNF-3912, sections 3.3.6.1.1 and 3.3.6.1.2.)
3.1.2	Service Water Pressure Detection System: requires the service water pressure system to be operable	N/A. Fails criteria 2 and 3	This requirement exists to prevent the potential for waste backflow into service water lines. This is based on a design below the level of concern of the SST System specification and does not apply for protection of equipment. This requirement is not for equipment protection and applies to a changeable subsystem.
3.1.3	Transfer Leak Detection Systems: Requires transfer leak detection systems to be operable.	N/A. Fails criteria 1 and 6. However, this requirement points to a higher level need. Therefore, specify a	This is an operations requirement that does not impose a constraint on the SST System. The need for leak detection is covered by a higher precedence requirement for providing leak detection (i.e. WAC-173-303). This requirement is already specified in the SST System specification (see HNF-

HNF-SD-WM-TSR-006: Tank Waste Remediation System Technical Safety Requirements, Rev. 0-S.

TSR Section	Title/Description	Disposition (re: SST System Spec)	Rationale
		different parameter based on that need.	2919, section 3.3.6.3.1).
3.1.4	Vent Stack CAM Interlock Systems	N/A. Fails criteria 1, 2	This LCO requires the CAM to be operable. It does not constrain the system design and is not there for equipment protection of an unchangeable subsystem.
3.1.4.A	HEPA Filter Differential Pressures And Stack Radiation Monitor Systems	N/A. Fails criteria 2, 3	This requirement does not address an item which cannot/will not change to support Phase 1.
3.2.2	SST Ventilation Systems - Active	N/A. Fails criteria 1.	This requirement is a control strategy to manage flammable gas hazards that does not impose a constraint on the SST design.
3.2.3	SST Ventilation Systems - Passive	N/A. Fails criteria 1.	This is an operations requirement that does not impose a constraint on the SST System regarding open state of HEPA filter breather isolation valves.
3.3.1	SST Waste Temperature Controls	N/A. Fails criteria 6. However, this requirement points to a higher level need. Therefore, specify a different parameter based on that need.	These values are based on safety limits which are not for equipment protection. More authoritative engineering basis exists. See resolution to OSD temperature limits. (See Attachment A of this document, for OSD-13 section 13.2.1.E)
4.0	Surveillance Requirements	N/A	SEE RESOLUTIONS FOR SECTION 3

HNF-SD-WM-TSR-006: Tank Waste Remediation System Technical Safety Requirements, Rev. 0-S.

TSR Section	Title/Description	Disposition (re: SST System Spec)	Rationale
5.7	Nuclear Criticality Safety	N/A. Fails criteria 5 and 6. However, this requirement points to a higher level need. Therefore, specify a different parameter based on that need.	Requirements cited are derived from Criticality Prevention Specifications (CPSs). CPSs were determined to be scenario specific and need to be revisited for specific Phase 1 scenarios. Refer to Attachment A of this document for OSD-013 section 13.2.6.A.
5.8	Source Inventory Controls	N/A. Fails criteria 5	Source Inventory control values are determined by process needs and thus are not constraints on system design.
5.9	Flammable Controls	N/A. Fails criteria 6. However, this requirement points to a higher level need. Therefore, specify a different parameter based on that need.	Flammable gas issues are covered by higher precedence requirements for design. Refer to HNF-3350, Attachment A referencing OSD-017, section 17.5 (see Attachment D of this document for the specific text required) and HNF-3912 section 3.3.6.3.7.
5.10	Ignition Controls	N/A. Fails criteria 6. However, this requirement points to a higher level need. Therefore, specify a different parameter based on that need.	Flammable gas issues are covered by higher precedence requirements for design as noted above (TSR-006, section 5.9).
5.11	Flammable Gas Monitoring Controls	N/A. Fails criteria 6. However, this requirement points to a higher level need. Therefore, specify a different parameter based on that need.	Flammable gas issues are covered by higher precedence requirements for design as noted above (TSR-006, section 5.9).



HNF-SD-WM-TSR-006: Tank Waste Remediation System Technical Safety Requirements, Rev. 0-S.

TSR Section	Title/Description	Disposition (re: SST System Spec)	Rationale
5.12	Transfer Controls	N/A. Fails criteria 1, 2, 3 and 6.	These are operational procedures that do not impose a constraint on the SST System design. They are not established for system safety, nor do they apply to an immutable part of the existing system.
5.13	Encasement Seal Loop Controls	N/A. Fails criteria 2, 3	These controls were established to reduce the consequence of leak in a primary pipe. Encasement piping is drained toward a pit with a leak detection system. This requirement does not exist for either equipment protection or address an immutable part of the system.
5.14	Emergency Preparedness	N/A. Fails criteria 1.	Requirement is operational in nature, and does not specify design.
5.15	Moisture Controls	N/A. Fails criteria 6. [see Appendix B, Item 4]	Requirement was established to protect the tank from fires, deflagrations and explosions. The OSD requirement is a specific scenario governed by a higher level constraint. [See Attachment C, reference to TSR-006 section 5.9]
5.16	Dome Loading	Applies, but use more complete requirement.	This control is governed by higher precedence requirements. See response to OSD-T-151-00013, section 13.2.1.C in Attachment A of this document.
5.17	Excavation Controls	N/A. Fails criteria 1	This control applies to excavation which is not a design constraint on the system. It applies to construction and maintenance.
5.18	HEPA Filters	N/A. Fails criteria 3	This requirement does not address an item which cannot/will not change to support Phase 1 if analysis indicates it should.
5.19	Process Instrumentation and Measuring and Test Equipment	N/A. Fails criteria 6.	Calibration requirements for instrumentation is covered by DOE Order 6430.1A. These requirements are captured with the following statement:  Systems shall be designed to allow periodic calibration. Calibration cycles, methods, and equipment shall be established based on manufacturer's instruction, component and system reliability, environmental conditions, and site-

HNF-SD-WM-TSR-006: Tank Waste Remediation System Technical Safety Requirements, Rev. 0-S.

TSR Section	Title/Description	Disposition (re: SST System Spec)	Rationale
			specific historical data.
5.20	Transfer Pump Admin Lock Controls	N/A. Fails criteria 1 and 6.	These controls are operational in nature and do not impose constraints on SST system design.
5.21	Tank Service Water Intrusion Monitoring Program	N/A. Fails criteria 2	This control was established to monitor for service water intrusion into SSTs. This requirement is not for equipment protection and the desired results can be achieved by other means. It is not an appropriate constraint on system design.
5.22	Transfer System Cover Removal Control	N/A. Fails criteria 1	This control establishes an operational control over pit cover blocks to prevent release of contamination. It is not a constraint upon SST System design.
5.23	Caustic Transfer Controls	N/A. Fails criteria 2, 3	This control applies to transfer of caustic, not waste. It is not for equipment protection and does not apply to an immutable portion of the system. It is not an appropriate constraint on system design.
5.24	Safety Management Programs	N/A. Fails criteria 1.	This is a programmatic requirement rather than a system requirement and is covered by higher precedence requirements.
5.25	Vent Controls	N/A. Fails criteria 2, 3	These controls are not established for equipment protection and apply to subsystems which are not immutable.
5.26	C-106 Waste Temperature Controls	N/A. Fails criteria 1	This control applies to a specific tank (241-C-106) and is not applicable to the SST System.

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**ATTACHMENT D**  
**RECOMMENDED CONSTRAINTS ON THE**  
**SINGLE-SHELL TANK SYSTEM DESIGN**

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Recommended Constraints on the Single-Shell Tank System Design											
Reference:	Constraint/Requirement										
OSD-T-151-00013, Section 13.2.1.B	<p>Maximum SST Waste Level:</p> <table border="1"> <thead> <tr> <th>Tank Identification</th> <th>Waste Level Limit(max.)</th> </tr> </thead> <tbody> <tr> <td>A, AX, SX</td> <td>360 in.</td> </tr> <tr> <td>B, C, T, U (200 series tanks)</td> <td>280 in.</td> </tr> <tr> <td>B, BX, C, T, U (100 series tanks)</td> <td>185 in.</td> </tr> <tr> <td>BY, S, TX, TY</td> <td>275 in.</td> </tr> </tbody> </table> <p>The maximum loading for the SSTs shall be in accordance with HNF-IP-1266, <i>Tank Farms Operations Administrative Controls</i>.</p> <p>The maximum tank dome deflection shall be 0.02 ft.</p> <p>The following temperature limits shall apply to the SST System:</p> <p>SST Temperatures      <u>Specification Limit</u></p> <ul style="list-style-type: none"> <li>- Maximum 300 °F for waste</li> <li>- Maximum 250 °F. for dome</li> <li>- Maximum change 3 °F/day for bulk waste temperature conditions in the tank.</li> </ul>	Tank Identification	Waste Level Limit(max.)	A, AX, SX	360 in.	B, C, T, U (200 series tanks)	280 in.	B, BX, C, T, U (100 series tanks)	185 in.	BY, S, TX, TY	275 in.
Tank Identification	Waste Level Limit(max.)										
A, AX, SX	360 in.										
B, C, T, U (200 series tanks)	280 in.										
B, BX, C, T, U (100 series tanks)	185 in.										
BY, S, TX, TY	275 in.										
OSD-T-151-00013, Section 13.2.1.C, HNF-SD-WM-TSR-006, Section 5.16											
OSD-T-151-00013, Section 13.2.1.D											
OSD-T-151-00013, Section 13.2.1.E, HNF-SD-WM-TSR-006, Section 3.3.1											
OSD-T-151-00013, Section 13.2.1.F	<p>Recommend that specific limits for tank pressure be applied to the SST specification as follows:</p> <p><u>Specification Limit</u></p> <ul style="list-style-type: none"> <li>Maximum pressure of +60 in. w.g.</li> <li>Minimum pressure of -15 in. w.g. with a minimum of 15 inches of liquid remaining in the tank.</li> <li>Minimum pressure shall be greater than or equal to 0 in. w.g. for all times when the height of the liquid waste is less than 15 inches.</li> </ul> <p>The system shall comply with the liquid effluent physical, chemical and radionuclide concentration limit requirements given in WHC-SD-ETF-WAC-001, Rev. 0, <i>Acceptance Criteria of Feed Streams for Treatment at the LERF/ETF Complex</i> when discharging liquid effluents to the Liquid Effluent Retention Facility (LERF) or the Effluent Treatment Facility (ETF).</p> <p>The SST System shall incorporate design features that limit the airborne emissions in compliance with WAC 173-303-400, 40 CFR 265, and HNF-PRO-2595 (for Non-</p>										
OSD-T-151-00013, Section 13.2.2.A											
OSD-T-151-00013, Section 13.2.2.B											

Recommended Constraints on the Single-Shell Tank System Design	
Reference:	Constraint/Requirement
	radioactive Airborne Emissions) and WAC 246-247 (for Radioactive Airborne Emissions).
OSD-T-151-00013, Section 13.2.6.A, HNF-SD-WM-TSR-006, Section 5.7	The SST System shall store fissionable material in a manner which prevents criticality in accordance with DOE Order 5480.24 and HNF-PRO-334, Rev. 0 <i>Criticality Safety General Requirements</i> .
OSD-T-151-00013, Section 13.2.6.C	Higher level requirements shall be derived through safety analyses (per HNF-PRO-70X series procedures) for design requirements regarding fuel concentration.
HNF-SD-WM-TSR-006, Section 3.1.1	Environmental and worker safety shall comply with DOE/RL-96-109 (HSRCM-1) and HNF-SD-WM-HSP-002.
HNF-SD-WM-TSR-006, Section 3.1.3	Leak detection shall be provided in accordance with WAC-173-303.
HNF-SD-WM-TSR-006, Section 5.9	The portions of the system which contact waste shall be designed and operated in accordance with the requirements of NFPA 70 (for Class 1, Division 1, Group B), NEC Articles 500 and 501, NFPA 77, and NFPA 496 (Type X). The portions of the system within the tank vapor space which do not contact the waste shall be designed and operated in accordance with the same codes and standards, except that Class 1, Division 2, Group B applies (NFPA 70) and Type Z (NFPA 496).
HNF-SD-WM-TSR-006, Section 5.19	Systems shall be designed to allow periodic calibration. Calibration cycles, methods, and equipment shall be established based on manufacturer's instruction, component and system reliability, environmental conditions, and site-specific historical data.

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