Department of Energy
Washington, DC 20585

April 28, 2003

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW, Suite 700
Washington, D.C. 20004-2901

Dear Mr. Chairman:

The purpose of this letter is to forward to you Revision 1 of the Savannah River Site (SRS) High-Level Waste Tank In-Service Inspection Program (ISIP) (Enclosure 1) as requested in your June 11, 2002, letter. This revised document incorporates the previous commitment to inspect all of the Type III/IIIA waste tanks and addresses your concerns regarding tank selection criteria and acceptance criteria for inspection results. Additionally, following discussions with your staff, the Department has decided to further revise the attached ISIP schedule in order to complete examination of all of the Type III/IIIA waste tanks by the end of 2007. A revised ISIP schedule will be provided to you by July 21, 2003. The Department is committed to adjusting the SRS ISIP as necessary, should inspection results indicate the existence of or potential for accelerated degradation in the Type III/IIIA waste tanks.

Also enclosed is a copy of a review (Enclosure 2) undertaken as a comparison of ISIPs for the Office of River Protection (ORP) and SRS. The review compares the two respective ISIPs with the *Guidelines for Development of Structural Integrity Programs for DOE High-level Waste Storage Tanks,* BNL-52527, January 1997. These guidelines were developed by a committee of experts known as the Tank Structural Integrity Panel (TSIP), and are recognized in DOE G 435.1 as providing an acceptable process for establishing a high-level waste tank structural integrity program. Both sites use the TSIP guidelines as the technical basis for their ISIPs. Both the ORP and the SRS ISIP conform to the TSIP guidelines as detailed in Enclosure 2.

If you have further questions, please contact me at (202) 586-7709.

Sincerely,

Paul Golan
Chief Operating Officer
Office of Environmental Management

Enclosures

cc: Mark Whitaker, S-3.1

In-Service Inspection Program for High Level Waste Tanks

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DISCLAIMER

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Table of Contents

List of Figures

1 INTRODUCTION

In-service inspection of the Savannah River Site (SRS) High Level Waste (HLW) tanks is an essential element in the demonstration of their structural integrity to maintain the function of waste confinement throughout the desired service life. A revised, code-based in-service inspection (ISI) program (which includes both visual (VT) and ultrasonic (UT) inspections) of the SRS Double Shell (DS)-HLW Tanks has been developed. The current ISI program for the HLW tanks is limited to VT of the tank walls. The program herein provides details for UT inspections that will augment the current ISI program. The prioritization of tanks for UT inspection, the extent, frequency, schedule of UT inspections, and equipment for UT inspection are included.

2 SCOPE

An important element in the demonstration of structural integrity of tanks is an ISI program to provide in-situ material condition information. Inspection also provides early detection of degradation, and allows for an appropriate response to maintain structural integrity. The current ISI program for the HLW tanks consists of the visual inspection of the primary tank wall exteriors for Type I, Type II, and Type III and Type IIIA waste tanks, via accessible annulus risers. For purposes of this document, references to Type III tanks are inclusive of Type IIIA tanks. The UT examinations to be done for selected Type III tanks will be used to augment the existing ISI program, and to validate current general thinning, pitting, and stress corrosion cracking models. Validation will be done by establishing an Ultrasonic baseline for specific areas of selected tanks and then periodically re-examining those areas for any detectable changes. The ISI program includes visual inspection of the interior tank walls of the single-shell Type IV waste tanks, but not UT inspection of Type IV waste tanks.

This document details the complete upgraded inspection program. Elements of the complete program include the following:

1. Enhanced Visual Inspection, Including Inspection of Secondary Tank
2. Organizational Responsibilities
3. Tanks Selection for UT Inspection
4. Extent of Inspection
5. Frequency of Inspection
6. Schedule of Inspection
7. Equipment
8. Inspector Qualifications
9. Acceptance Criteria/Action Limits
10. Records Management

This inspection plan includes the UT inspection program and a brief summary of the current VT program. The current VT program will be implemented as outlined in WSRC-TR-95-0076, "HLWE Structural Integrity Inspection and Monitoring Program". A summary of HLW tank design and construction is included within the Appendix for reference.

3 RESPONSIBILITIES

3.1 Concentrate Storage Transfer Engineering (CSTE)

CSTE shall:

1. Develop and maintain plans for inspections, structural integrity, and indication investigations.

2. Generate, review, and authenticate inspection records.

3. Review, validate, report, and disposition inspection results via the In-Service Inspection Review Committee (ISIRC).

4. Maintain records, including index(s) of inspections.

3.2 Concentrate Storage Transfer Maintenance (CSTM)

CSTM shall:

1. Perform inspections in accordance with applicable qualified inspection procedure(s).

2. Perform surveillance and monitoring as directed by CSTE.

3. Operate and maintain surveillance and monitoring equipment.

4. Perform work and complete records with guidance from CSTE.

5. Maintain records as appropriate.

3.3 Savannah River Technology Center (SRTC)

SRTC shall:

1. Support disposition of inspection results with guidance from CSTE.

2. Assist in testing and qualification of specific equipment when requested.

3. Perform inspections in accordance with applicable qualified inspection procedure(s).

4. Perform work and complete records with guidance from CSTE.

5. Administer SRS Operations Non-Destructive Examination (NDE) Certification Program.

6. Perform NDE as requested [Including automated ultrasonic and remote (crawler) visual inspection of HLW tanks] using certified Level II and Level III inspectors.

7. Maintain records as appropriate.

4 INSPECTION REQUIREMENTS AND METHODS

4.1 Scope

This section details the VT and UT inspection requirements, including inspector qualifications, examination methods, and equipment qualification.

4.2 Qualifications of Inspectors

This section establishes a requirement for certification of personnel who perform or assist in the surveillance, monitoring, and inspection of HLW tanks.

4.2.1 VT Inspector(s)

Personnel interpreting and/or reviewing data shall be certified to at least VT Level II-L in visual examination, in accordance with NDEP 2.1.

All certified personnel shall pass an annual eye examination given by SRS Medical personnel or SRS Level III personnel. Personnel shall meet the following eye examination requirements:

1. Distance vision of 20/30 in at least one eye either corrected or uncorrected.
2. Near vision capability to read Jaeger type 1 letters at a distance not less than 12 inches on a Jaeger Test Chart or Snellen Equivalent.
3. Color vision must be acceptable for the NDE method in which certification is sought.

4.2.2 UT Inspector(s)

Personnel performing UT examinations shall be certified to Level II or Level III in the method(s) being used, in accordance with NDEP 2.1.

4.2.3 Data Collector(s)

Data collectors are not required to be certified, but they are required to be proficient in equipment operation and data collection in accordance with the applicable procedures.

4.3 Examination Methods

4.3.1 Visual Examinations (VT)

The following summarizes the current visual examination program. As UT data is acquired and the degradation models and performance of the HLW tanks are validated, recommendations for modifications of this plan will be identified and presented to the DOE for review and approval.

Inspection plans shall be prepared for each inspection period (1 year) prior to the actual inspection and shall include the following:

1. Tank identification
2. Access (opening)
3. Bases for each inspection
4. Frequency
5. Access constraints
6. Inspection type (general or detailed)

The visual inspection (VT) interval shall be a maximum of two calendar years using all accessible annulus risers for Type I, Type II, and Type III HLW tanks. Increased surveillance may be necessary to monitor relevant conditions pending disposition.

An addition to the current VT program is the detailed examination of the secondary pan. A detailed inspection through an accessible riser in one quadrant of the tank shall be performed during a detailed VT inspection of the tank. All four quadrants of the secondary shall be inspected within 4 calendar years.

4.3.2 Ultrasonic Examination (UT)

The following summarizes the UT examination program. Inspection plans shall be prepared for each inspection prior to the actual inspection and shall include the following as a minimum:

1. Tank Identification

2. Access (opening) through which inspection(s) will take place
3. Basis for inspection
4. Frequency (as listed below)
5. Access constraints
6. Inspection type(s) to be performed (thickness mapping or weld inspection)
7. Extent of examination - minimum area and location to be examined with each inspection type.

4.3.3 Equipment Qualification

Equipment includes, but is not limited to cameras (film, digital and video), remote cameras, fiberscopes, ultrasonic inspection instruments and delivery systems. This equipment shall be used for surveillance, monitoring, and determination of structural integrity and in-service inspection of HLW tanks. Equipment used for surveillance, monitoring or inspection (annual detailed inspections, NDE, structural integrity) shall be qualified for use by performance demonstration.

4.3.3.1 Camera/Video/Visual Imaging Equipment

All equipment used for surveillance, monitoring, structural integrity and in-service inspection of HLW tanks shall be qualified to assure it meets the lighting and resolution requirements of ASME Section V, Article 9.

4.3.3.2 Ultrasonic testing equipment

The UT system (instrument, transducer, scanning device, and cables) shall have the following detection limits (tested at ½ inch nominal thickness):

1. General corrosion/thinning detection within 0.020 inches.
2. Pitting detection within 0.050 inches. (elliptical or hemispherical)
3. Crack depth detection within 0.100 inches, $\geq$ 0.5 inches long, < 6 inches long. In the absence of an acceptable cracked sample, a machined notch 0.05 inches deep x 1inch long can be used instead of a crack.

4.3.4 Procedures

All inspections shall be performed according to the appropriate procedures. Inspection procedures shall be written in accordance with ASME Section V Article 4 (ultrasonic) and Article 9 (visual) and validated for use by the In-Service Inspection Review Committee (ISIRC).

5 PRIORITIZATION, FREQUENCY, AND EXTENT OF UT INSPECTIONS

5.1 Prioritization of Tanks for UT Inspection

All 27 Type III and IIIA tanks will be inspected by UT within the next 10 years. Five of the 27 tanks were selected for routine inspections, while an augmented inspection is planned for the balance of the tanks. The tanks selected for the routine inspections will provide data for trending any active corrosion mechanisms that may occur during their remaining service life. The basis for selection of these tanks was presented within WSRC-TR-2001-00469. Categories were constructed to identify tanks with similar risks for corrosion. The features considered in the categorization were materials of

construction, service history, tank function, and projected future use. A ranking system was developed that provided input into the selection of the tanks for the routine inspection. The tanks that were selected for routine inspection are shown in Table 1.

The augmented inspection is scheduled as a one-time inspection and will be utilized to verify that no unexpected accelerated corrosion is occurring in the remaining tanks. The same categorization document was utilized to prioritize the order in which the tanks will be inspected.

One Type II tank will be inspected by UT (see Table 1). Tank 15 will be inspected twice to validate known corrosion models (e.g., stress corrosion cracking) and to investigate anomalous corrosion behavior (e.g., long, curved crack indication). The results of the UT inspection performed on Tank 15 will be applied to the family of Type I and II tanks, both leaking and non-leaking tanks.

Table 1: Tanks Selected for UT Examination

Category	*Tank Category*	*Tanks Selected*	*Year of 1st Inspection*
Type I and II Tanks	*Leakage Observed*	Tank 15	FY 02
	No-Leakage Observed	None	
Type III Tanks	*Fresh Waste Receiver*	Tank 32	FY 03
	Waste Processing	Tank 48	FY 04
	Unconcentrated Salt Solution	Tank 47	FY 06
	Evaporator System		
	Evaporator Bottoms Receipt (H-Area)	Tank 29	FY 05
	Evaporator Feed (F-Area)	Tank 26	FY 04

5.2 Frequency and Extent of UT Inspection

The following inspection frequency shall be used for UT examination of Type I, Type II, and Type III HLW tanks:

1. Tank 32, a fresh waste receiver for the majority of its service history, shall be inspected every 7 years.

2. The remaining Type III tanks that are part of the routine UT inspection program and shall be inspected every 10 years.

3. Tanks selected for the augmented UT inspection shall be scheduled such that all 27 tanks are inspected once within 10 years.

4. Tank 15 shall be inspected two times within a five-year time span to validate current degradation models. Known leak sites will be characterized in addition to the normal extent of examination. If leakage occurs in unexpected regions and unknown degradation mechanisms are suspected, additional inspections will be performed. The first inspection is scheduled for FY02.

5. A formal review of the ISI program shall be performed every three years to determine if adjustments to the routine or augmented program are necessary. Changes to the program may be made due to discovery of any instances of accelerated corrosion or changes in the tank closure schedule. The first review will be performed in FY06 and will be conducted by the In-Service Inspection Review Committee (ISIRC).

The combined schedule for the routine and augmented inspections are shown in Figure 1. Tanks that are part of the routine program are indicated with number that show each successive inspection, while tanks included in the augmented program are shown by an "x". Tanks included in the routine program will be inspected prior to FY06 and the first formal review. The highest risk tanks in each category not selected for routine inspection will also be inspected prior to FY06. The tank closure schedule is based on the High Level Waste System Plan.

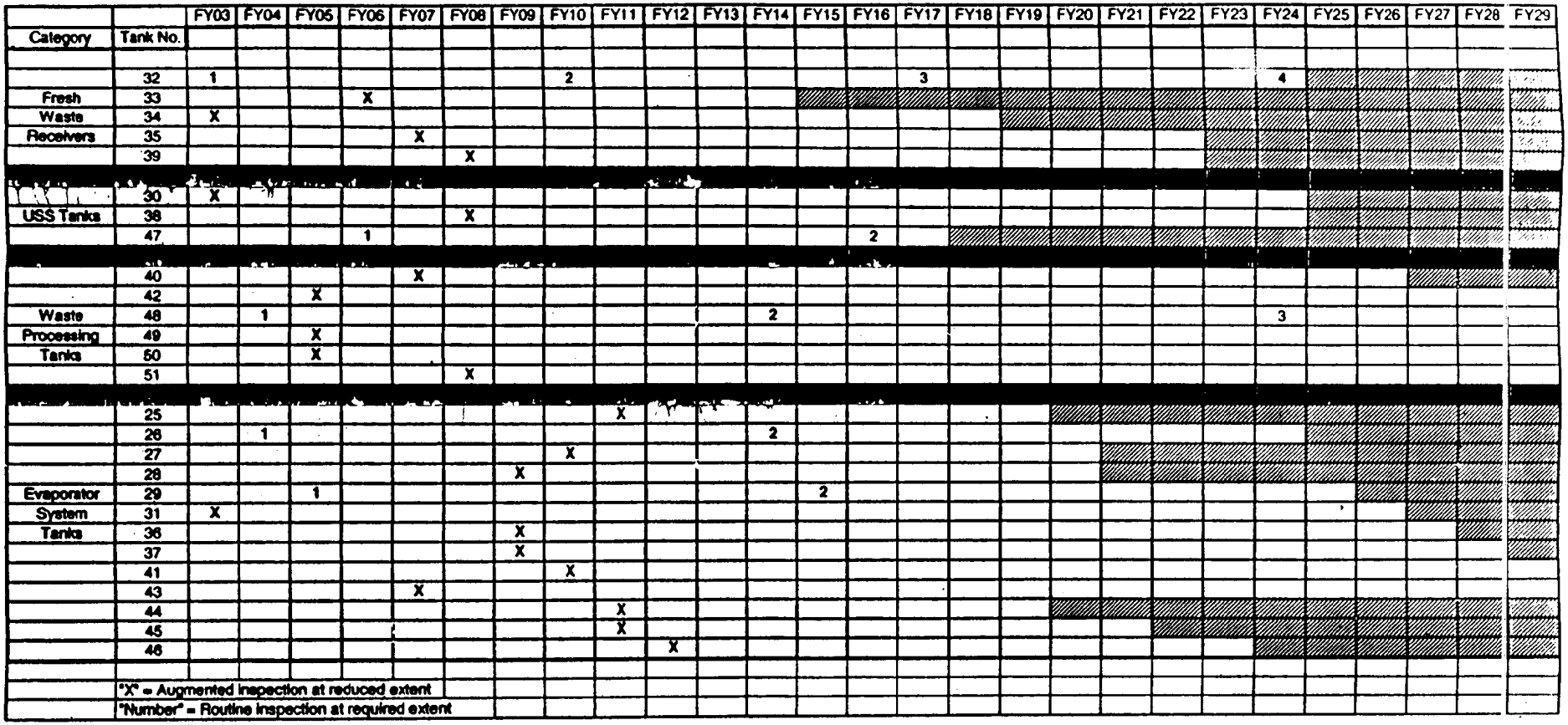

Figure 1. Schedule for Routine and Augmented Inspections for Type III and IIIA Tanks.

Figure 2 shows the extent of a routine UT examination. Table 2 summarizes the extent of the routine UT examination.

Table 2: Extent of Routine UT Examination of SRS Waste Tanks

Inspection Region	*Extent of Examination*	*Mechanism*
1. Liquid-Vapor Interface	See External Surface	Thinning, pitting, and cracking
2. Liquid-Sludge Interface	See External Surface	Thinning, pitting, and cracking
3. Upper Weld of Lower Knuckle of Primary Tank	5% of accessible circumference of the upper weld of the lower knuckle	Cracking
4. Lower Knuckle Base Metal	See External Surface	Cracking
5. External surface of primary tank	Four, vertical strips along the accessible height of the tank. Two strips in each semi-circle (180° arc) of the tank for the accessible vertical section.	Thinning, pitting, and cracking
6. Bottom Plate of the Tank	Feasibility of obtaining access to the tank bottom will be determined.	Thinning, pitting
7. Vertical and horizontal welds other than the lower knuckle weld	One vertical course section and 5% of middle horizontal weld.	Cracking
8. Secondary Tank	Extent of examination of the bottom plate and sidewall will be determined.	Thinning, pitting

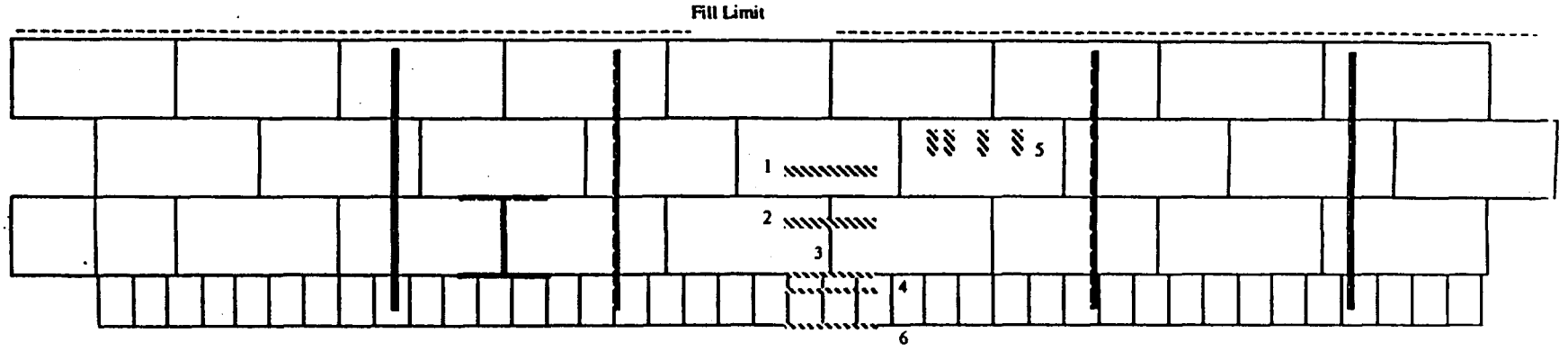

Figure 2: Unwrapped Surface of a Typical Type III Waste Tank, Illustrating TSIP Inspection Requirements (- - - -) and Planned Inspection Extent (——) at SRS.

Note: Numbers correspond to TSIP Regions for inspection shown in Table 2.

For the augmented inspections a single vertical strip along the accessible height of the tank will be chosen. The inspection will be for thinning, pitting, and stress corrosion cracking.

6 ACCEPTANCE CRITERIA

The results of the inspections shall be disposed of in accordance with the set of standards, or acceptance criteria, detailed in WSRC-TR-2002-00063, "Acceptance Criteria for Disposition of Inspection Results of SRS Type III High Level Waste Tanks." This set of standards provides actions in response to indications from ultrasonic testing (UT), and the visual testing (VT) inspections, based on the characteristics or size of the indications. Indications that are below the criteria for successive examination, yet above the detection limit of the UT instrument will be noted in the inspection reports. These indications will be reviewed and dispositioned by the ISIRC.

The decision logic shown in Figures 3 and 4 will be used to disposition inspection results in accordance with the acceptance criteria. Figure 3 shows the decision logic for general thinning, pitting, and local thinning. Figure 4 shows the decision logic for service induced flaws.

Successive examinations decrease the inspection interval to 5 years for pitting and thinning and shall be repeated at that interval until three such examinations reveal no additional degradation. For flaws, successive examinations decrease the inspection interval to 3 years and shall be done at that interval, until three consecutive examinations show no additional flaw growth. Additional examinations double the extent of the region of the scheduled examination within a single service category. This shall be accomplished by inspection of an additional 50% in the degraded tank, and inspection of 50% of a regular inspection in another tank within the same category. The additional tank shall be chosen in accordance with the selection criteria. Degradation found in the additional tank shall be disposed of in accordance with the same acceptance criteria.

The results of the inspections will be presented to HLWD management. The management will identify the appropriate controls, and acceptable operating envelope in accordance with "S/RID Functional Area 16 (Waste Management) Requirement".

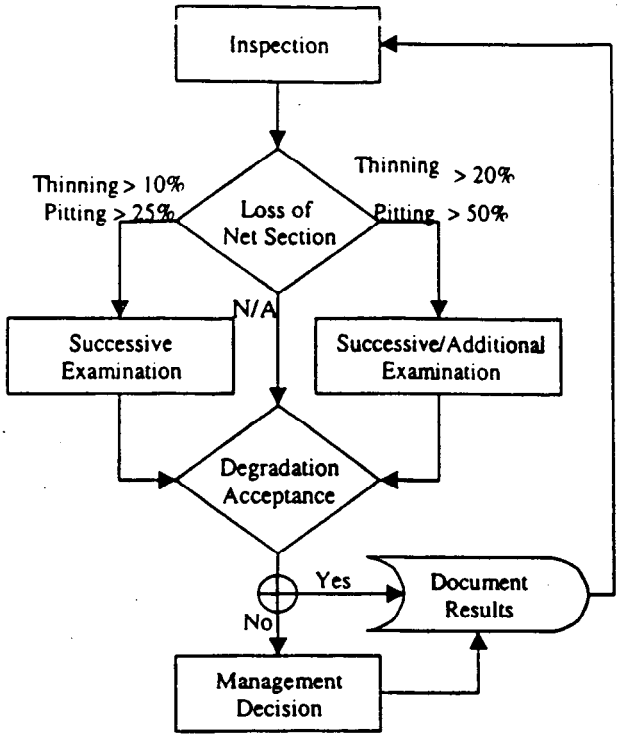

Figure 3: Decision Logic for Disposition of General Thinning, Pitting, and Local Thinning

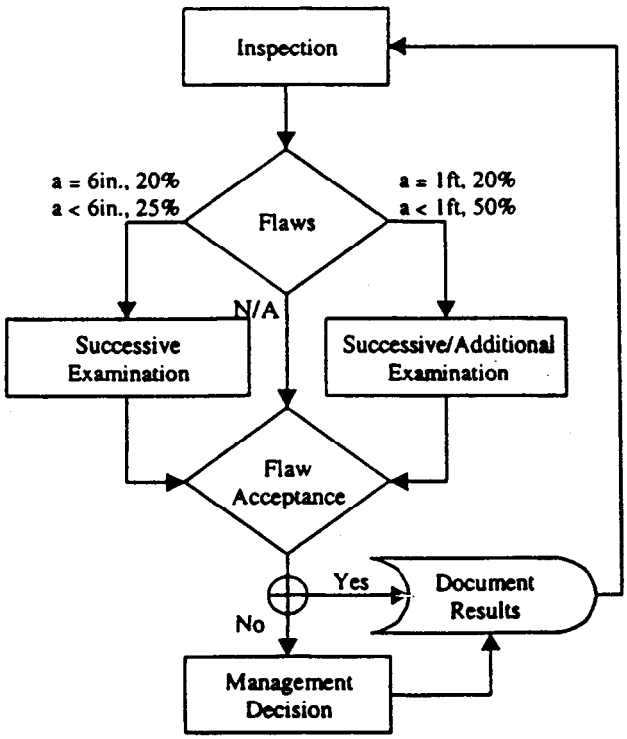

Figure 4: Decision Logic for Disposition of Service Induced Flaws

7 RECORDS

7.1 Purpose

This section establishes requirements for the identification, administration and storage of documents and data generated during the performance of surveillance, monitoring and inspection of HLW Tanks.

7.2 Scope

The requirements herein are applicable to data compiled in surveillance, monitoring, structural integrity and in-service inspection of HLW tanks. Written reports, inspection plans, photographs, slides, videotapes, and other such information are subject to the requirements of this section.

7.3 Procedure

Records shall be protected from loss, damage, and unauthorized access, and must be retrievable and legible. Each employee is responsible for assuring that the records(s) he creates are properly authenticated, and plans for adequate retention are implemented. Records shall be maintained as specified; when the retention period has expired.

7.4 Classification

The product(s) of work on the following items shall be considered records and handled in accordance with this section: HLW Type I/II and III primary tank.

7.5 Maintained Records

1. An index of records
2. Inspection plans
3. Repair records
4. Inspection procedures
5. Inspection results/reports shall be maintained by CSTE and distributed as appropriate.
6. Images of inspection activities (videotapes, disks, photographs, slides, digital images, etc).

7.6 Storage Facility Requirements

Records shall be stored in a facility that complies with site storage facility requirements.

7.7 Report & Letter storage/records

Paper records shall be stored in accordance with site requirements for records.

7.8 Video Tape, Photographs, Slides, Magnetic Media

Non-paper media are considered specially processed records and require the following additional storage and special handling requirements:

1. Store in such a manner so as to prevent damage from excessive light, stacking, electromagnetic fields (electronic media), temperature, and humidity.
2. Store records separately in individual sleeves, envelopes, or folders. If these sleeves, envelopes, or folders contain adhesives, the adhesive portion must not come into contact with the media.

5. Handle film media outside of its protective enclosure utilizing white cotton low-lint or lint-free gloves.

7.9 NDE Reports

NDE group generated records shall be maintained in the NDE Group files and/or at their option or sent to document control. Records maintained by the NDE Group shall meet the requirements of this section.

8 REFERENCED STANDARDS AND SPECIFICATIONS

BNL-52527 – UC-406, "Guidelines for Development of Structural Integrity Programs for DOE High Level Waste Storage Tanks, January 1997.

HLWM-16004, "Crane Operations in High Level Waste".

NDEP 2.1, "Qualification and Certification of NDE Personnel".

NDEP 2.5, "Qualification of NDE Procedures (U)".

NDEP 4.2, "Visual Examination VT-1 and VT-3 (U)".

NDEP 7.9, "Automated Ultrasonic Thickness Examination (U)".

NDEP 7.11, "Automated Ultrasonic Examination of Ferritic Welded Components".

S/RID FA-16 "S/RID Functional Area 16 (Waste Management) Requirements," WSRC-RP-94-1128-016, Revision 01-19.

WSRC-TR-1995-0076, Rev. 0, "SRS High Level Waste Tank and Piping Systems – Structural Integrity Program and Topical Report (U)," June 1995.

WSRC-TR-2001-00469, "Selection of Representative High Level Waste Tanks for Ultrasonic Examination," September 2001.

WSRC-TR-2002-00063, "Acceptance Criteria for UT Examination of SRS HLW Tanks," February 2002.

APPENDIX: TANK DESIGN AND CONSTRUCTION

This section summarizes pertinent information on the Type II, and III High Level Waste Tanks.

a) Type II Tanks (see Figure 5)

Constructed – 1955 through 1956

Capacity – 1,030,000 gallons

Material – ASTM A285, Grade B Carbon Steel

Construction Code – ASME-52

Project Number – 8980 PWO

Four Tanks total. H-Area Tanks 13-16

Five-foot steel secondary containment pan. Material is A285, Grade B carbon steel

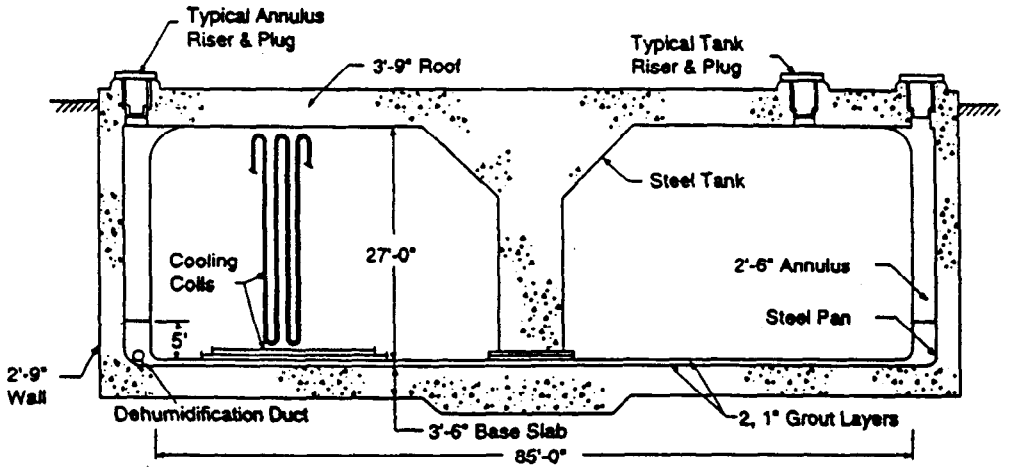

Figure 5: Type II High Level Waste Tank

b) Type III Tanks (See Figure 6)

Constructed – 1967 through 1972

Capacity – 1,300,000 gallons

Material – ASTM A516, Grade 70 Carbon Steel

Construction Code – ASME-56

Project Numbers – 9S1232 and 9S0974

Six Tanks total. H-Area Tanks 29-32. F-Area Tanks 33-34

Single wall secondary liner. Material is ASTM A516 Grade 70 carbon steel

c) Type IIIA Tanks (See Figure 6)

Constructed – 1974 through 1981

Capacity – 1,300,000 gallons

Material – ASTM A516, Grade 70 Normalized (Tanks 25-28, 35-37) and ASTM A537, Class I (Tanks 38-51) Carbon Steel

Construction Code – ASME-56

Project Numbers – 9S1463, 9S1493, 9S1618, 9S1747, 9S1828

21 Tanks total. H-Area Tanks 35-43 and 48-51. F-Area Tanks 25-28 and 44-47.

Single wall secondary liner. Material is ASTM A516 Grade 70 carbon steel

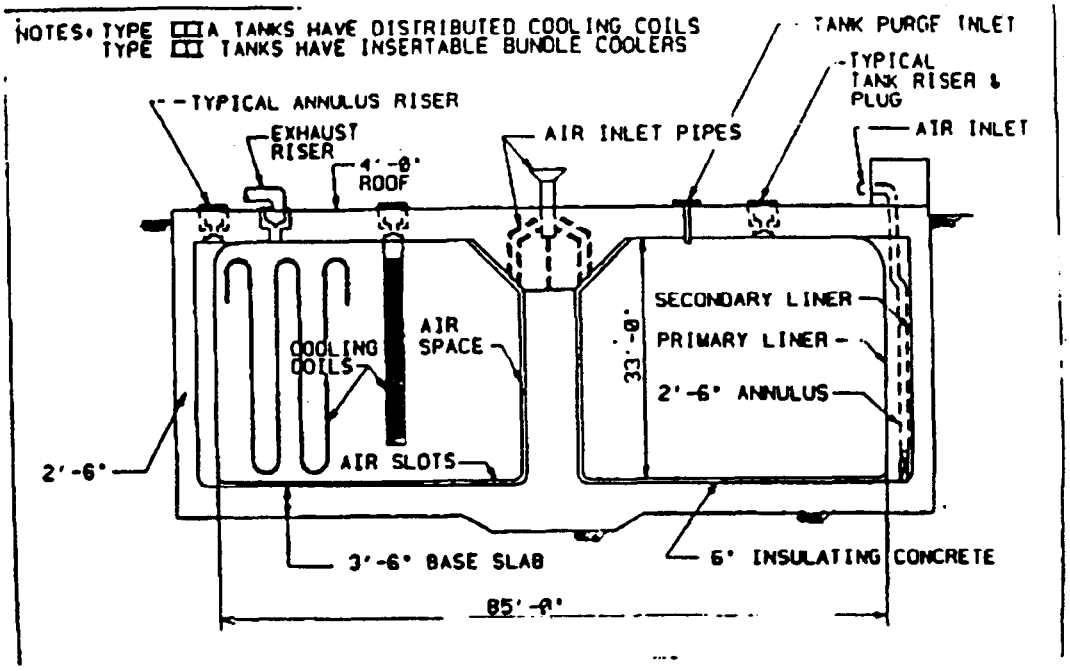

Figure 6: Type III High Level Waste Tank

GLOSSARY

Acceptance Standards - Limits to geometric condition indicators to avoid a structural instability by maintaining specified minimum margins against instability.

Additional Examination Standards - Limits on geometric condition indicators that trigger additional examination regions in the examined tank and/or additional tanks within a tank service category

Certification – Written testimony of qualification.

Certifying Authority – The representative of the WSRC who performs the function of NDE personnel certification.

Data Collector – Personnel responsible for equipment set-up, operating camera and collecting/decoding visual surveillance or monitoring data.

Equipment Qualification – The act of testing an item, such as a camera system, to determine that the item meets (or exceeds) the stated requirements. The record of this test is referred to as equipment qualification.

Evaluation - The process of determining the acceptability of a part or item based on a set of acceptance criteria.

Geometric Condition Indicator - Planar Flaw: The characterized length and depth of a planar flaw from an UT examination. If the distance between a pair of co-linear flaws is less than or equal to 6 inches, the pair of flaws shall be considered to be a single flaw of effective length equal to the distance between the farthest flaw ends. If two flaws are parallel but not co-linear, and the perpendicular distance between them is less than or equal to 0.5 inches, then the above rule shall also apply to determine the effective flaw length. This procedure may result in the combination of several pairs of flaws into a single effective flaw.

Geometric Condition Indicator - Thickness: Measurements of the thickness in a region of the tank wall from UT examination.

In-service Inspection Review Committee (ISIRC) – A committee that will develop the tank specific in service inspection plan and review, validate, report and disposition the inspection results.

Inspection – Evaluation of an item utilizing visual, ultrasonic or some other NDE method, to a procedure by personnel certified to perform the inspection.

Inspector – Personnel responsible for implementation of appropriate sections of in-service inspection program. Responsibilities include the development and issuance of inspection plans and inspection results.

Interpretation - The process of judging the cause of an indication and the nature of a discontinuity.

Monitoring – Ongoing or periodic observation of an item to detect and/or track changes.

NDE – Nondestructive examination: Inspection, testing, examination of an item to determine physical soundness or acceptability.

Qualification – Demonstrated skill, training, knowledge, and experience required for personnel to properly perform the duties of a specific job.

Record - A completed document or other medium that provides objective evidence of an item, service, or process.

Reporting Standard - Condition indicators that exceed a specified level, above that associated with the sensitivity of the method of examination, that indicate service-induced degradation of the tank and are of interest to the tank structural integrity. A condition indicator at or exceeding the Reporting Standard is a relevant condition as determined in the inspection of the tank.

Successive Examination Standards - Limits on geometric condition indicators that trigger more frequent examinations in the examined tank. The Successive Examination Standards are more limiting than the Acceptance Standards to account for degradation rates, NDE condition indicator uncertainties, etc.

Surveillance – Observation of an item or process to provide immediate information on the item or process.

Training – The structured classroom training, laboratory exercises, and / or assigned self-study materials as approved by the assigned NDE Level III, which encompasses the required knowledge necessary for qualification in a given NDE method.

Review of the Savannah River Site and the Office of River Protection High-Level Waste Tank In-Service Inspection Programs

Approach/Methodology

The two Department of Energy sites with the highest volumes of high-level waste in storage are the Office of River Protection (ORP) and the Savannah River Site (SRS). A request was made to both sites that they provide input on their respective High-Level Waste Tank In-Service Inspection Programs (ISIPs).

Both ORP and SRS used the Brookhaven National Laboratory (BNL) *Guidelines for Development of Structural Integrity Programs for DOE High-level Waste Storage Tanks* (BNL-52527, January 1997), as the technical basis for their respective ISIPs. The committee of experts who developed these guidelines is commonly known as the Tank Structural Integrity Panel (TSIP), and the guidelines are referred to as the "TSIP guidelines."

DOE Guide 435.1, Chapter II, identifies the TSIP guidelines, as the document that provides an acceptable process for establishing a structural integrity program. This set of guidelines was finalized in January 1997 to promote the structural integrity of high-level waste storage tanks and transfer lines at facilities of the Department. In summary, the document lays out the essential elements of a structural integrity program. The procedures contained in the guidelines provide an acceptable methodology to assess the structural integrity of existing tanks and to estimate the end of service life.

While the TSIP guidelines provide the overarching technical basis for the ISIPs, it also allows the flexibility for each site to develop their own integrity program as it states, "Site-specific structural integrity programs will have to be developed for the tank farms or even individual tanks by judicious selection of the appropriate portions of the guidelines presented in this document."

Both ORP and SRS provided information on how their respective ISIP elements compared with the TSIP as detailed in the attached tables.

General ISIP Program Overview

The following two paragraphs summarize details of the ORP and SRS ISIPs.

ORP

The ORP Non-Destructive Examination (NDE) program was formally initiated in 1997, and all 28 double-shell tanks (DSTs) will have an initial ultrasonic (UT) inspection baseline by the end of FY 2005 (total duration 8 years). UT inspections will be repeated in successive 8-10 year cycles. The basis for examination of all 28 DSTs is in accordance with the Tri-Party Agreement milestone M-48 with the Washington State Department of Ecology (Ecology). Ecology has

regulatory authority over the DSTs under the Resource Conservation and Recovery Act of 1976 and over nonradioactive emissions under the Washington State Clean Air Act. Activities and milestone dates for completing integrity assessments of the DST System are included in administrative orders (Silver 2000a, 2000b).

SRS

The SRS ISIP was formally initiated in 2002, and all 27 DSTs will have a UT inspection completed within the next 10 years (by the end of 2012). As identified in the ISIP, 5 of the 27 (or 19 %) Type III tanks were selected for routine examinations, while an augmented inspection is planned for the balance of the tanks. The tanks selected for routine inspections will provide data for trending any corrosive mechanisms that may occur during their remaining service life. The five representative tanks (i.e., highest risk) selected for routine examinations will be inspected within five years. UT inspections will be repeated for the representative tanks in 7-10 year cycles. The basis for selection of these tanks was presented within WSRC-TR-2001-00469, *Selection of Representative High-Level Waste Tanks for Ultrasonic Examination.* The SRS high-level waste tanks are permitted by the South Carolina Department of Health and Environmental Control (SCDHEC) as industrial wastewater treatment facilities.

Both sites used the TSIP Guidelines as the technical basis for their ISIPs. Both the ORP and the SRS ISIP conform to the TSIP guidelines as detailed in the attached tables.

Attachment

Office of River Protection Double-Shell Tank Integrity Program Elements

UT	TSIP (BNL-52527 – UC-406)	Hanford DST Integrity Program	Rationale for Departure from TSIP Guidelines	Comments
Tank Selection	At least 10% (or 1 if < 10%); select based on age, severity of operating conditions, and transients; if not homogenous, >10% may be required to represent worst-case	• Tank selection based on weighted averages of waste composition, least waste height variation, temperature, age, and material. All 28 DSTs prioritized based on this criteria. • All 28 DSTs will have initial inspection (UT baseline) by the end of FY 2005. UT inspections will be repeated in successive 8-10 year cycles. • 6 DSTs selected for examination of tank bottoms and 6 DSTs selected for examination of lower knuckles were selected based on a variety of factors as documented in "Engineering Task Plan" for the Ultrasonic Inspection of Hanford	• N/A—exceeds TSIP guidance • Examination of all 28 DSTs will be performed in accordance with M-48 milestone agreement with Washington State Department of Ecology. • Number of DSTs selected for examination of tank bottoms and lower knuckles were agreed upon by the Washington State Department of Ecology.	Rationale for UT of all 28 DSTs versus 3 required by DSTIP is that the DSTs have different service dates and different types of waste. Reference: "Description of Double-Shell Tank Selection Criteria for Inspection" (WHC-SD-WM-ER-529).
	If >10% are examined, option to reduce percent per tank accordingly.	No reduction used	Required scope by M-48 milestone agreement with state of Washington	None

Office of River Protection Double-Shell Tank Integrity Program Elements

UT	TSIP (BNL-52527 – UC-406)	Hanford DST Integrity Program	Rationale for Departure from TSIP Guidelines	Comments
Extent of Examination	5% of liquid-vapor interface	The liquid/vapor interface on 6 DSTs will be examined over a 20-ft. length, 15-in. wide, centered on the estimated location of the static liquid/air interface that existed for a minimum of 5 years. This area will be examined for pits, cracks, and wall thinning.	This scope of examination is as agreed to by DOE and Ecology in draft TPA milestone M-48-14. A 20 ft. length in a 75 ft. diameter tank exceeds 5% of the liquid/air interface. 15 inches centered on the liquid/air interface does not comply with the TSIP guidance of +/- 1 foot, but can be accomplished in a single scan—otherwise 2 scans would be required to encompass 12" above and 12" below the interface. However this scope can be and has been increased depending on the condition of the tank. For example, on AY-101 two scans were done on the liquid/air interface because thinning was found over a fairly large vertical range in the two 15-in. wide vertical scans on the east side of the tank. In all 28 DSTs, any previous or existing liquid/air interface is examined in the top-to-bottom 30-in. wide vertical strip (consisting of two 15-in. wide vertical strips) that is scanned in each tank.	Should there be more than one interface of 5 or more years, an evaluation will be performed to determine if it needs examination as well.
	5% of liquid-sludge interface	Any liquid/sludge interface above the lower knuckle weld is examined over a 30-in. length, within the 30-in. vertical strip examined on each DST. No horizontal scan of the liquid/sludge interface is conducted.	UT results to date for vertical scans in 11 DSTs have not found any evidence of accelerated degradation or flaws at a liquid/sludge interface that exists now, or may have existed during the tank operating history. By FY 2005, all 28 DSTs will be examined over a ~35-ft. by 30-in. wide vertical strip. Evidence of accelerated degradation or flaws at a liquid/sludge interface could potentially cause expansion of the examination scope for that tank.	None

Office of River Protection Double-Shell Tank Integrity Program Elements

UT	TSIP (BNL-52527 – UC-406)	Hanford DST Integrity Program	Rationale for Departure from TSIP Guidelines	Comments
	5% divided between knuckle* base metal and lower weld if accessible. Otherwise 5% of knuckle divided into two or more segments. *[Lower knuckle of primary tank. Predicted maximum stress region of base metal plus lower weld if accessible.]	• 6 DSTs have been identified for examination of a 20-ft. circumferential length of the lower knuckle. Examinations are to be conducted on the entire 20-ft. length in each interval, rather than partially in sub-intervals. • SAFT/T-SAFT will inspect the lower knuckle region to the lower knuckle/bottom plate weld. • Extended arm P-scan will overlap the SAFT/T-SAFT inspection from the lower knuckle top weld to just above the maximum stress region. • The bottom/lower knuckle weld is not examined, except through air slots when tank bottoms are examined. • 20-ft. of weld and HAZ joining the vertical wall to lower knuckle is examined, if accessible.1 The entire 20-ft. length is examined at one time—not in 2 or more subintervals.	• N/A exceeds TSIP guidelines for lower knuckle region. Examination scope is not presently planned to be apportioned among sub-intervals due to higher costs associated with multiple tank entries. Examination of lower knuckle region is dependent upon accessibility. • Frequency of successive lower knuckle region examinations will be increased if significant degradation or evidence of SCC, or any cracking is observed. • No cracks, significant wall thinning, or other problems have been observed to date in examination of the welds and HAZ in 11 DSTs.	Development of a tandem synthetic aperture focusing technique (T-SAFT) was accomplished and deployed on one DST (January 2003), demonstrating the ability to examine the high stress region and lower knuckle to bottom weld. An extended arm for UT examination allows more area of the knuckle to be examined above the high stress region.
	Examine primary tank bottom as practical for cracks, pits, and wall thinning, on a "best effort" basis.	Primary tank bottoms are scheduled to be examined through accessible air-slots for wall thinning and circumferential cracks, on 6 DSTs. Per TPA Milestone M-48, the examination shall extend at least 10 ft. toward the center of the tank from the lower knuckle joint or to the length practical within the limits of best available equipment. Extent of examination is dependent on surface conditions, obstructions, and geometry constraints.	N/A—current approach complies with TSIP guidance for tank bottoms	None

[1] Exceptions: On AY-101 and AY-102, lower knuckle weld could not be examined due to concrete splatter. Instead, 20 ft of the lowest accessible horizontal weld is examined—which in AY-102 was the weld joining plate #2 to plate #3. On AW-103 (the first tank examined—in 1997) welds were not examined, except where included in the 10¼ in. wide vertical strips.

Office of River Protection Double-Shell Tank Integrity Program Elements

UT	TSIP (BNL-52527 – UC-406)	Hanford DST Integrity Program	Rationale for Departure from TSIP Guidelines	Comments
	External surface of primary tank In accessible regions, UT 10 areas of 1 ft^2 area for thickness measurement.	Each of 28 DSTs is examined over a ~35-ft. by 30-in. wide vertical strip, regardless of waste surface level. Overall coverage of vertical wall exam is approximately 87 ft^2 or approximately 1% of tank surface. Wall examinations also include 20-ft. of vertical welds, and 20-ft. of vertical wall/lower knuckle weld.	N/A—current approach complies with and exceeds TSIP guidance	None
	Secondary tank - 5 areas of 1 ft^2 and 5% of knuckle region welds	Examination of a 20-ft. length of the secondary tank knuckle and 10 ft^2 of the secondary tank floor, for wall thinning, pits, and cracks is planned for 3 DSTs.	N/A—current approach exceeds TSIP guidance	None
Evaluation Criteria/Acceptance Levels	• Wall thinning: 20% t • Pits: 50% t • Cracks <12": 50% t • Cracks >12": 20% t	• Wall thinning: 20% t • Pits: 50% t • Cracks <12": 3/16" • Cracks >12": 3/16"	• N/A for wall thinning and pits (same as TSIP) • Hanford acceptance criteria for crack depth is equal to or more stringent than TSIP guidance for crack length <12 in., but less stringent for crack length >12 in. Hanford acceptance criteria for crack length >12 in. is consistent with WHC-SD-WM-AP-036, issued 9/27/95. Rationale: a single conservative value for crack depth acceptance criteria, independent of plate thickness, is less prone to error than one that varies with plate thickness (i.e. used 50% of 3/8" plate). In practice, all detectable cracks have been reported	ASME Section XI, IWC-2424 was used as references in developing Hanford Standards

Office of River Protection Double-Shell Tank Integrity Program Elements

UT	TSIP (BNL-52527 – UC-406)	Hanford DST Integrity Program	Rationale for Departure from TSIP Guidelines	Comments
	Additional examinations are to follow IWC-2430: Examination results that exceed acceptance criteria require extending the examination to include additional areas of similar material and service	Where indications are found, additional examinations are performed, as directed by an expert panel (UT Inspection Panel).	N/A—practice at Hanford has involved: • increasing the sample size to all 28 DSTs vs. original scope of 6 DSTs, • extending examinations, in the same tank, when acceptance criteria was triggered or approximated, based on recommendations of the UT Inspection Panel consistent with WHC-SD-WM-AP-036.	ASME Section XI, IWC-2430 and IWA-2430 were used as references in developing Hanford Standards
	Repair or corrective action for > 75% t	Repair not currently an option; Management Decision based on thorough technical analysis.	N/A	**None**
Acceptance Criteria	None	Evaluation of indications exceeding the acceptance levels are documented, tracked, and dispositioned via the Hanford occurrence reporting system. Part of this disposition includes assembling a UT inspection review panel comprised of appropriate subject matter experts. Analysis of indications is performed in accordance with industry accepted methods, such as, but not limited to, ASME XI, API, EPRI, or NASA.	N/A – not covered by TSIP guidelines	**None**
Frequency	**10 years**	• Initial inspection occurred more than 10 years after DSTs placed in service. This is scheduled to be complete in FY 2005 • Repeat inspections planned at 8 to 10 year intervals	• UT program for DSTs established when draft TSIP guidelines became available, codified in TPA Milestone M series. • Intervals for repeat inspections are consistent with TSIP guidelines	ASME Section XI, IWA-2432 is used as a reference for development of frequency
Schedule	None	See Frequency	N/A	

Office of River Protection Double-Shell Tank Integrity Program Elements

UT	TSIP (BNL-52527 – UC-406)	Hanford DST Integrity Program	Rationale for Departure from TSIP Guidelines	Comments
Equipment	Capability of detection and sizing – must detect 50% t pits, 20% t thinning, 20% t for 1-ft length and 50% t for shorter cracks; uncertainty no more than ± 20% of these values	• Wall thinning: +/- 0.02". • Pits: +/- 0.05" • Cracks: +/- 0.1"	Rationale: Accuracy limits for Hanford DSTs were established not as a function of plate thickness, but based on actual equipment capability as demonstrated in Performance Demonstration Tests administered by PNNL in 1998 and 2000. Accuracy limits for thinning and pitting in Hanford DSTs are equal to or more stringent than TSIP recommendations for ½" or heavier plate sizes, but less stringent for 3/8" plate size. Accuracy limits for crack depth in Hanford DSTs are less stringent than TSIP recommendations.	ASME Section XI Appendix VIII used for stress corrosion cracking
Inspector Qualifications	ANSI/ANST CP-189	NDE personnel are qualified in accordance with ASNT Guideline SNT-TC-1A-92	Both ASNT CP-189 and SNT-TC-1A-92 were considered in establishing qualification requirements for personnel. SNT-TC-1A was considered adequate for tank inspections, and was selected. At the time of selection most NDE technicians were being qualified to SNT-TC-1A. Additionally, Inter-granular Stress Corrosion Cracking (IGSCC) training is required for NDE Level III technicians.	None
UT Procedure Requirements	Applicable portions of ASME Section XI Appendix VIII should be limited to 2100 (a), (b), (c), and (d); and Supplements 2 and 3.	UT contractor procedure includes all elements in VIII-2100, does not include supplements 2 and 3 since they do not apply to tanks.	N/A—UT procedure for DSTs complies with TSIP guidance. Supplements 2 and 3 apply to piping—not to tanks.	None
Action Limits	See evaluation criteria.	See evaluation criteria.	See evaluation criteria	None
Records Management	None	36 CFR (Code of Federal Regulations), 1234 DOE O 1324.5B, DOE O 414.1, 10 CFR 820.120, DOE O 200.1	None	None

Savannah River Site In-Service Inspection Program Elements

UT	TSIP (BNL-52527 –UC-406)	SRS HLW Tank ISIP
Tank Selection	At least 10% (or 1 if < 10%); select based on age, severity of operating conditions, and transients; if not homogenous, >10% may be required to represent worst-case	Technical basis developed to categorize tanks by type of service; ranked based on potential for degradation; materials of construction, years under corrosion control program, years of service, years at high temperatures, time at constant waste level, tank function, anomalous observations. 100% Type III/IIIA tanks Full Scope – 19% (5/27) Type III/IIIA tanks; 6% (1/16) Type I/II tanks Augmented Scope – 81% (22/27) Type III/IIIA tanks Exceeds TSIP
	If >10% are examined, option to reduce percent per tank accordingly.	Augmented scope on 22 tanks – 1 vertical strip 8.5 inches wide from top knuckle to bottom knuckle
Extent of Examination (ASME Section XI, IWC-2500)	5% of liquid-vapor interface	1% - 4 each vertical 8.5 inch wide strips from top knuckle to bottom knuckle covers historical interfaces – Meet TSIP*
	5% of liquid-sludge interface	1% - 4 each vertical 8.5 inch wide strips from top knuckle to bottom knuckle covers historical interfaces – Meets TSIP*
	2.5% of lower knuckle base material, if possible 2.5% of knuckle to bottom weld, if possible	5% of accessible circumference in 1 or more segments; Meets TSIP – maximum knuckle accessible is inspected
	Bottom plate, as accessible	Access to bottom plate being pursued – Meets TSIP – maximum bottom plate accessible is inspected
	External surface of primary tank	4 each vertical 8.5 inch wide strips from top knuckle to bottom knuckle covers historical interfaces; 10 areas X 1ft^2 1 vertical weld; 5% of horizontal weld Meets TSIP
	Secondary tank - 5 areas of 1 ft^2 and 5% of knuckle region welds	Extent of exam due to accessibility TBD Extent of accessible region will meet or exceed TSIP
	Overall coverage equates to approx. 80 ft^2; approx. 1%	Overall coverage equates to approx. 100 ft^2; approx. 1%; Exceeds TSIP
Evaluation Criteria (ASME Section XI, IWC-2424 and -2430)	Successive examinations for pits 25% t; cracks 10% t for ≥1 ft, 25% t for <1 ft; 10% t for thinning	Successive examinations at 25% nominal t for pitting; 20% nominal t for ≥ 6 inches, 25% nominal t for < 6 inches for cracks; 10% nominal t for thinning; ISI Review Committee evaluates smaller indications for early mitigation; Meets TSIP
	Additional Examinations for pits 50% t; cracks 20% t for ≥1 ft, 50 % t for <1 ft; 20% t for thinning	Additional examinations at 20% nominal t for pitting; 20% nominal t for ≥ 1 ft, 50% nominal t for < 1 ft for cracks; 20% nominal t for thinning; Meets TSIP
	Repair or corrective action for > 75% t	Repair not currently an option; Management Decision re: mitigation – Meets TSIP
Acceptance Criteria/Standard	None	General Thinning – Primary tank stresses within ASME Section VIII, Division 2 allowable stresses Pitting – Single pit of any depth (up to thru wall) is acceptable provided TSR leakage criterion is met Local Thinning – with $t_{ave} < t_{nom}$, $P_L + P_b \leq k\ 1.5Sm$ and $P_L + P_b + Q \leq 3Sm$ where variables are defined in ASME Section VIII, Div 2; t_{ave} methodology provided in API

Savannah River Site In-Service Inspection Program Elements

UT	TSIP (BNL-52527 –UC-406)	SRS HLW Tank ISIP
		653 Service Induced Flaws – 50% nominal t and > 1.5 inches subject to flaw specific analysis for projected length at next exam; maximum acceptable flaw size ≤ 0.5X the instability length; Established and documented critical flaw lengths and assumptions for flaw propagation rates based on experience and modeling; Exceeds TSIP
Frequency (ASME Section XI, IWA-2432)	10 years	Tank 32 every 7 years; 4 each full scope Type III/IIIA tanks every 10 years; Tank 15 twice within 5 year period; 22 augmented scope Type III/IIIA once; Meets TSIP
Schedule	None	Complete UT of all Type III/IIIA tanks by FY12; 3/4 of Type III tanks with no previous UT data scheduled for FY03, other in FY06;
Equipment (ASME Section XI Appendix VIII)	Capability of detection and sizing – must detect 50% t pits, 20% t thinning, 20% t for 1-ft length and 50% t for shorter cracks; uncertainty no more than ± 20% of these values	Force Institutes P-Scan PS4 (Lite); P-Scan AMS-1T Scanner; Capable of detecting: Thinning within 0.020 inches (4% nominal t); pitting within 0.050 inches (10% nominal t); crack depth within 0.100 inches for ≥ 0.5 inches long, < 6 inches long (25% nominal t); Meets TSIP
Inspector Qualifications (ANSI/ANST CP-189)	ANSI/ANST CP-189	Level II or III per American Society for Nondestructive Testing Recommended Practice No. SNT-TC-1A Meets TSIP
Action Limits	See evaluation criteria.	See evaluation criteria.
Records Management	None	36 CFR (Code of Federal Regulations), Chapter XII, Subchapter B, "Records Management" DOE G 244-1, "Implementation Guide for Use with 36 CFR Chapter XII, Subchapter B, Records Management" DOE Records Schedules (NARA approved) Meets TSIP

* Although the percent of interface inspected is less than that called for in TSIP, the intent of TSIP is satisfied. The HLW tanks at SRS have seen a varied waste level over the operating history of the tanks. The current waste level, and associated interface regions, may or may not have been constant over the last several years. A constant waste level was one of the criteria utilized to rank the tanks for determining full scope versus augmented scope and scheduling of inspections (worst-case). 4X 8.5 inch strips over the entire accessible height of the tank will encompass all of the historical interface regions over the operating history of the tank. The intent of the NDE, as stated in the TSIP, is to detect degradation due to generic mechanisms that cause pitting, thinning, and/or cracking. It is the judgement of SRS that generic degradation would be exhibited over the majority of the circumference at the interface region. By covering all historical interfaces, versus the current interface only, SRS judges the intent of the TSIP is satisfied for this particular aspect.