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# ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 657289

Proj. ECN

| 2. ECN Category (mark one) | 3. Originator's Name, Organization, MSIN, and Telephone No. | 4. USQ Required? | 5. Date |
|---|---|---|---|
| Supplemental [] <br> Direct Revision [] <br> Change ECN [] <br> Temporary [] <br> Standby [] <br> Supersedure [X] <br> Cancel/Void [] | Melvin R. Adams, Data Assessment and Interpretation, R2-12, 373-6167 | [] Yes [X] No | 06/20/00 |
| | 6. Project Title/No./Work Order No. <br> Tank 241-TX-113 | 7. Bldg./Sys./Fac. No. <br> 241-TX-113 | 8. Approval Designator <br> N/A |
| | 9. Document Numbers Changed by this ECN (includes sheet no. and rev.) 6-21-00 REV <br> HNF-SD-WM-ER-716, Rev. ~~1~~0-A | 10. Related ECN No(s). <br> ECNs: 64796 | 11. Related PO No. <br> N/A |

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13a. Description of Change

13b. Design Baseline Document? [] Yes [X] No

Document has been released and superseded by an electronic information database and data currently available via hard copy are now available at the HLAN address: http://pctwins.pnl.gov:9397/twinsproto/default.htm.

14a. Justification (mark one)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Criteria Change | [X] | Design Improvement | [] | Environmental | [] | Facility Deactivation | [] |
| As-Found | [] | Facilitate Const | [] | Const. Error/Omission | [] | Design Error/Omission | [] |

14b. Justification Details

Electronic access to information and data is superseding hard copy document.

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

See attached distribution.

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1. ECN (use no. from pg. 1) ECN-657289

| 16. Design Verification Required | 17. Cost Impact | | | | 18. Schedule Impact (days) | |
|---|---|---|---|---|---|---|
| | ENGINEERING | | CONSTRUCTION | | | |
| [] Yes | Additional | [] $ | Additional | [] $ | Improvement | [] |
| [X] No | Savings | [] $ | Savings | [] $ | Delay | [] |

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

| | | | | | |
|---|---|---|---|---|---|
| SDD/DD | [] | Seismic/Stress Analysis | [] | Tank Calibration Manual | [] |
| Functional Design Criteria | [] | Stress/Design Report | [] | Health Physics Procedure | [] |
| Operating Specification | [] | Interface Control Drawing | [] | Spares Multiple Unit Listing | [] |
| Criticality Specification | [] | Calibration Procedure | [] | Test Procedures/Specificatio n | [] |
| Conceptual Design Report | [] | Installation Procedure | [] | Component Index | [] |
| Equipment Spec. | [] | Maintenance Procedure | [] | ASME Coded Item | [] |
| Const. Spec. | [] | Engineering Procedure | [] | Human Factor Consideration | [] |
| Procurement Spec. | [] | Operating Instruction | [] | Computer Software | [] |
| Vendor Information | [] | Operating Procedure | [] | Electric Circuit Schedule | [] |
| OM Manual | [] | Operational Safety Requirement | [] | ICRS Procedure | [] |
| FSAR/SAR | [] | IEFD Drawing | [] | Process Control Manual/Plan | [] |
| Safety Equipment List | [] | Cell Arrangement Drawing | [] | Process Flow Chart | [] |
| Radiation Work Permit | [] | Essential Material Specification | [] | Purchase Requisition | [] |
| Environmental Impact Statement | [] | Fac. Proc. Samp. Schedule | [] | Tickler File | [] |
| Environmental Report | [] | Inspection Plan | [] | | [] |
| Environmental Permit | [] | Inventory Adjustment Request | [] | | [] |

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

| Document Number/Revision | Document Number/Revision | Document Number Revision |
|---|---|---|
| N/A | | |

21. Approvals

| | Signature | Date | | Signature | Date |
|---|---|---|---|---|---|
| Design Authority | | | Design Agent | | |
| Cog. Eng. M. R. Adams | MRAdams | 6/20/00 | PE | | |
| Cog. Mgr. J. G. Field | JG Field | 7/10/00 | QA | | |
| QA | | | Safety | | |
| Safety | | | Design | | |
| Environ. | | | Environ. | | |
| Other | | | Other | | |

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

# Tank Characterization Report for Single-Shell Tank 241-TX-113

**Melvin R. Adams**
CH2M Hill Hanford Group, Inc., Richland, WA 99352
U.S. Department of Energy Contract 8023764-9-K001

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| RECORD OF REVISION | (1) Document Number HNF-SD-WM-ER-716 | Page 1 |
|---|---|---|

(2) Title

Preliminary Tank Characterization Report for Single-Shell Tank 241-TX-113: Best-Basis Inventory

CHANGE CONTROL RECORD

| (3) Revision | (4) Description of Change - Replace, Add, and Delete Pages | Authorized for Release (5) Cog. Engr. | (6) Cog. Mgr. Date |
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**HNF-SD-WM-ER-716, Rev. 1**
**This report prepared especially for ARCHIVE TIR on 6/20/00**

**Some of the reports herein may contain data that has not been reviewed or edited. The data will have been reviewed or edited as of the date that a Tank Interpretive Report (TIR) is prepared and approved. The TIR for this tank was approved on June 19, 2000.**

Tank: 241-TX-113

Sampling Events:
- 253
- 258

Reports:
- Tank Interpretive Report

Constituent Groups:
- Anions
- Inorganics
- Metals/Nonmetals
- Organics
- PCBs
- Physical Properties
- Radionuclides

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## Data Dictionary to Reports in this Document

| Report | Field | Description |
|---|---|---|
| Tank Interpretive Report | | Interprets information about the tank answering a series of seven questions covering areas such as information drivers, tank history, tank comparisons, disposal implications, data quality and quantity, and unique aspects of the tank. |

## Tank Interpretive Report For 241-TX-113

### Tank Information Drivers

*Question 1: What are the information drivers applicable to this tank? What type of information does each driver require from this tank? (Examples of drivers are Data Quality Objectives, Mid-Level Disposal Logic, RPP Operation and Utilization Plan, test plans and Letters of Instruction.) To what extent have the information and data required in the driving document been satisfied to date by the analytical and interpretive work done on this tank?*

The information drivers for tank 241-TX-113 include the Safety Screening Data Quality Objective (DQO) (Dukelow et al. 1995), the Flammable Gas DQO (Bauer and Jackson 1998), the Historical DQO (Simpson and McCain 1997), and the Pretreatment DQO (Slankas et al. 1995 and Kupfer et al. 1995).

**Safety Screening DQO**: Does the waste pose or contribute to any recognized potential safety problems?

The data needed to screen the waste in tank 241-TX-113 for potential safety problems are documented in *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). These potential safety problems are exothermic conditions in the waste, flammable gases in tank headspace, and criticality conditions in the waste. Tank 241-TX-113 has been sufficiently sampled to meet the requirements of the Safety Screening DQO. The individual issues addressed in the DQO are discussed below.

Results obtained using differential scanning calorimetry (DSC) indicated that none of the core samples obtained from tank 241-TX-113 in 1998 and 1999 exceeded the safety screening decision threshold of 480 J/g (dry-weight basis). The highest individual sample result was 7.3 J/g (dry-weight basis) from core 258 segment 3 upper half. The highest calculated one-sided 95 percent confidence interval upper limit on the mean was 8.04 J/g (dry-weight basis) from core 258 segment 3 upper half. These results are well below the safety screening decision threshold, alleviating the concern regarding exothermic conditions in the waste.

Under the direction of the *Tank 241-TX-113 Rotary Mode Core Sampling and Analysis Plan* (McCain 1998) headspace vapor measurements were taken during the 1998 and 1999 sampling event. All results were 2 percent of the lower flammability limit (LFL) or less. The results from the combustible gas meter readings are reported in the *IH Sniff Data* Standard Report. On August 6, 1997, samples of the tank 241-TX-113 headspace vapor were collected and analyzed using the in situ vapor sampling system (ISVSS). Calculations using the maximum reported values from the vapor sampling event (Viswanath 1997) determined that the LFL is 2.1 percent (Fowler 1998). These results are all well below the action level of 25 percent of the LFL.

The threshold value for the criticality issue is 1 g/L of plutonium. The total alpha activity is often the basis for the comparison of sample results to the threshold value. A sample density must be applied to convert 1 g/L of plutonium to the equivalent total alpha activity. The maximum bulk density result for the sampling event is usually applied when assessing the safety screening criticality issue.

However, for tank 241-TX-113, the hard crystalline nature of the samples prevented bulk density analyses. Tank 241-TX-118 was similar to tank 241-TX-113 in process history and nature of the waste. Therefore, the maximum sample density of 1.88 g/mL converted from tank 241-TX-118 saltcake solids specific gravity was used to calculate the total alpha equivalent to 1 g/L of plutonium. Assuming that all alpha activity is from $^{239}$Pu, and using the sample density of 1.88 g/mL, 1 g/L of $^{239}$Pu is equivalent to 32.7 $\mu$Ci/g. The maximum total alpha result was 0.0701 $\mu$Ci/g with a calculated 95 percent confidence interval of 0.0935 $\mu$Ci/g. Therefore, criticality is not a concern for this tank.

**Flammable Gas DQO**: Does a possibility exist for releasing flammable gases into the headspace of the tank or releasing chemical or radioactive materials into the environment?

The requirements to support the flammable gas issue are documented in the *Data Quality Objective to Support Resolution of the Flammable Gas Safety Issue* (Bauer and Jackson 1998). The Flammable Gas DQO has been extended to apply to all tanks. Analyses and evaluations will change according to program needs until this issue is resolved. Final resolution of the flammable gas safety issue is expected by September 30, 2001 (Johnson 1997).

As stated in the safety screening DQO section of the tank interpretive report, headspace vapor measurements taken during the 1998/1999 sampling event showed results well below the action limit of 25 percent of the LFL.

The results from the August 6, 1997 headspace vapor sampling event are documented in the *Tank Vapor Sampling and Analysis Data Package for Tank 241-TX-113, Sampled August 6, 1997* (Viswanath 1997). The following analytes were detected at greater than their vapor program required quantitation limits (VPRQLs): acetone, ammonia, 1-butanol, 2-butanone, carbon dioxide, carbon tetrachloride, chloroform, ethanol, Freon 11, 2-pentanone, 1-propanol, 2-propanol, tetrahydrofuran, toluene, non-methane organic carbon, and water vapor. Of these species, the most abundant constituents detected were carbon dioxide, ammonia, and water vapor. None of the analytes were detected at concentrations greater than the notification limits specified in the *Vapor Sampling and Analysis Plan* (Buckley 1997). As stated in the Safety Screening DQO portion of the tank interpretive report, calculations using the maximum reported values from the vapor sampling event determined that the LFL is 2.1 percent (Fowler 1998), well below the action limit of 25 percent of the LFL.

**Historical DQO:** Is the waste inventory generated by a model based on process knowledge and historical information (Agnew et al. 1997a) representative of the current tank waste inventory?

The purpose of the historical evaluation is to determine whether the Hanford Defined Waste (HDW) model, based on process knowledge and historical information (Agnew et al. 1997a), agrees with current descriptions of tank inventories based on sampling. Historical DQO issues (Simpson and McCain 1997) have largely been replaced by the Best-Basis Inventory assessment (see Question 7). The following discussion of the historical DQO evaluation is presented for information.

The historical DQO identifies the waste type of interest for tank 241-TX-113 as SMMT2 saltcake. In the evaluation, a gateway analysis is performed by comparing analytical results with DQO-defined concentration levels for the key analytes in the SMMT2 saltcake waste type. If the analytical results are > 10 percent of the DQO-defined levels and the sum of the analyte masses is > 85 percent of the

sum for the total tank waste, the waste type and layer identification are considered acceptable (Simpson and McCain 1997).

According to Agnew et al. (1997a), tank 241-TX-113 is expected to contain a layer comprised of eight segments of SMMT2 saltcake waste. The 1998/1999 rotary-mode core extrusion and analytical results indicated the total tank inventory was representative of saltcake. Therefore, the analytical results for the key analytes from each of the segments from the 1998/1999 sampling event were compared to the historical model evaluation DQO-predicted concentrations for these waste types.

The key analytes for SMMT2 saltcake are sodium, aluminum, chromium, nitrate, sulfate, and weight percent water (Simpson and McCain 1997). A comparison between the analyte concentrations measured by acid digest in the 1998/1999 core 253 segments and the SMMT2 waste type is found in Table 1-1 and Table 1-2, and the comparison between the analyte concentrations in core 258 and the SMMT2 waste type is found in Table 1-3.

Table 1-1. 241-TX-113 Historical DQO Comparison: Core 253

| Analyte | Unit | Segment 1 Core 253 | Segment 3 Core 253 | Segment 4 Core 253 | Segment 5 Core 253 | Segment 6 Core 253 | SMMT2[1] |
|---|---|---|---|---|---|---|---|
| Na[2] | ppm | 212,000 | 278,000 | 272,000 | 261,000 | 210,000 | 173,000 |
| Al[2] | ppm | 14,600 | 1,210 | 1,880 | 3,790 | 1,610 | 17,300 |
| Cr[2] | ppm | 634 | 214 | 262 | 493 | 230 | 1,870 |
| $H_2O$ | ppm | 243,000 | 125,000 | 116,000 | 134,000 | 185,000 | 398,000 |
| $NO_3$ | ppm | 411,000 | 231,000 | 254,000 | 70,800 | 340,000 | 275,000 |
| $SO_4$ | ppm | <1,110 | 203,000 | 173,000 | 197,500 | 87,500 | 13,136 |
| Totals | ppm | 882,344 | 838,424 | 817,142 | 667,583 | 824,340 | 878,306 |

Notes:
[1]Simpson and McCain (1997)
[2]Acid digestion results were used.

Table 1-2. 241-TX-113 Historical DQO Comparison: Core 253

| Analyte | Unit | Segment 7 Core 253 | Segment 8 Core 253 | Segment 9 Core 253 | Segment 10 Core 253 | Segment 11 Core 253 | SMMT2[1] |
|---|---|---|---|---|---|---|---|
| Na[2] | ppm | 259,000 | 325,000 | 313,000 | 285,000 | 269,000 | 173,000 |
| Al[2] | ppm | 3,370 | 5,960 | 4,740 | 1,750 | 2,620 | 17,300 |
| Cr[2] | ppm | 343 | 876 | 572 | 225 | 405 | 1,870 |
| $H_2O$ | ppm | 146,000 | 115,000 | 68,200 | 14,900 | 257,000 | 398,000 |
| $NO_3$ | ppm | 41,200 | 48,700 | 325,000 | 644,000 | 476,000 | 275,000 |
| $SO_4$ | ppm | 220,000 | 202,000 | 157,000 | 66,700 | 96,500 | 13,136 |
| Totals | ppm | 669,913 | 697,536 | 868,512 | 1,012,575 | 1,101,525 | 878,306 |

Notes:
[1]Simpson and McCain (1997)
[2]Acid digestion results were used.

Table 1-3. 241-TX-113 Historical DQO Comparison: Core 258

| Analyte | Unit | Segment 2 Core 258 | Segment 3 Core 258 | Segment 4 Core 258 | Segment 5 Core 258 | Segment 6A Core 258 | SMMT2[1] |
|---|---|---|---|---|---|---|---|
| Na[2] | ppm | 250,000 | 217,000 | 258,000 | 245,000 | 233,000 | 173,000 |
| Al[2] | ppm | 264 | 2,450 | 211 | 350 | 1,230 | 17,300 |
| Cr[2] | ppm | 141 | 154 | 94.4 | 179 | 656 | 1,870 |
| $H_2O$ | ppm | 24,800 | 12,700 | 53,600 | 54,600 | 98,700 | 398,000 |
| $NO_3$ | ppm | 715,000 | 714,000 | 691,000 | 666,000 | 640,000 | 275,000 |
| $SO_4$ | ppm | <2,810 | <2,640 | <3,140 | 4,350 | <1,420 | 13,136 |
| Totals | ppm | 993,015 | 948,944 | 1,006,045 | 970,479 | 975,006 | 878,306 |

Notes:
[1]Simpson and McCain (1997)
[2]Acid digestion results were used.

As shown in Table 1-1 and Table 1-2, segments 4, 5, 7, 8, 9, and 11 from core 253 passed the gateway analysis for the 10 percent criterion when compared to the SMMT2 saltcake fingerprint analyte concentrations. Core 253, segment 1 failed the criterion due to a low sulfate value, core 253, segments 3 and 6 failed the criterion due to low aluminum values, and core 253, segment 10 failed the criterion due to low percent water. None of the segments from core 258 (Table 1-3) passed the gateway analysis for the 10 percent criterion when compared to the SMMT2 saltcake fingerprint analyte concentrations. The Core 258 analyte concentrations were less than 10 percent of the Historical DQO SMMT2 saltcake fingerprint values for aluminum in all segments except segment 3, for chromium in all segments except segment 6A, and for percent water in segments 2 and 3.

To pass the 85 percent total mass criterion for the waste type, the segments must have a total mass of at least 850,000 ppm for the same analytes. The Historical DQO SMMT2 saltcake fingerprint analytes overestimate the aluminum, chromium, and percent water concentrations in the core 253 segments, causing the failure of segments 3 through 8 in the 85 percent total mass criterion for the waste type. Core 253 segments 1 and 10 passed the 85 percent criterion but failed the 10 percent criterion; therefore, they are not considered representative of the historical DQO SMMT2 waste type. The core 258 segments each passed the 85 percent criterion for the SMMT2 saltcake. However, the core 258 segments each failed the 10 percent criterion for the Historical DQO and none of the core 258 segments are considered representative of the waste type for the Historical DQO. Core 253 segments 9 and 11 passed both sets of criterion for the Historical DQO, and are considered representative of the SMMT2 saltcake waste type.

**Pretreatment DQO**: What fraction of the waste is soluble when treated by sludge washing and leaching?

An archived solid composite sample of 150 grams (g) was requested for the Pretreatment DQO (Slankas et al. 1995 and Kupfer et al. 1995) in the *Tank 241-TX-113 Rotary Mode Core Sampling and Analysis Plan* (McCain 1998). The request for the 150 g composite was based on the expectation of two seven-segment cores from tank 241-TX-113. A 77.7 g composite from core 253 and an 80.5 g composite from core 258 were archived for future pretreatment analysis and evaluation to assess what fraction of the waste is soluble when treated by sludge washing and leaching.

**Heat Load Estimate:**

A factor in assessing tank safety is the heat generation and temperature of the waste. Heat is generated in the tanks from radioactive decay. The heat load estimate based on the process history was 2,580 W (8,800 Btu/hr) (Agnew et al. 1997a). The heat load estimate based on the tank headspace temperature was 1,637 W (5,588 Btu/hr) (Kummerer 1995). The tank heat load based on the Best-Basis Inventory (see Standard Report *Best-Basis Inventory [Radioactive]*), decayed back to January 1, 1994, was 378 W (1,290 Btu/hr) as shown in Table 1-2. These are all well below the limit of 7,600 W (26,000 Btu/hr) that separates high and low heat load single-shell tanks (CHG 2000).

Table 1-2. Heat Load Estimate Based on the Best-Basis Radionuclide Inventory.

| Radionuclide | Waste Inventory | Decay Heat Generation Rate | Heat Load (W) |
|---|---|---|---|
| Strontium-90 | 8.76E+03 Ci | 0.00669 W/Ci | 59 |
| Cesium-137 | 6.75E+04 Ci | 0.00472 W/Ci | 319 |
| Total | - | - | 378 |

**Bounding Concentrations:**

Sample results from tank 241-TX-113 were screened against the bounding concentration limits used to develop the authorization basis source term, derived from the Final Safety Analysis Review. These bounding concentration limits are found in Tables 4-1 and 4-2 in HNF-SD-PROC-021 Rev. 3, Section 18.0 (Adams 1999). No analyte results exceeded the respective bounding concentration limits.

## Tank History

*Question 2: What is known about the history of this tank as it relates to waste behavior?*

The 241-TX Tank Farm was constructed during 1947 and 1948 in the 200 West Area. The TX Tank Farm contains eighteen 100-series tanks. The 100-series tanks have a capacity of 2,869 kL (758 kgal), a diameter of 22.9 m (75.0 ft), and an operating depth of 7.3 m (23.94 ft). Tank 241-TX-113 is the first tank in a three tank cascade with tanks 241-TX-114 and 241-TX-115. Tank 241-TX-113 is listed as an assumed leaker and currently contains 2,472 kL (653 kgal) of noncomplexed waste.

Hanlon (2000) lists the waste volume for tank 241-TX-113 as 2,298 kL (607 kgal), based on the process history. The waste volume of 2,472 kL (653 kgal) was estimated using the zipcord readings taken prior to the 1998/1999 core sampling event. The waste volume of 2,472 kL (653 kgal) will be reflected in a future Hanlon report update. Tank descriptions and figures are presented in standard reports *Description of Tank, Tank Plan View, Tank Profile View*, and *Riser Configuration Table*.

Agnew et al. (1997b) indicated that tank 241-TX-113 entered service in the fourth quarter of 1950 with the receipt of first cycle decontamination cycle waste from T Plant. Anderson (1990) reports that tank 241-TX-113 entered service in the second quarter of 1952 as an active bottoms tank for the 242-T Evaporator. Between 1952 and 1953 tank 241-TX-113 received evaporator bottoms from tank 241-TX-118. No activity was reported for the tank between 1953 and 1966. Waste was exchanged between tank 241-TX-113 and tank 241-TX-118 in 1966. Tank 241-TX-113 received concentrated evaporator bottoms (T2 saltcake) from and sent recycled supernates to the evaporator, via tanks 241-TX-116 and 241-TX-118, for the second 242-T Evaporator feed campaign between 1966 and 1976. In 1975, supernate was transferred from tank 241-TX-113 to tank 241-TX-115.

There are discrepancies between sources as to the tank 241-TX-113 service start and end dates. According to Agnew et al. (1997b), tank 241-TX-113 went into service in 1950 when bismuth phosphate process 1C waste was received from T Plant. Agnew et al. (1997b) stated the tank received 1C waste between 1950 and 1951, and the waste cascaded from tank 241-TX-113 to tank 241-TX-114. Tank 241-TX-113 then sent 1C supernatant to tank 241-TX-118 in 1952. Anderson (1990) cites the service start date as the second quarter of 1952, with the addition of the 242-T Evaporator bottoms. The documented tank activity from 1952 to 1975 agrees between both sources. Tank 241-TX-113 was declared an assumed leaker in 1974 and removed from service in 1975, according to Anderson (1990). The tank was declared inactive in 1977 as stated in Brevick et al. (1997). Interim stabilization was complete in April 1983, and intrusion prevention was complete in August 1984.

## Tank Comparisons

*Question 3: What other tanks have similar waste types and waste behaviors, and how does knowledge of the similar tanks contribute to the understanding of this tank?*

According to Agnew et al. (1997a), tank 241-TX-113 currently contains first cycle decontamination (1C) sludge and late campaign 242-T evaporator bottoms (T2 saltcake). It is the first tank in a three tank cascade with tanks 241-TX-114 and 241-TX-115. All three tanks have a significant layer of T2 saltcake waste. The T2 saltcake waste type is relatively well defined and understood, and can be found in a number of other tanks. Inventories of greater than 1,136 kL (300 kgals) of T2 saltcake waste exist in 241-TX-105, 241-TX-106, 241-TX-110, 241-TX-111, 241-TX-112, and 241-TX-114. Tank 241-U-102 also contains a sizable T2 saltcake waste layer. Knowledge from these tanks may contribute to the understanding of the T2 saltcake inventory in tank 241-TX-113. The T2 saltcake layer in tank 241-TX-118 provides valuable information regarding the waste in tank 241-TX-113. The saltcake waste in tank 241-TX-113 and 241-TX-118 have similar historical and physical characteristics. Saltcake waste was exchanged between these two tanks from 1966 through 1976. The waste in both tanks was observed to be very dry, causing difficulty in obtaining accurate bulk density measurements. The tank 241-TX-118 saltcake solids specific gravity was used to estimate the density for tank 241-TX-113. The estimated density value of 1.79 g/mL was incorporated into the best basis inventory effort for tank 241-TX-113, and was applied to calculations for bounding limits and the safety screening DQO evaluation.

The 1C sludge waste layer attributed to tank 241-TX-113 is uncertain. Process history attributed a 1C sludge waste volume of 693 kL (183 kgal) to tank 241-TX-113 based primarily on a sludge reading during the first quarter of 1965. This was before the tank had been placed in evaporator bottoms service for the second time. However, a significant degree of uncertainty associated with

these sludge level measurements was noted in Anderson (1990). T1 saltcake and caustic supernatant had been in contact with the sludge during the first evaporator bottoms service. Subsequent solids volume measurements in the second quarter of 1957 and the first quarter of 1965 indicated that T1 saltcake layer had been removed. The 1C sludge waste may have mixed with the T1 saltcake prior to the transfer of the T1 saltcake waste from the tank. Core sampling in 1998/1999 recovered waste from the area of the tank that was assumed to be 1C sludge. Analytical results indicated the waste composition was representative of saltcake. If 1C sludge waste is present in tank 241-TX-113, the volume is likely to be very small, and has probably co-mingled with the saltcake waste in the tank. Therefore, information from other tanks containing 1C sludge would not contribute much to the understanding of the waste in tank 241-TX-113.

## Disposal Implications

*Question 4: Given what is known about the waste properties and waste behaviors in this tank, what are the implications of the waste properties and behaviors to the waste retrieval/processing methodologies and equipment selection?*

Tank 241-TX-113 has been selected as a Phase II source tank for vitrification. The single-shell tank (SST) retrieval strategy (Kirkbride et al. 2000) lists tank 241-TX-113 as a Category 7 tank because of the assumed leaker status of the tank and the waste inventory of saltcake.

The tank contains 2,472 kL (653 kgal) of saltcake, as estimated from zipcord readings taken prior to the 1998/1999 core sampling event. No drainable liquid was recovered during the 1998/1999 sampling event for the tank. The percent waste recovery for each of the segments was low, and difficulty in sample recovery may be attributed to the dry nature of the waste. Bulk density measurements were not performed on the segments because the hard crystalline nature of the saltcake prevented conventional density assays. This indicates that the waste will require softening to be removed from the tank with the current retrieval technology. However, the tank is listed as an assumed leaker. If the past practice of water addition to soften the waste for sluicing is used, it could create difficulties regarding seepage of liquid to the vadose zone beneath the tank. Currently, the use of a dissolution process that minimizes standing head and reduces leak potential is being explored. However, the viability of this approach has not been proven for the specific conditions of a saltcake leaker.

Sample results showed that the tank waste has low total alpha concentrations, alleviating criticality concerns during retrieval and processing. The flammable gas concentrations in the tank headspace measured 2 percent or less of the LFL prior to sampling events. The vapors were measured during steady-state conditions; the waste may behave differently during retrieval operations such as sluicing, mixing, or pumping.

Assessments that could be conducted to better address disposal implications include evaluating pretreatment issues and estimating the number of glass logs that tank 241-TX-113 waste will produce. A 77.7 g composite from core 253 and an 80.5 g composite from core 258 were archived for future pretreatment analysis and evaluation to assess what fraction of the waste is soluble when treated by sludge washing and leaching. These assessments are beyond the scope of the current effort.

*Question 5: Given the current state of understanding of the waste in this tank on the one hand and the information drivers on the other; should additional tank data be sought via sampling/analysis from a strictly technical point-of-view? Can the waste behavior in this tank be adequately understood by other means (eg. archive samples, tank grouping studies, modeling) without additional sampling and analysis? If so, what characteristics of the tank waste lend themselves to a non-sample alternative? Is the quality of the data from this tank adequate from a field sampling and analytical laboratory point-of-view? Are there any clarifications or explanations needed for the data tables and figures?*

**Sampling and Analysis**

Two core samples were requested to be taken from tank 241-TX-113 (McCain 1998). Thirteen segments per core were expected from the tank to obtain a full core profile. Rotary-mode core sampling between October 1998 and June 1999 recovered two cores. Thirteen segments for core 253 were taken from tank riser 3 between October 22, 1998 and February 12, 1999. Six segments for core 258 from riser 5 were taken between April 15, 1999 and June 10, 1999. The core 258 sampling was abandoned after a hydraulic jack was needed to free the drill string from the waste and recover segment 6A.

The average waste yield from each core segment (where waste was recovered) from the 1998/1999 sampling event was 30 percent. Five samplers were found empty during the sampling operations. No waste material was recovered for core 253, segments 12 and 13, or for core 258, segments 1 and 6. The sampler for core 253, segment 2A was also empty (sample material from core 253 segment 2 was lost when the sample vial broke prior to laboratory analyses). The difficulty in sampling may be attributed to the dry nature of the waste. The percent water measured for each of the segments recovered averaged 11 percent. High pressures using the hydraulic extruder were required to perform the extrusion on four of the five segments from core 258 (Bell 1999).

Two core composites were created to address the Historical DQO using solids from the 1998/1999 sampling event. For core 253, the solid composite results listed are from the homogenization of approximately 10 grams of material from each of the segments 4 through 7 and segments 10 and 11, with the exception of segment 5. Core 253 segment 5 was divided into upper and lower halves, and each of these subsegments contributed 10 grams of material to the core composite. The solid composite results listed for core 258 are from the homogenization of approximately 15 grams of material from each of the segments 2 through 5.

Conditional analyses based on an evaluation of selected analytical results against the Historical DQO document were performed on segment 10 of core 253 and segment 4 of core 258 (Bell 1999). All recovered sample material was saltcake, but selected analytical data together with sample color indicated that sample material for certain segments may have represented different tank strata. The tank sampling and analysis plan (TSAP) (McCain 1998) required specific analyses on subsamples of these strata in support of the Flammable Gas DQO. Segments 3 and 8 of core 253 and segments 4 and 6A of core 258 were believed to represent strata. The same analyses required on the strata were performed on the core composites because it was unclear whether each of these segments truly represented a stratum. Comparison of the results from the suspected strata with the core composite results indicated that the segments were representative of the whole core.

The following DQOs and waste issues have been addressed for this tank and accepted by the Project Hanford Management Contract River Protection Project (RPP): Safety Screening DQO (Dukelow et al. 1995), Flammable Gas DQO (Bauer and Jackson 1998), Historical DQO (Simpson and McCain 1997), and the Pretreatment DQO (Slankas et al. 1995 and Kupfer et al. 1995). No additional sampling or analyses are necessary to satisfy current safety issue requirements for this tank.

## Data Quality

The data obtained from the core sampling events were collected and analyzed with approved and recognized sampling and laboratory procedures and in accordance with the sampling and analysis plan (McCain 1998). The laboratory procedures for the core sample analysis can be found in the *Analytical Methods and Procedures* Standard Report. Quality Control (QC) parameters assessed in conjunction with tank 241-TX-113 samples included standard recoveries, spike recoveries, duplicate analyses, and blanks. Appropriate QC footnotes were applied to data outside QC parameter limits. Analytical results and data quality for the core samples are discussed in the tank 241-TX-113 data package (Bell 1999). Vapor sampling results and a summary of the data quality are provided in Viswanath (1997).

The majority of QC results were within the boundaries specified in the sampling and analysis plans. Discrepancies noted in the analytical reports and footnoted in the *Analytical Results* Standard Report should not impact the data validity or use. A brief discussion of these discrepancies is presented below.

*Ion-Specific Electrode (ISE) analyses*

Ammonia analysis was performed only on the field blank, as there were no drainable liquids present in the segments. The standard recovery and spike recovery were outside the TSAP limits (McCain 1998). The samples were not re-run because the results were close to the detection limit.

*Anions by Ion Chromatography (IC)*

The IC results included three chloride samples and one oxalate sample with relative percent difference (RPD) values that were above the 20 percent limit (McCain 1998). The results were close to the detection limit and sample analyses were not re-run.

The detection limits for the IC analyses were high because the significant concentrations of nitrate in the samples required large dilutions.

Low levels of chloride and nitrite were found in three preparation blanks and small concentrations of formate were found in one preparation blank. The concentrations were considered negligible compared to the lowest detected sample associated with the blank.

The field blank contained small concentrations of chloride and sulfate. The formate analysis on the field blank required a second procedure and instrument, and since either no detectable amount or very small amounts of the other anions were detected, the field blank was not analyzed for formate.

*Differential Scanning Calorimetry (DSC) analyses*

The RPD associated with the DSC analysis on sample S99T000788 was 61.4, which exceeded the TSAP limit of 20. The sample was not rerun because the results were very small, hundreds of times below the 480 J/g notification limit for the safety screening DQO.

*Inductively Coupled Plasma (ICP) analyses*

A second ICP acid digest was performed on the core 253 composite sample because of high relative percent difference (RPD) values on some results. The RPD values from the second digest was better for some analytes and worse for others. The high RPD values were attributed to sample heterogeneity (Bell 1999).

Analytes with RPD failures (measured by ICP) included individual B, Bi, Ca, Fe, Li, and Si values. The high RPD samples from the core 253 composite were not re-run because a second acid digest had been performed on the composite. Two iron samples from segments and the core 258 composite iron sample had RPDs greater than 20 percent. The reason for the RPD failures was not clear. It was suggested that small concentration differences of certain species in the sample and duplicate preparations had a significant effect on iron solubility. Three segment samples with high silicon RPD values were not rerun because the concentrations were close to the detection limits.

Matrix spike recoveries outside of the 75 percent to 125 percent control limits (McCain 1998) were reported for some Al, Fe, Na, Si, and Zr results. This was attributed to the high concentration of these analytes in the samples with respect to the amount of spike standard added. A post-digestion spike analysis and some serial dilutions were performed with results within the required limits. One potassium spike recovery from the second acid digest for the core 253 composite was outside the TSAP limits. The first acid digest on the core 253 composite had a satisfactory spike recovery of 117.8 percent.

Standard recoveries associated with most Na determinations were over 120 percent. This was negligible compared to the sample concentrations, and these standard recoveries were within the laboratory control limits. No re-runs were initiated for Na because of perceived high standard recoveries. Almost all Si standard recoveries were outside the limits of 80% to 120%. The laboratory upper and lower control limits are much wider than the standard recovery limits because Si may be leached from glassware and/or lost as insoluble silicates or gaseous silicon tetrafluoride.

Some preparation blanks for the ICP analyses showed Al, B, Ca, Fe, Na, Si, and Zn results above the detection level. The levels of these analytes in the preparation blanks are inconsequential when compared to the results for the samples.

*Thermogravimetric analysis (TGA)*

The percent water measurements by TGA had high RPD values for the core 253 segment 11, and core 258 composite results. Both samples were re-run, with improved results for the core 258 composite.

*Total inorganic carbon (TIC) analyses*

A second TIC determination was performed on each of the samples because the matrix spike was not recovered from the first analysis. The reported TIC results represent the re-run results. The RPD value was above the TSAP limit of 20 percent for sample S99T000560. The sample results from the first and second analyses were comparable, and a third analysis was not run. All analytical blanks had detectable levels of TIC; however, the highest blank concentration was nearly 70 times less than the sample concentration.

*Total organic carbon (TOC) analyses*

The RPD values associated with two TOC results are above the TSAP limit. All analytical blanks were found to contain TOC, however, the concentrations were negligible when compared to sample results. The matrix spike recoveries were acceptable. The samples were not re-run.

*Radiochemical analyses*

A small amount of contamination was detected in some preparation blanks for the radionuclide determinations. Contamination was noted in the preparation blanks for total alpha, total beta, $^{90}Sr$, and $^{137}Cs$. For each of these preparation blanks, the level of contamination was insignificant when compared to the associated sample results, except for one blank associated with the total alpha results for samples S99T000478 and S99T000479. The preparation blank had an activity that was greater than 5 percent of the respective activity in the samples. The activity in the blank was virtually at the minimum detectable activity, and the detection limits were greater than 5 percent of the activity in the samples. Therefore, the preparation blank was not re-run.

Three total alpha samples had RPD values higher than the TSAP limit of 20 percent (McCain 1998). Sample S99T001349 was re-run, with a high RPD for the second result. No further re-runs were performed because the alpha activities in the samples were near the minimum detectable activity. The high RPD values may be attributed to the resulting decrease in the precision of the analysis. One $^{89/90}Sr$ sample had a high RPD, and a second fusion digestion was performed with acceptable RPD results. The RPD from one total beta sample was above the limit. The sample was not re-run since the RPD for another sample from the same segment portion was acceptable.

*Bulk density measurements*

No bulk density analyses were performed on the samples. The hardness of the sludge samples and the large crystalline nature of the saltcake samples were judged as incapable of yielding accurate bulk density measurements using conventional methods.

The TSAP (McCain 1998) required that settling behavior tests be performed on all half-segments. Subsequent to the release of the TSAP, the customer cancelled settling behavior studies on tank 241-TX-113 samples (Hall 1998). Therefore, no settling behavior tests were performed on the core samples.

There were no drainable liquids in any of the segments; therefore, no volume percent solid determinations were performed.

Some analytical results from the sampling event were flagged by a computer algorithm using internal quality control standards. These results were reviewed to determine if the data were compromised, and if so, the anomalous value was removed from the *Analytical Results* Standard Report. The primary lanthanum value for core 253, segment 9 (sample number S99T000300) was reported as 3,300 $\mu$g/g. The duplicate for this sample and all other 35 lanthanum results for 241-TX-113 were reported as below the detection limit. The average detection limit for this data set for lanthanum was less than 40 $\mu$g/g, and the result that was flagged exceeded the surrounding data by an order of magnitude of about 100. The lanthanum value of 3,300 $\mu$g/g from the acid digest analysis was determined biased (Hulse 2000) and removed from the *Analytical Results* Standard Report.

The zero-flow rotary mode core sampling for tank 241-TX-113 in 1998/1999 did not use hydrostatic head fluid (HHF) in the sampling event. However, 13 gallons of HHF with lithium bromide tracer was used in the sampling event to wash down the drill string in riser 3, after core 253, segment 2, before continuing to sample core 253, segments 3 through 11. The use of HHF wash water is the source of the lithium and bromide detected in the segments 3, 4, 6, and 7 of core 253. The bromide results above the detection limits were reviewed, and the two highest results of 4,740 $\mu$g/g and 4,173 $\mu$g/g in core 253 reflect an HHF intrusion of greater than 10% TGA based on possible dilution of the solids from HHF wash water. No drainable liquid was recovered from the core sampling event, and samples with detectable bromide results were dry (10 to 20 percent water). The low percent water measured in these segments precludes the accuracy of the lithium bromide spreadsheet to assess the correct amount of intrusion. The detectable lithium and bromide in tank 241-TX-113 sample data does not represent significant dilution of the solids samples from HHF intrusion (Hulse 2000). Therefore, it was determined that HHF intrusion did not affect the integrity of the tank 241-TX-113 core sampling data.

## Clarification and Explanation of Data Tables and Figures

*Description of Tank* Standard Report: The total waste volume of 2,472 kL (653 kgal) shown in this standard report does not agree with the Hanlon (2000) volume. Hanlon (2000) lists the waste volume for tank 241-TX-113 as 2,298 kL (607 kgal), based on the process history. The waste volume of 2,472 kL (653 kgal) was calculated from the zipcord readings taken prior to the 1998/1999 core sampling event. The waste phase volumes also differ between the standard report and Hanlon (2000) report. The drainable liquid volume in the standard report reflects the liquid level measurement of 71 inches recorded from the neutron probe on May 23, 2000. The sludge volume previously associated with the tank based on process history was removed from the standard report because of the absence of sludge recovered from the sampling event. The tank saltcake volume in the standard report equals the total tank volume. The updated volumes will be reflected in a future revision to Hanlon (2000).

The *241-TX-113 HTCE Surface Levels* Standard Report: The diagram shows the tank service start date as occurring in 1952. This date does not agree with the service date of 1950 reported in the *Waste Status and Transaction Records Summary* (Agnew et al. 1997b). Anderson (1990) reports the in-service date as the second quarter of 1952.

The *241-TX-113 Average Monthly Tank Surface Level* Standard Report: The graph shows the tank level dropping from 217 inches in April 1996 to 198 inches in June 1996. This drop does not represent a real decrease in the waste level, but was caused when the manual tape was changed out for an ENRAF gauge. Furthermore, in-tank videos show that the surface level device is located over a hole in the waste surface about 15 cm (6 in.) in diameter and at least 15 cm (6 inches) deep (Lipnicki 1997). This hole and some compaction of the tank waste after saltwell pumping may also explain the difference in surface levels between the *241-TX-113 HTCE Surface Levels* Standard Report and the *241-TX-113 Average Monthly Tank Surface Level* Standard Report. Because of the existence of the hole in the waste under the ENRAF gauge, the ENRAF is not considered a reliable estimate of the tank surface level. The surface level estimate of 245 inches, taken from zip cord reading prior to the sampling event, is considered more representative of the tank 241-TX-113 surface level.

## Unique Aspects of the Tank

*Question 6: What are unique chemical, physical, historical, operational or other characteristics of this tank or its contents?*

The dry nature of the saltcake waste in tank 241-TX-113 is relatively unique. The saltcake waste type based on process history is SMMT2 saltcake. The SMMT2 saltcake template used in the best basis inventory estimates the percent water for the waste type to be 32.3 percent, based on the percent water measured in tanks with similar waste. This is much higher than the average percent water for tank 241-TX-113 (11 percent). The tank was listed as an assumed leaker in 1974, and supernatant was removed from the tank in 1975. Saltwell pumping in 1984 removed a majority of the remaining liquid.

The photographs of the tank 241-TX-113 interior taken April 11, 1983, and the in-tank video taken on September 3, 1994, show the waste surface as an opaque, tan to brown, dry, uneven surface. Based upon visual observations of the extrusion photographs, the waste in segments 1 and 2 of core 253 was a dry white and gray saltcake. The waste in the core then transitioned to a yellow saltcake through segment 9. Segments 10 and 11 from core 253 were white and brown saltcake crystals. The waste in segments 2 through 4 of core 258 was white and beige saltcake. Core 258, segment 6A was a light-yellow saltcake.

## Means and Confidence Intervals

*Question 7: What statistical model was used to generate the means and confidence intervals? What data was included in the calculations?*

A nested analysis of variance (ANOVA) model was fit to the data from the solid portion of the laboratory samples. Mean analyte concentrations, and 95% confidence intervals on the mean, were estimated using results from the ANOVA. Two variance components were estimated and used in the computations. The variance components represent concentration differences between laboratory samples and between analytical replicates.

The model is:

$$Y_{ij} = \mu + L_i + A_{ij},$$

$$i=1,2,\ldots,a;\ j=1,2,\ldots,n_i;$$

where

| | | |
|---|---|---|
| $Y_{ij}$ | = | concentration from the $j^{th}$ analytical result from the $i^{th}$ riser |
| $\mu$ | = | the mean |
| $L_i$ | = | the effect of the $i^{th}$ laboratory sample |
| $A_{ij}$ | = | the analytical error |
| a | = | the number of laboratory samples |
| $n_i$ | = | the number of analytical results from the $i^{th}$ laboratory sample. |

The variable $L_i$ is a random effect. This variable and $A_{ij}$ are assumed to be uncorrelated and normally distributed with means zero and variances $\sigma^2(L)$, and $\sigma^2(A)$, respectively.

The restricted maximum likelihood method (REML) was used to estimate the mean concentration and standard deviation of the mean for all analytes that had 50% or more of their reported values greater than the detection limit. The mean concentrations and standard deviations of the mean were used to calculate the 95% confidence intervals. The following table gives the estimate of the mean, degrees of freedom, and confidence interval on the mean.

Some analytes had results that were below the detection limit. In these cases the value of the detection limit was used for non-detected results. For analytes with a majority of results below the detection limit, a simple average is reported.

The lower and upper limits, LL(95%) and UL(95%), of a two-sided 95% confidence interval on the mean were calculated using:

$$LL(95\%):\ \hat{\mu} - t_{(df,\ 0.025)} \times \hat{\sigma}(\hat{\mu})$$

$$UL(95\%):\ \hat{\mu} + t_{(df,\ 0.025)} \times \hat{\sigma}(\hat{\mu}).$$

In these equations, $\hat{\mu}$ is the REML estimate of the mean concentration, $\hat{\sigma}(\hat{\mu})$ is the REML estimate of the standard deviation of the mean, and $t_{(df,\ 0.025)}$ is the quantile from Student's t distribution with *df* degrees of freedom. The degrees of freedom are the number of laboratory samples with data minus one. In cases where the lower limit of the confidence interval was negative, it was reported as zero.

The means for each data set are listed separately in the *241-TX-113 Means and Confidence Intervals* Standard Report. The *Tank 241-TX-113 95 Percent Two-Sided Confidence Interval for the Mean*

*Concentration for Solid Core Composite Data* table refers to data generated from core 253 and core 258 composites. The *Tank 241-TX-113 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Solid Subdivision Data* table refers to data generated from core 253, segments 1 through 11; and core 258, segments 2 through 5 and 6A.

## Best-Basis Inventory Derivation

*Question 8: What is the source data used to derive this tank's Best-Basis inventories by mass (kg) and activity (Ci) for the standard list of 25 chemicals and 46 radionuclides?*

The Best-Basis Inventory (BBI) effort involves developing and maintaining waste tank inventories comprising 25 chemical and 46 radionuclide components in the 177 Hanford Site underground storage tanks. These best-basis inventories provide waste composition data necessary as part of the River Protection Program (RPP) process flowsheet modeling work, safety analyses, risk assessments, and system design for waste retrieval, treatment, and disposal operations.

Development and maintenance of the best-basis inventory is an on-going effort. Since new sample data were recently made available for single-shell tank 241-TX-113, a re-evaluation of the best-basis inventory was performed and is documented in the following text. The following information was used in this evaluation:

- Tank 241-TX-113 statistical means based on the October 1998 through April 1999 core samples (cores 253 and 258) as of May 2000 (see *Means and Variances* Standard Report).
- Best-Basis Inventory T2 template for saltcake solids and saltcake liquid waste.
- Tank 241-TX-118 saltcake segment mean specific gravity.

The following table represents how the available data were used to derive the best-basis inventory for tank 241-TX-113.

Table 7-1. Tank 241-TX-113 Best-Basis Inventory Source Data.

| Waste Phase | Waste Type | Applicable Concentration Data | Associated Density | Associated Volume |
|---|---|---|---|---|
| Saltcake | T2 saltcake solids | Mean concentrations for saltcake segment solids | 1.79 g/mL | 2,358 kL (623 kgal) |
| | | Mean concentrations for saltcake composite solids | 1.79 g/mL | |
| | | T2 Saltcake solids template | 1.67 g/mL | |
| | T2 saltcake liquid | T2 Saltcake liquid template | 1.47 g/mL | 114 kL (30 kgal) |
| Total Tank | | | | 2,472 kL (653 kgal) |

The waste phase and waste type designations for Table 7-1 were based on core sampling extrusion (see *Core Profile* Standard Report) and analytical results, and process history. The extrusions from cores 253 and 258 showed a dry saltcake in each recovered segment. The ratio of soluble to insoluble constituent concentrations indicates that the waste is saltcake; therefore, analytical results support the visual description of the waste. The waste type of T2 saltcake was assigned to the tank inventory based on the waste from the 242-T evaporator added to the tank between 1966 and 1976 (Agnew et al. 1997b).

Process history attributed a first cycle decontamination (1C) sludge waste volume of 693 kL (183 kgal) to tank 241-TX-113. However, a significant degree of uncertainty is associated with the process history waste inventory estimate. Core sampling in 1998/1999 recovered waste from the area of the tank that was historically 1C sludge. Analytical results indicated the waste recovered was T2 saltcake. Caustic supernatant and T1 saltcake had been in contact with the solids during the first evaporator bottoms service. It is likely that the operation of the tank as a bottoms receiver/recycler caused the dissolution of the 1C solids waste until none remained. Therefore, for the purpose of the BBI, no sludge waste phase was assumed.

The tank inventories were calculated from core 253 and core 258 unweighted means. The segment means included data from core 253 segments one through eleven, and core 258 segments two through five and six-A. The composite means are comprised of data from the core 253 composite and the core 258 composite. The core 253 composite included waste material from segments four through seven, and segments ten and eleven. The core 258 composite included waste material from segments two through five and six-A.

The T2 saltcake solids template values were used for constituents below the detection limits or not measured from the core sampling event. The T2 saltcake liquid template values were used for the liquid volume estimated for the tank, as no drainable liquid was recovered from the 1998/1999 core sampling event. Templates are based on sampling data from tanks that are believed to contain the same waste type as tank 241-TX-113, supplemented with HDW model data. A multiplier (1.315) was used to scale the saltcake solids template vector to the sample data using the sample weight percent water (11.1 percent) and density (1.79 g/mL). A multiplier was not applied to the saltcake liquids template, as no sample weight percent water or density were available. A more detailed description of template data and how they are applied is found in Tran (1999).

The density value of 1.79 g/mL for the mean concentrations for saltcake segment and composite solids was derived from the mean specific gravity of the tank 241-TX-118 saltcake segments. Bulk density measurements were not performed on tank 241-TX-113 core samples because of the hard crystalline nature of the recovered waste from the tank. Specific gravity measurements for solids were not requested because no high alpha results were detected for this tank. The tank 241-TX-118 saltcake mean specific gravity for solids was considered representative of the tank 241-TX-113 waste because of the similarities in process history and physical characteristics of the T2 waste. The T2 saltcake solids template density was 1.67 g/mL. The T2 saltcake liquid template density was 1.47 g/mL.

The total tank volume of 2,472 kL (653 kgal) was calculated from the zipcord readings taken prior to the 1998/1999 core sampling event. The average surface level measured from the zipcords in risers 3 and 5 was 245 inches, which equals 2,472 kL (653 kgal) occupied volume. The neutron probe in

the tank recorded a liquid level measurement, on May 23, 2000, of 71 inches. Therefore, the saturated saltcake volume equals 662 kL (175 kgal). The saltcake liquid volume was determined from the 662 kL (175 kgal) of saturated saltcake by multiplying a saltcake porosity of 17 percent, determined from the saltwell pumping event (Boettger 1997). The saltcake liquid volume of 114 kL (30 kgal) was subtracted from the total tank volume of 2,472 kL (653 kgal) to obtain a volume of 2,358 kL (623 kgal) for the saltcake solids.

For calculating the BBI, the mean concentrations for segment data were preferred, where available. Where segment values were below the detection limits and the composite values were above the detection limit, the composite values were chosen. When comparing mean values below detection limits, the lowest nondetect value was selected, whether segment or composite data, unless the T2 saltcake template value was below the lowest nondetect mean. All values except for the silicon composite were from acid digest where a choice existed between acid and water digest, since water digest analyses were only performed on limited segments. The silicon composite water digest value was chosen because the acid digest value for that analyte had numerous quality control failures. When no sample values were available for a given analyte or there were no values above detection limits and the T2 saltcake template value was below the lowest nondetect value, T2 template values were used. The best-basis mercury value is zero because no mercury-bearing waste was transferred to the tank (Higley 2000).

All inventory calculations were performed using the Best-Basis Inventory Maintenance (BBIM) Tool. The updated best-basis inventory values for tank 241-TX-113 can be found in the *Best-Basis Inventory (Non-Radionuclides)* and *Best-Basis Inventory (Radionuclides)* Standard Reports.

Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valences of other analytes. This charge balance approach is consistent with that used by Agnew et al. (1997a).

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