DOCUMENT RELEASE AND CHANGE FORM

Prepared For the U.S. Department of Energy,
Assistant Secretary for Environmental Management
By Washington River Protection Solutions, LLC., PO Box 850, Richland, WA 99352
Contractor For U.S. Department of Energy, Office of River Protection, under Contract DE-AC27-08RV14800

1a. **Doc No:** RPP-RPT-58857 **Rev.** 01

1b. **Project Number:** ☒ N/A

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

Printed in the United States of America.

Release Stamp

DATE: Mar 08, 2016 HANFORD RELEASE

2. **Document Title**

Derivation of Best-Basis Inventory for tank 241-A-104 as of February 1, 2016

3. **Design Verification Required**

☐ Yes ☒ No

4. **USQ Number** ☒ N/A

5. **PrHA Number** ☒ N/A
Rev.

6. **USQ Screening:**

a. Does the change introduce any new failure modes to the equipment? ☐ **Yes** ☒ **No**
Basis is required for Yes:_____

b. Does the change increase the probability of existing failure modes? ☐ **Yes** ☒ **No**
Basis is required for Yes:

c. For Safety Significant equipment, does the change require a modification to Chapter 4 of the DSA and/or FRED? ☐ **Yes** ☐ **No** ☒ **N/A**
Basis is required for Yes:

7. **Description of Change and Justification** (Use Continuation pages as needed)

This document reports the change in the best-basis inventory (BBI) for Tank 241-A-104 for the second quarter of fiscal year 2016. The change was needed to correct densities and process knowledge based inventories in Appendix A.

8. **Approvals**

Title	Name	Signature	Date
Checker	FIELD, JIM G	FIELD, JIM G	03/02/2016
Document Control Approval	RAYMER, JULIA R	RAYMER, JULIA R	03/08/2016
Originator	TEMPLETON, ANDREW M	TEMPLETON, ANDREW M	03/02/2016
Responsible Manager	BAUNE, HEATHER L	BAUNE, HEATHER L	03/03/2016

9. **Clearance Review:**

Restriction Type:

☒ Public
☐ Undefined
☐ Unclassified Controlled Nuclear Information (UCNI)
☐ Export Control Information (ECI)
☐ Official Use Only Exemption 2-Circumvention of Statute (OUO-2)
☐ Official Use Only Exemption 3-Statutory Exemption (OUO-3)
☐ Official Use Only Exemption 4-Commercial/Proprietary (OUO-4)
☐ Official Use Only Exemption 5-Privileged Information (OUO-5)
☐ Official Use Only Exemption 6-Personal Privacy (OUO-6)
☐ Official Use Only Exemption 7-Law Enforcement (OUO-7)

DOCUMENT RELEASE AND CHANGE FORM

Doc No: RPP-RPT-58857 **Rev.** 01

10. **Distribution:**

Name	Organization
ANDERSON, MASON A	TNK WST INVENTORY & CHARACTZTN
BAUNE, HEATHER L	222S LABORATORY ENGINEERING
CRAWFORD, JORDAN T	TNK WST INVENTORY & CHARACTZTN
DETRICH, ELIZABETH J	TNK WST INVENTORY & CHARACTZTN
FERRITER, SEAN D	TNK WST INVENTORY & CHARACTZTN
FIELD, JIM G	PROD OPERATIONS PROCESS ENGRNG
HO, QUYNH-DAO T	ONE SYS PROJECT FLOWSHEETS
KADINGER, JENNIFER A	TNK WST INVENTORY & CHARACTZTN
LAURENZ, JULIAN E	
LUKE, SCOTT N	TNK WST INVENTORY & CHARACTZTN
NGUYEN, DUC M	TNK WST INVENTORY & CHARACTZTN
OLANDER, ALAN R	PROCESS ENGINEERING ANALYSIS
RASMUSSEN, JUERGEN H	TNK WST INVENTORY & CHARACTZTN
SASAKI, LEELA M	ONE SYS PROJECT FLOWSHEETS
STURMAN, GRANT A	TNK WST INVENTORY & CHARACTZTN
TEMPLETON, ANDREW M	TNK WST INVENTORY & CHARACTZTN

11. **TBDs or Holds** ☒ N/A

12. **Impacted Documents – Engineering** ☒ N/A

Document Number	Rev.	Title

13. **Other Related Documents** ☐ N/A

Document Number	Rev.	Title
RPP-7625	12	GUIDELINES FOR UPDATING BEST-BASIS INVENTORY
RPP-8847	01B	BEST-BASIS INVENTORY TEMPLATE COMPOSITIONS OF COMMON TANK WASTE LAYERS
RPP-PLAN-60585	00	Software Management Plan for Utility Calculation Software Tank Waste Volume Calculator
RPP-RPT-42742	00	2009 AUTO-TCR FOR TANK 241-A-104

14. **Related Systems, Structures, and Components:**

14a. **Related Building/Facilities** ☐ N/A	14b. **Related Systems** ☐ N/A	14c. **Related Equipment ID Nos. (EIN)** ☐ N/A
241-A	241-WST	241-A-104

DOCUMENT RELEASE AND CHANGE FORM CONTINUATION SHEET	**Document No:** RPP-RPT-58857 **Rev.** 01

N/A

RPP-RPT-58857
Revision 1

Derivation of Best-Basis Inventory for Tank 241-A-104 as of February 1, 2016

A. M. Templeton
Washington River Protection Solutions, LLC
Richland, WA 99352
U.S. Department of Energy Contract DE-AC27-08RV14800

EDT/ECN:	DRCF	UC:	N/A
Cost Center:	2KL00	Charge Code:	202382
B&R Code:	N/A	Total Pages:	31

Key Words:
241-A-104, Best Basis Inventory, BBI, Fiscal Year 2016

Abstract:
This document reports the change in the best-basis inventory (BBI) for Tank 241-A-104 for the second quarter of fiscal year 2016. The change was needed to correct densities and process knowledge based inventories in appendix A. Process knowledge (template) based inventories increased by about 50% compared to the previous BBI.

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

APPROVED
By Julia Raymer at 8:08 am, Mar 08, 2016

Release Approval Date

DATE:
Mar 08, 2016
HANFORD RELEASE

Release Stamp

Approved For Public Release

RPP-RPT-58857
Revision 1

Derivation of Best-Basis Inventory for Tank 241-A-104 as of February 1, 2016

Prepared by

A. M. Templeton
Washington River Protection Solutions, LLC

Date Published
March 2016

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

Contract No. DE-AC27-08RV14800

TABLE OF CONTENTS

1.0 INTRODUCTION 1
2.0 DERIVATION OF BEST-BASIS INVENTORY 1
2.1 WASTE HISTORY 2
2.2 TANK VOLUME 3
2.3 SAMPLING HISTORY 5
2.4 COMPONENT DENSITIES AND WEIGHT PERCENT WATER 6
2.5 TEMPLATE VECTORS 7
2.6 DEVELOPMENT OF THE BBI 8
3.0 SUMMARY OF CHANGES 8
4.0 REFERENCES 9
APPENDIX A CONDENSED BEST-BASIS CACULATION DETAIL REPORTS FOR TANK 241-A-104 PRIMARY AND SUPPLEMENTAL ANALYTES A-1

LIST OF TABLES

Table 2-1. Tank 241-A-104 Best-Basis Inventory Source Data. 2
Table 2-2. Tank 241-A-104 Component Density and Wt% Water 7
Table A-1. Condensed Best-Basis Calculation Detail Reports for Tank 241-A-104 Primary and Supplemental Analytes A-2

LIST OF FIGURES

Figure 2-1. Photograph of Tank 241-A-104 Waste Surface (1986) 4
Figure 2-2. Surface Level Measurements Tank 241-A-104 (1979 to Present) 5

LIST OF TERMS

Abbreviations and Acronyms

AR	Water washed PUREX sludge entrained in decants of recovered sludge or the water washes of this sludge and the solids remaining after acidification (1967-1968)
BBI	Best-Basis Inventory
BBIM	Best-Basis Inventory Maintenance
CY	Calendar year
HDW	Hanford Defined Waste
HLW	High Level Waste
OWW	PUREX organic wash waste and non-boiling waste
P	PUREX HLW, 1956-72. Sometimes assumed to be 50% OWW. Used NPH/TBP to extract both Pu and U. Np was also extracted from 1963-72.
P1	PUREX high-level wastes generated between 1956 and 1962
P2	PUREX high-level wastes generated between 1963 and 1967
PCB	Polychlorinated Biphenyl
PSS	PUREX sludge supernatant
PUREX	Plutonium Uranium Extraction (Plant)
RPP	River Protection Project
TWINS	Tank Waste Information Network System
Waste type B	B-Plant Strontium Solvent Extraction Waste

Units

µg/mL	microgram per liter
kgal	kilogallon (1,000 gallons
kL	kiloliters
%	percent

1.0 INTRODUCTION

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 Project (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. This revision was needed to correct Table 2-1 densities and process knowledge based inventories in Appendix A. As a result, a re-evaluation of the BBI for tank 241-A-104 as of February 1, 2016 was performed and is documented in the following text.

2.0 DERIVATION OF BEST-BASIS INVENTORY

The following information was used in this evaluation:

- Chemical and radionuclide concentrations from a 1974 sample event (Internal memorandum Buckingham and Horton 1974, “Characterization of Sludge from Tank 104-A”).
- P2 and AR solids templates (RPP-8847, *Best-Basis Inventory Template Compositions of Common Tank Waste Layers*). Templates are based on sample data for similar tank wastes supplemented with Hanford Defined Waste (HDW) model data (RPP-19822, *Hanford Defined Waste Model – Revision 5*) where sample data are not available.
- Sample-based template estimates for PCB’s in solid waste phases (RPP-RPT-26878, *Best-Basis Inventory Templates for Polychlorinated Biphenyls*.

Table 2-1 summarizes how the best-basis inventories for tank 241-A-104 were derived.

Table 2-1. Tank 241-A-104 Best-Basis Inventory Source Data.

Waste Phase	Waste Type	Applicable Concentration Data[1]	Associated Density (g/mL)	Multiplier	Associated Volume[3]
Sludge	AR	1974 Solids Sampling Event (P/A104/003)	1.64	1.000	89 kL (24 kgal)
		AR Sludge Template (TE/U204/048)	1.34	2.248	
		241-241-A-104 Sludge PCBs (TS/A104/001)	1.64	1.000	
	P1	1974 Solids Sampling Event (P/A104/003)	1.64	1.000	4 kL (1 kgal)
		P2 Sludge Template (TE/U204/016)	1.61	1.053	
		241-A-104 Sludge PCBs (TS/A104/001)	1.64	1.000	
Total tank					93 kL (25 kgal)

Notes:

[1]Vector handles, shown in parentheses, are unique serial identifiers for the vectors used in the BBIM database.

[2] The sludge waste phase contains no drainable liquid.

[3] The sum of the waste phase volumes in kgal may not exactly match the tank total volume due to rounding.

2.1 WASTE HISTORY

The 241-A tanks were designed for the storage of boiling waste generated from irradiated fuel reprocessing at the 202-A PUREX Plant. Tank 241-A-104 was constructed from February 1954 to January 1955 and sat unused until June 1958 (RPP-ENV-37956, *Hanford A/AX-Farm Leak Assessments Report*).

In August 1958, tank 241-A-104 received 76 kL (20 kgal) of Plutonium Uranium Extraction (PUREX) high level waste (HLW) plus 379 kL (100 kgal) of water to cool the tank waste. Transfers of PUREX HLW to tank 241-A-104 started in January 1959 and self-concentration (boiling) of waste was reported in August 1959 (RPP-ENV-37956). Organic wash waste (OWW) from PUREX was also reported to have been transferred to tank 241-A-104 from 1960 through March 1968 (RPP-RPT-54921, *Estimation of Past Leaks Rates for Selected Hanford Single-Shell Tanks*). The OWW was concentrated (i.e., evaporated) in the tank. In the first and second quarters of 1969 the OWW/PUREX HLW was transferred from tank 241-A-104 to tank 241-C-105. Sluicing of the solids from tank 241-A-104 to tank 241-A-106 was conducted from May 12, 1969 through October 1969. An estimated 11 kL (3 kgal) of solids remained in tank 241-A-104 following sluicing (RPP-RPT-54912, *Hanford Single-Shell Tank Leak Causes and Locations – 241-A Farm*). The tank was refilled with 3,623 kL (957 kgal) of tempered water from tank 241-A-101 for a leak test to confirm tank integrity and the tank was declared a spare. No additional waste transfers were made into or out of tank 241-A-104 until 1972.

Between the third quarter of calendar year (CY) 1972 and the second quarter of CY 1974, tank 241-A-104 received water, PUREX sludge solution from 244-AR vault (AR waste), and B-Plant strontium solvent extraction waste (waste type B). By the fall of 1974 the tank contained an estimated 80,000 gal of sludge (ARH-CD-133B, *Operations Division Waste status Summary April 1, 1974 through June 30, 1974*).

Prior to sluicing tank 241-A-104 again, the supernatant was pumped out of the tank leaving the liquid level reported at 56-in (or ~155 kgal) on September 1, 1974. Sluicing of the accumulated solids in tank 241-A-104 to the 244-AR Vault was started in September 1974 and was halted April 7, 1975, due to an increase in the radiation detected in lateral 14-04-02 beneath the tank (RPP-ENV-37956). The tank was pumped to a minimum heel and a portable exhauster was added to the tank to dry the residual sludge (provided more drying capacity than the existing exhauster) leaving a waste level in the tank of ~9 inches on May 1975 (RPP-RPT-54921).

Tank 241-A-104 was administratively stabilized in September of 1978 based on a Tank Farms Process Engineering evaluation of tank photographs and/or liquid and solids level data. The stabilization evaluation data is missing, but photographs taken on June 25, 1975, indicated that the sludge is definitely drying (no visible pools of liquid and a surface of cracked solids (RPP-ENV-37956). The tank was estimated to contain zero gallons of supernatant and the status was reported as "Leaker-Interim Stabilized" (HNF-SD-RE-TI-178, *Single-Shell Tank Leak Stabilization Record*).

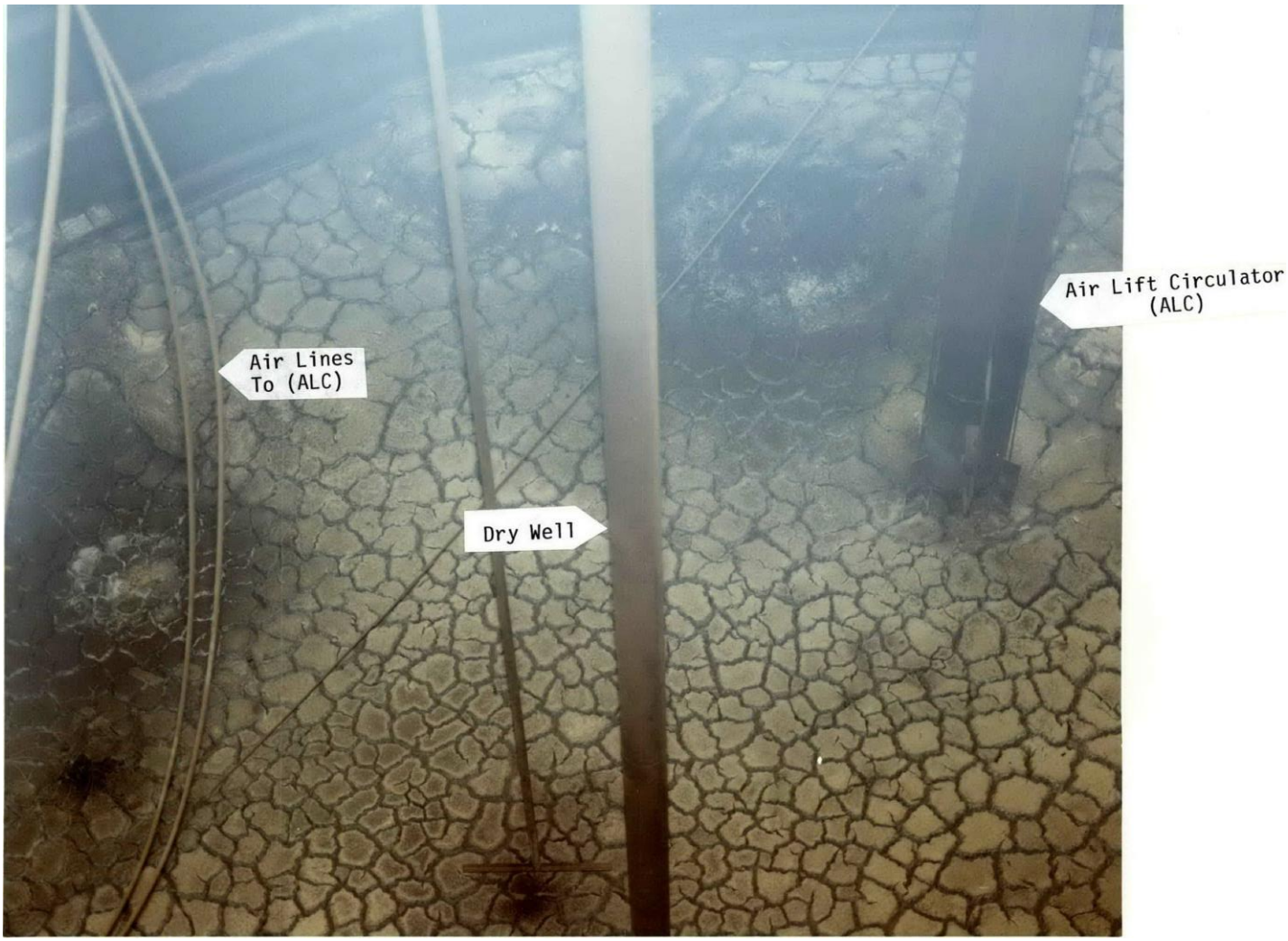
It is unknown when the 241-A-104 leak began. The radiation level in lateral 14-04-02 under tank 241-A-104 exceeded the background level on March 18, 1975. The leak may have begun in February 1975, but no basis is stated for this assumption (RPP-RPT-54921). Tank 241-A-104 was declared a confirmed leaker in April 1975 (Occurrence Report 75-39; HNF-4872, *Single-Shell Tank History Compilation*). The estimated waste loss from SST 241-A-104 was determined to be ~2,000 gal (~8 kL) based on radioactivity in the laterals. Based on the activity in the laterals under the tank and the absence of gamma activity from drywells surrounding the tank, it appears that the tank liner leaked at or near the tank footing, likely due to tank liner failure (HNF-4872). The actual size of the leak is uncertain.

2.2 TANK VOLUME

Review of photographs taken in 1986 show tank 241-A-104 contains what appears to be a level dry waste (Figure 2-1). The bottoms of the air lift circulators and other equipment can be seen in the photographs, and it was concluded that the waste depth was minimal. The photographs show the bottom of the bare tank in places and the bottom stiffener rings. The distance from the tank bottom center to the top of the lowest stiffener ring (SR 10) is 24 inches. A conservative waste depth of 9 inches was assessed from the photographic evidence. (Letter G. Burton, Jr, *Status of Tank 241-A-104*). In 1986, an attempt was made to take a core sample from three different risers. Zip core readings from this attempt showed that the bottom of the tank was higher than expected. This indicates that the tank bottom was likely bulged (supporting the action declaring the tank an assumed leaker in 1975, after which it was taken out of service). After the 1986 failed sampling event, it was determined that the volume of waste in tank 241-A-104 was

probably less than the 106 kL (28 kgal) previously identified, but this waste volume estimate continued to be used as a bounding case. Any water is likely bound within the waste matrix.

Figure 2-1. Photograph of Tank 241-A-104 Waste Surface (1986)

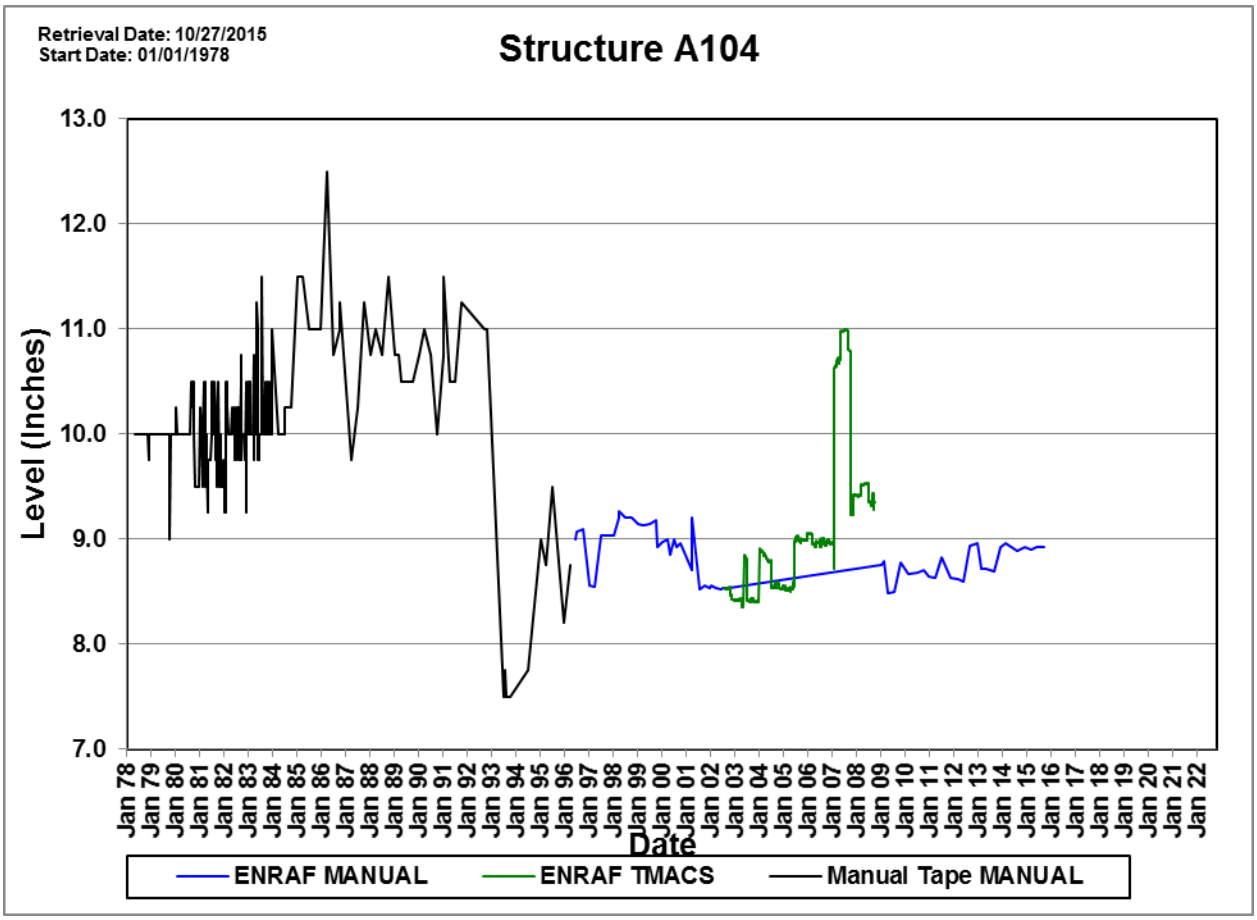


The previous volumes in Table 2-1 for each waste phase were based on LA-UR-96-3860, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 4.* LA-UR-96-3860 estimated the remaining P1 (PUREX high-level wastes generated between 1956 and 1962) and AR [Water washed PUREX sludge entrained in decants of recovered sludge or the water washes of this sludge and the solids remaining after acidification (1967-1968)] process waste streams to 241-A-104 to be 4 kL (1 kgal) and 102 kL (27 kgal) respectively, for a total of 106 kL (28 kgal).

The most current ENRAF surface level measurement as of February 1, 2016 is 8.93 inches [Tank Waste Information Network System (TWINS, Queried 2/24/2016, [Level/Temp, Surface Level, Tank Name]: A-104, Measurement date: 1/1/1978 to 2/24/2016, Sensor Type: Enraf Manual, Date 9/21/2015, 8.93 in.) as shown in Figure 2-2. This level is consistent with previous

estimates based on photographic evidence. This calculates to a total waste volume of 93 kL (25 kgal) (RPP-PLAN-60585, *Software Management Plan for Utility Calculation Software Tank Waste Volume Calculator*). The waste volumes in the HDW model for P1 waste (4 kL) was assumed and the remainder of the waste, 89 kL, was assumed to be AR sludge (89 kL = 93- 4).

Figure 2-2. Surface Level Measurements Tank 241-A-104 (1978 to Present)



2.3 SAMPLING HISTORY

A sample was taken of the sludge in tank 241-A-104 just before sluicing started in 1974 (Internal memorandum Buckingham and Horton to J.C. Womack, *Characterization of Sludge from Tank 104-A*). It was assumed that the 1974 sludge sample should represent the sludge after sluicing. Since tank 241-A-104 was used to store PUREX Sludge Supernatant (PSS) generated during the sluicing of tanks 241-A-101, 241-A-103, and 241-A-106, most of the sludge in the tank consists of material that did not settle in tank 002-AR when the sluicing was performed (Internal memorandum Buckingham and Horton 1974). The supernatants from sluicing of tanks 241-A-101, 241-A-103, and 241-A-106 were transferred to tank 241-A-104 where the remaining solids settled out.

At the time of sampling in 1974, the sludge material from Tank 241-A-104 was quite fluid having a consistency similar to heavy cream. The sludge had a density of 1.64 g/ml and water content was 42.3%. A PUREX acid gel made from 30 percent slurry of sludge and 70 percent supernatant gelled in five to seven days due to the high silica content.

An earlier liquid sample taken in 1974 (Internal letter, *Analysis of Tank Samples Sample; T-2983 Tank A-104,* R.E. Wheeler to R.L. Walser, 1974) reported a yellow solution with less than 1% solids and a density of 1.132 g/mL.

A waste characterization effort for tank A-104 was performed in 1986 using the core sampling method. No sample analysis results are available due to insufficient sample recoveries (WHC-SD-RE-TI-207, *Data Transmittal Package for 241-A-104 Waste Tank Characterization)* however, field observations made during core sampling indicate that the waste level and the elevation of the tank bottom are variable and not predictable. The core sampler stopped several inches above the expected tank bottom under risers 14 and 17**,** and there was an eleven inch elevation difference in penetration depths between the two risers (WHC-SD-WM-TP-247, *Tank 241-A-104 Tank Characterization Plan*).

The tank was again sampled in 1995 to recover auger samples from tank 241-A-104 from risers 1 and 7. No waste material was recovered from either riser. Consequently no analyses were performed. (Letter G.L. Miller to D. R. Bratzel, *Project Conclusion for Single Shell Tank 241-A-104, Auger Samples, Risers 1 and 7*).

The density and weight percent water of the 1974 solids sample was analytically determined to be 1.64 g/mL and 42.3% respectively (ARH-ST-110 A, *Chemical Composition of Salt Cake Produced in the 242- S Evaporator*). This sample was taken prior to the supernatant being removed, prior to tank sluicing and prior to a portable exhauster being used to dry the solids.

While the exhauster may have removed most of the supernatant from the tank, the amount of drying or drainage that occurred for the solids and the current percent water for the solids is unknown. Given that the waste is sludge and there is only ~9 inches of waste in the tank, interstitial liquid would be held by capillary forces and little drainage from solids interstitial liquids would be expected from a tank leak. Drying of the solids by evaporation due to the exhauster and high temperatures, would have removed only water and would not have changed the inventory of other constituents in the waste. Therefore, lacking additional data for this BBI, it is assumed that, for available constituents, the 1974 sample concentrations, weight percent water and density provide reasonable estimates for both the AR and P2 (PUREX high-level wastes generated between 1963 and 1967) sludge inventories.

2.4 COMPONENT DENSITIES AND WEIGHT PERCENT WATER

The sample measured values of 42.3 wt% water and 1.64 g/ml density are used for both the AR and P2 sludge.

Table 2-2 summarizes the assumed Density and Wt% Water for each waste type.

Table 2-2. Tank 241-A-104 Component Density and Wt% Water

Waste Phase	Waste Type	Component Density (g/mL)	Component Wt% Water	Source
Sludge Solids	AR	1.64	42.3	1974 Sample results
Sludge Solids	P1	1.64	42.3	1974 Sample results

2.5 TEMPLATE VECTORS

Templates are based on sampling data from tanks that contain the same waste type as tank 241-A-104 supplemented with HDW model Revision 5 data (RPP-19822). The 1974 sample analyses provide the basis for the tank 241-A-104 AR and P1 waste inventories for constituents measured. Since the sample data only include some of the BBI analytes, the AR and P2 waste type templates were used to estimate the remaining analytes. The templates are based on sample data from tanks that contain the same waste type as tank 241-A-104, supplemented with data from revision 5 of the HDW model (RPP-19822).

A multiplier is used to scale the template vector to the sample data using the adjusted sample weight percent water and density. Multipliers were calculated by the following equation:

$$Multiplier = \frac{\rho_b}{\rho_a} \times \frac{100 - \text{wt\% water}_b}{100 - \text{wt\% water}_a}$$

where ρ = density
a = the secondary sample or template being adjusted, and
b = the "preferred" or most representative sample.

The weight percent water for the AR waste vector template is 68.6% with a waste density of 1.34 g/mL. The P2 waste type template is used for P1 waste since the wastes are generally similar and the P2 template is supported by sample data. The template value for the P2 waste weight percent water is 44.2% and the density is 1.61 g/mL.

The multiplier for the AR sludge template was calculated to be 2.249 (= 1.64/1.34*(100-42.3)/(100-68.6) and the multiplier for the P2 sludge template was 1.053 (= 1.64/1.61*(100-42.3)/(100-44.2)

2.6 DEVELOPMENT OF THE BBI

The inventories in this BBI were developed in accordance with the BBI creation rules documented in RPP-7625, *Guidelines for Updating Best-Basis Inventory* with the exceptions noted below.

- The P2 waste type template is used for P1 since the wastes are generally similar and the P2 template is supported by sample data.

All inventory calculations were performed using the Best-Basis Inventory Maintenance (BBIM) Tool. The update BBI values for tank 241-A-104 can be found in the *Best-Basis Calculation Detail Report* and the *Best-Basis Calculation Detail-Supplemental Analytes* report in TWINS. A condensed version of these reports is included in Appendix A. Radionuclides in these reports are decay-corrected to July 1, 2015. Unique data treatments are discussed below by analyte.

Alpha-emitting isotopes – Data from analysis of $^{239/240}$Pu and the template isotopic distribution ratios for AR sludge were used to generate inventories for the various plutonium isotopes determined by the BBIM tool. The uranium, americium, and curium isotopes are based on the waste type template values.

PCBs – The PCB inventory for each waste phase were developed using the sample-based PCB template values reported in RPP-RPT-26878, since current sample data were not available. The sample-based PCB concentrations for the PCB solids templates are reported on a dry weight basis. The reported concentrations are converted to wet weight using the associated waste weight percent water result. The PCB concentration for the P1 and AR sludge is <3.263 μg/g (dry weight). When this concentration is converted to wet weight using the AR and P1 sludge weight percent water of 42.3, it equals <1.883 μg/g [3.263 μg/g * (100%-42.3%)/100]. The density of the AR and P1 sludge PCB vectors is assumed to be 1.64 g/mL the same as the sample based density.

3.0 SUMMARY OF CHANGES

This update was needed to correct Table 2-1 densities and process knowledge based inventories in Appendix A. Process knowledge (template) based inventories increased by about 50% compared to the previous BBI. There were no volume changes. The relative volumes of the AR and P1 solid waste types in this BBI are being further evaluated and are expected to updated in the next revision.

4.0 REFERENCES

ARH-CD-133B, 1974, *Operations Division Waste status Summary April 1, 1974 through June 30, 1974*, Atlantic Richfield Hanford Company, Richland, Washington.

ARH-ST-110 A, 1974, *Chemical Composition of Salt Cake Produced in the 242- S Evaporator*, Atlantic Richfield Hanford Company, Richland, Washington.

Buckingham, J. S., and J. E. Horton, 1974, "Characterization of Sludge from Tank 104-A", internal memorandum from J.S. Buckingham and J.E. Horton to J.C. Womack, September 4, 1974), Atlantic Richfield Hanford Company, Richland, Washington.

HNF-4872, 199, *Single-Shell Tank Leak History Compilation Volume I: Summary*, Rev. A,, Lockheed Martin Hanford Corporation, Richland, Washington.

HNF-SD-RE-TI-178, 2005, *Single-Shell Tank Leak Stabilization Record*, Rev. 9, CH2M HILL Hanford Group, Richland, Washington.

Internal Letter, *Analysis of Tank Samples Sample; T-2983 Tank A-104*, R.E. Wheeler to R.L. Walser, March 25, 1974, Atlantic Richfield Hanford Company, Richland, Washington.

LA-UR-96-3860, 1997, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 4*, Los Alamos National Laboratory, Los Alamos, New Mexico.

Letter G. Burton, Jr, 1975, *Status of Tank 241-A-104* Contract E (45-1)-2130 1975, G. Burton, Jr to O.J. Elgert, July 10, 1975, Atlantic Richfield Hanford Company, Richland, Washington.

Letter G.L. Miller to D.R. Bratzel, *Project Conclusion for Single Shell Tank 241-A-104, Auger Samples, Risers 1 and 7*, February 10, 1995, Westinghouse Hanford Company, Richland, Washington.

Occurrence Report, 75-39, 1975, *Leakage from Tank 104-Atlantic Richfield Hanford Company, Richland, Washington.*

RPP-7625, 2015, *Best-Basis Inventory Process Requirements*, Rev. 12, Washington River Protection Solutions LLC, Richland Washington.

RPP-8847, 2007, *Best-Basis Inventory Template Compositions of Common Tank Waste Layers*, Rev. 1B, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-19822, 2005, *Hanford Defined Waste Model – Revision 5*, RPP-19822, Rev. 0A, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-ENV-37956, 2014, *Hanford A/AX-Farm Leak Assessments Report*, Rev. 2, Washington River Protection Solutions LLC, Richland Washington.

RPP-PLAN-60585, 2015, *Software Management Plan for Utility Calculation Software Tank Waste Volume Calculator,* Rev. 0, Washington River Protection Solutions LLC, Richland Washington.

RPP-RPT-26878, *Best-Basis Inventory Templates for Polychlorinated Biphenyls*, Rev. 0, Washington River Protection Solutions LLC, Richland Washington.

RPP-RPT-42742, 2009, *Auto TCR for Tank 241-A-104*, Rev. 0, Washington River Protection Solutions LLC, Richland, Washington.

RPP-RPT-54912, 2013, *Hanford Single-Shell Tank Leak Causes and Locations – 241-A Farm*, Rev. 0, Washington River Protection Solutions LLC, Richland, Washington.

RPP-RPT-54921, 2014, *Estimation of Past Leaks Rates for Selected Hanford Single-Shell Tanks* Rev. 0, Washington River Protection Solutions LLC, Richland Washington.

Tank Waste Information Network System (TWINS, Queried 2/24/2016, [Level/Temp, Surface Level, Tank Name]: A-104, Measurement date: 1/1/1978 to 2/24/2016, Sensor Type: Enraf Manual, Date 9/21/2015, 8.93 in.)

WHC-SD-WM-TP-247, 1996, *Tank 241-A-104 Tank Characterization Plan*, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-RE-TI-207,1998, *Data Transmittal Package for 241-A-104 Waste Tank Characterization,* Rev. 0, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A
CONDENSED BEST-BASIS CALCULATION DETAIL REPORTS FOR TANK 241-A-104 PRIMARY AND SUPPLEMENTAL ANALYTES

Table A-1. Condensed Best-Basis Calculation Detail Reports for Tank 241-A-104 Primary and Supplemental Analytes

Radionuclide Decay Date 7/1/2015

Analyte	Phase	Waste Type	Qualifier	Inventory	Units	RSD (%)	Basis	Calculation (Density*Volume* Concentration*Conversion*Multiplier)[a]
Al	Sludge Solid	AR (Solid)		6.77E+03	kg		Process Knowledge	1.64 g/ml * 89 kL * 46394 ug/g * 0.001 * 1
Al	Sludge Solid	P1 (Solid)		3.04E+02	kg		Process Knowledge	1.64 g/ml * 4 kL * 46394 ug/g * 0.001 * 1
Ba	Sludge Solid	AR (Solid)		1.10E+02	kg		Process Knowledge	1.64 g/ml * 89 kL * 753.7 ug/g * 0.001 * 1
Ba	Sludge Solid	P1 (Solid)		4.94E+00	kg		Process Knowledge	1.64 g/ml * 4 kL * 753.7 ug/g * 0.001 * 1
Bi	Sludge Solid	AR (Solid)		7.03E-02	kg		Template Engineering	1.34 g/ml * 89 kL * 0.262 ug/g * 0.001 * 2.249
Bi	Sludge Solid	P1 (Solid)		0.00E+00	kg		Template Engineering	1.61 g/ml * 4 kL * 0 ug/g * 0.001 * 1.053
Ca	Sludge Solid	AR (Solid)		1.46E+03	kg		Process Knowledge	1.64 g/ml * 89 kL * 10020 ug/g * 0.001 * 1
Ca	Sludge Solid	P1 (Solid)		6.57E+01	kg		Process Knowledge	1.64 g/ml * 4 kL * 10020 ug/g * 0.001 * 1
Cl	Sludge Solid	AR (Solid)		1.11E+02	kg		Template Engineering	1.34 g/ml * 89 kL * 415 ug/g * 0.001 * 2.249
Cl	Sludge Solid	P1 (Solid)		1.65E+00	kg		Template Engineering	1.61 g/ml * 4 kL * 243 ug/g * 0.001 * 1.053
TIC as CO3	Sludge Solid	AR (Solid)		2.31E+03	kg		Template Engineering	1.34 g/ml * 89 kL * 8620 ug/g * 0.001 * 2.249
TIC as CO3	Sludge Solid	P1 (Solid)		3.69E+02	kg		Template Engineering	1.61 g/ml * 4 kL * 54400 ug/g * 0.001 * 1.053
Cr	Sludge Solid	AR (Solid)		1.46E+02	kg		Template Engineering	1.34 g/ml * 89 kL * 546 ug/g * 0.001 * 2.249

Table A-1. Condensed Best-Basis Calculation Detail Reports for Tank 241-A-104 Primary and Supplemental Analytes

Radionuclide Decay Date 7/1/2015

Analyte	Phase	Waste Type	Qualifier	Inventory	Units	RSD (%)	Basis	Calculation (Density*Volume* Concentration*Conversion*Multiplier)[a]
Cr	Sludge Solid	P1 (Solid)		1.13E+01	kg		Template Engineering	1.61 g/ml * 4 kL * 1660 ug/g * 0.001 * 1.053
F	Sludge Solid	AR (Solid)		1.38E+00	kg		Template Engineering	1.34 g/ml * 89 kL * 5.16 ug/g * 0.001 * 2.249
F	Sludge Solid	P1 (Solid)		5.32E-01	kg		Template Engineering	1.61 g/ml * 4 kL * 78.5 ug/g * 0.001 * 1.053
Fe	Sludge Solid	AR (Solid)		2.48E+04	kg		Process Knowledge	1.64 g/ml * 89 kL * 169924 ug/g * 0.001 * 1
Fe	Sludge Solid	P1 (Solid)		1.11E+03	kg		Process Knowledge	1.64 g/ml * 4 kL * 169924 ug/g * 0.001 * 1
Hg	Sludge Solid	AR (Solid)		3.14E+01	kg		Template Engineering	1.34 g/ml * 89 kL * 117 ug/g * 0.001 * 2.249
Hg	Sludge Solid	P1 (Solid)		6.77E-01	kg		Template Engineering	1.61 g/ml * 4 kL * 99.8 ug/g * 0.001 * 1.053
K	Sludge Solid	AR (Solid)		4.94E+01	kg		Template Engineering	1.34 g/ml * 89 kL * 184 ug/g * 0.001 * 2.249
K	Sludge Solid	P1 (Solid)		6.61E-01	kg		Template Engineering	1.61 g/ml * 4 kL * 97.4 ug/g * 0.001 * 1.053
La	Sludge Solid	AR (Solid)		0.00E+00	kg		Template Engineering	1.34 g/ml * 89 kL * 0 ug/g * 0.001 * 2.249
La	Sludge Solid	P1 (Solid)		7.73E+00	kg		Template Engineering	1.61 g/ml * 4 kL * 1140 ug/g * 0.001 * 1.053
Mg	Sludge Solid	AR (Solid)		2.38E+02	kg		Process Knowledge	1.64 g/ml * 89 kL * 1631 ug/g * 0.001 * 1
Mg	Sludge Solid	P1 (Solid)		1.07E+01	kg		Process Knowledge	1.64 g/ml * 4 kL * 1631 ug/g * 0.001 * 1

Table A-1. Condensed Best-Basis Calculation Detail Reports for Tank 241-A-104 Primary and Supplemental Analytes

Radionuclide Decay Date 7/1/2015

Analyte	Phase	Waste Type	Qualifier	Inventory	Units	RSD (%)	Basis	Calculation (Density*Volume* Concentration*Conversion*Multiplier)[a]
Mn	Sludge Solid	AR (Solid)		3.47E+03	kg		Process Knowledge	1.64 g/ml * 89 kL * 23784 ug/g * 0.001 * 1
Mn	Sludge Solid	P1 (Solid)		1.56E+02	kg		Process Knowledge	1.64 g/ml * 4 kL * 23784 ug/g * 0.001 * 1
Na	Sludge Solid	AR (Solid)		2.79E+04	kg		Template Engineering	1.34 g/ml * 89 kL * 104000 ug/g * 0.001 * 2.249
Na	Sludge Solid	P1 (Solid)		3.50E+02	kg		Template Engineering	1.61 g/ml * 4 kL * 51600 ug/g * 0.001 * 1.053
Ni	Sludge Solid	AR (Solid)		1.63E+03	kg		Template Engineering	1.34 g/ml * 89 kL * 6090 ug/g * 0.001 * 2.249
Ni	Sludge Solid	P1 (Solid)		4.92E+01	kg		Template Engineering	1.61 g/ml * 4 kL * 7250 ug/g * 0.001 * 1.053
NO2	Sludge Solid	AR (Solid)		5.87E+03	kg		Template Engineering	1.34 g/ml * 89 kL * 21900 ug/g * 0.001 * 2.249
NO2	Sludge Solid	P1 (Solid)		1.18E+01	kg		Template Engineering	1.61 g/ml * 4 kL * 1740 ug/g * 0.001 * 1.053
NO3	Sludge Solid	AR (Solid)		1.28E-05	kg		Template Engineering	1.34 g/ml * 89 kL * 4.77e-005 ug/g * 0.001 * 2.249
NO3	Sludge Solid	P1 (Solid)		3.02E+02	kg		Template Engineering	1.61 g/ml * 4 kL * 44500 ug/g * 0.001 * 1.053
Free OH	Sludge Solid	AR (Solid)		1.24E+04	kg		Calculated	5873.92 * 82093.5 / 38887.1
Free OH	Sludge Solid	P1 (Solid)		2.49E+01	kg		Calculated	11.7995 * 82093.5 / 38887.1
Oxalate	Sludge Solid	AR (Solid)		0.00E+00	kg		Calculated	(0 kg * 0.164)/ 0.273
Oxalate	Sludge Solid	P1 (Solid)		0.00E+00	kg		Calculated	(0 kg * 0.98)/ 0.273

Table A-1. Condensed Best-Basis Calculation Detail Reports for Tank 241-A-104 Primary and Supplemental Analytes

Radionuclide Decay Date 7/1/2015

Analyte	Phase	Waste Type	Qualifier	Inventory	Units	RSD (%)	Basis	Calculation (Density*Volume* Concentration*Conversion*Multiplier)[a]
Pb	Sludge Solid	AR (Solid)		7.67E+00	kg		Template Engineering	1.34 g/ml * 89 kL * 28.6 ug/g * 0.001 * 2.249
Pb	Sludge Solid	P1 (Solid)		4.88E+01	kg		Template Engineering	1.61 g/ml * 4 kL * 7200 ug/g * 0.001 * 1.053
PO4	Sludge Solid	AR (Solid)		3.49E+02	kg		Template Engineering	1.34 g/ml * 89 kL * 1300 ug/g * 0.001 * 2.249
PO4	Sludge Solid	P1 (Solid)		1.68E+02	kg		Template Engineering	1.61 g/ml * 4 kL * 24800 ug/g * 0.001 * 1.053
Aroclors (Total PCB)	Sludge Solid	AR (Solid)	<	2.75E-01	kg	111.332	Template Sample	1.64 g/ml * 89 kL * 1.883 ug/g * 0.001 * 1
Aroclors (Total PCB)	Sludge Solid	P1 (Solid)	<	1.24E-02	kg	111.332	Template Sample	1.64 g/ml * 4 kL * 1.883 ug/g * 0.001 * 1
Si	Sludge Solid	AR (Solid)		2.07E+03	kg		Process Knowledge	1.64 g/ml * 89 kL * 14214 ug/g * 0.001 * 1
Si	Sludge Solid	P1 (Solid)		9.32E+01	kg		Process Knowledge	1.64 g/ml * 4 kL * 14214 ug/g * 0.001 * 1
SO4	Sludge Solid	AR (Solid)		1.17E+03	kg		Template Engineering	1.34 g/ml * 89 kL * 4380 ug/g * 0.001 * 2.249
SO4	Sludge Solid	P1 (Solid)		1.56E+02	kg		Template Engineering	1.61 g/ml * 4 kL * 23000 ug/g * 0.001 * 1.053
Sr	Sludge Solid	AR (Solid)		3.57E+01	kg		Calculated	90Sr * 2.4436e-005
Sr	Sludge Solid	P1 (Solid)		6.37E+00	kg		Template Engineering	1.61 g/ml * 4 kL * 940 ug/g * 0.001 * 1.053

Table A-1. Condensed Best-Basis Calculation Detail Reports for Tank 241-A-104 Primary and Supplemental Analytes

Radionuclide Decay Date 7/1/2015

Analyte	Phase	Waste Type	Qualifier	Inventory	Units	RSD (%)	Basis	Calculation (Density*Volume* Concentration*Conversion*Multiplier)[a]
Th	Sludge Solid	AR (Solid)		1.48E-02	kg		Template Engineering	1.34 g/ml * 89 kL * 0.0553 ug/g * 0.001 * 2.249
Th	Sludge Solid	P1 (Solid)		5.45E-09	kg		Template Engineering	1.61 g/ml * 4 kL * 8.03e-007 ug/g * 0.001 * 1.053
TOC	Sludge Solid	AR (Solid)		0.00E+00	kg		Template Engineering	1.34 g/ml * 89 kL * 0 ug/g * 0.001 * 2.249
TOC	Sludge Solid	P1 (Solid)		0.00E+00	kg		Template Engineering	1.61 g/ml * 4 kL * 0 ug/g * 0.001 * 1.053
UTOTAL	Sludge Solid	AR (Solid)		1.50E+03	kg		Template Engineering	1.34 g/ml * 89 kL * 5600 ug/g * 0.001 * 2.249
UTOTAL	Sludge Solid	P1 (Solid)		1.73E+01	kg		Template Engineering	1.61 g/ml * 4 kL * 2550 ug/g * 0.001 * 1.053
Zr	Sludge Solid	AR (Solid)		6.14E-04	kg		Template Engineering	1.34 g/ml * 89 kL * 0.00229 ug/g * 0.001 * 2.249
Zr	Sludge Solid	P1 (Solid)		2.08E+01	kg		Template Engineering	1.61 g/ml * 4 kL * 3070 ug/g * 0.001 * 1.053
3H	Sludge Solid	AR (Solid)		7.71E-01	Ci		Template Engineering	1.34 g/ml * 89 kL * 0.0028758 uCi/g * 1 * 2.249
3H	Sludge Solid	P1 (Solid)		1.54E-02	Ci		Template Engineering	1.61 g/ml * 4 kL * 0.00226525 uCi/g * 1 * 1.053
14C	Sludge Solid	AR (Solid)		3.16E-01	Ci		Template Engineering	1.34 g/ml * 89 kL * 0.00117793 uCi/g * 1 * 2.249
14C	Sludge Solid	P1 (Solid)		8.73E-03	Ci		Template Engineering	1.61 g/ml * 4 kL * 0.00128773 uCi/g * 1 * 1.053
59Ni	Sludge Solid	AR (Solid)		8.39E+00	Ci		Template Engineering	1.34 g/ml * 89 kL * 0.0312959 uCi/g * 1 * 2.249

Table A-1. Condensed Best-Basis Calculation Detail Reports for Tank 241-A-104 Primary and Supplemental Analytes

Radionuclide Decay Date 7/1/2015

Analyte	Phase	Waste Type	Qualifier	Inventory	Units	RSD (%)	Basis	Calculation (Density*Volume* Concentration*Conversion*Multiplier)[a]
59Ni	Sludge Solid	P1 (Solid)		2.28E-01	Ci		Template Engineering	1.61 g/ml * 4 kL * 0.0335956 uCi/g * 1 * 1.053
60Co	Sludge Solid	AR (Solid)		2.46E+01	Ci		Process Knowledge	1.64 g/ml * 89 kL * 0.168712 uCi/g * 1 * 1
60Co	Sludge Solid	P1 (Solid)		1.11E+00	Ci		Process Knowledge	1.64 g/ml * 4 kL * 0.168712 uCi/g * 1 * 1
63Ni	Sludge Solid	AR (Solid)		7.20E+02	Ci		Template Engineering	1.34 g/ml * 89 kL * 2.68612 uCi/g * 1 * 2.249
63Ni	Sludge Solid	P1 (Solid)		1.98E+01	Ci		Template Engineering	1.61 g/ml * 4 kL * 2.92126 uCi/g * 1 * 1.053
79Se	Sludge Solid	AR (Solid)		8.54E-02	Ci		Template Engineering	1.34 g/ml * 89 kL * 0.000318268 uCi/g * 1 * 2.249
79Se	Sludge Solid	P1 (Solid)		3.59E-03	Ci		Template Engineering	1.61 g/ml * 4 kL * 0.000528952 uCi/g * 1 * 1.053
90Sr	Sludge Solid	AR (Solid)		1.46E+06	Ci		Process Knowledge	1.64 g/ml * 89 kL * 10012.7 uCi/g * 1 * 1
90Sr	Sludge Solid	P1 (Solid)		6.57E+04	Ci		Process Knowledge	1.64 g/ml * 4 kL * 10012.7 uCi/g * 1 * 1
90Y	Sludge Solid	AR (Solid)		1.46E+06	Ci		Calculated	90Sr * 1
90Y	Sludge Solid	P1 (Solid)		6.57E+04	Ci		Calculated	90Sr * 1
93mNb	Sludge Solid	AR (Solid)		2.03E+00	Ci		Template Engineering	1.34 g/mL * 89 kL * 0.017031 uCi/g
93mNb	Sludge Solid	P1 (Solid)		8.44E-02	Ci		Template Engineering	1.61 g/mL * 4 kL * 0.0131058 uCi/g

Table A-1. Condensed Best-Basis Calculation Detail Reports for Tank 241-A-104 Primary and Supplemental Analytes

Radionuclide Decay Date 7/1/2015

Analyte	Phase	Waste Type	Qualifier	Inventory	Units	RSD (%)	Basis	Calculation (Density*Volume* Concentration*Conversion*Multiplier)[a]
93Zr	Sludge Solid	AR (Solid)		2.26E+00	Ci		Template Engineering	1.34 g/ml * 89 kL * 0.00842994 uCi/g * 1 * 2.249
93Zr	Sludge Solid	P1 (Solid)		9.49E-02	Ci		Template Engineering	1.61 g/ml * 4 kL * 0.0139999 uCi/g * 1 * 1.053
99Tc	Sludge Solid	AR (Solid)		1.19E+01	Ci		Template Engineering	1.34 g/ml * 89 kL * 0.0442979 uCi/g * 1 * 2.249
99Tc	Sludge Solid	P1 (Solid)		4.99E-01	Ci		Template Engineering	1.61 g/ml * 4 kL * 0.0735965 uCi/g * 1 * 1.053
106Ru	Sludge Solid	AR (Solid)		2.67E-09	Ci		Template Engineering	1.34 g/ml * 89 kL * 9.97312e-012 uCi/g * 1 * 2.249
106Ru	Sludge Solid	P1 (Solid)		1.42E-09	Ci		Template Engineering	1.61 g/ml * 4 kL * 2.09488e-010 uCi/g * 1 * 1.053
113mCd	Sludge Solid	AR (Solid)		1.13E+00	Ci		Template Engineering	1.34 g/ml * 89 kL * 0.00422238 uCi/g * 1 * 2.249
113mCd	Sludge Solid	P1 (Solid)		5.39E-02	Ci		Template Engineering	1.61 g/ml * 4 kL * 0.00794455 uCi/g * 1 * 1.053
125Sb	Sludge Solid	AR (Solid)		1.85E+00	Ci		Process Knowledge	1.64 g/ml * 89 kL * 0.0126825 uCi/g * 1 * 1
125Sb	Sludge Solid	P1 (Solid)		8.32E-02	Ci		Process Knowledge	1.64 g/ml * 4 kL * 0.0126825 uCi/g * 1 * 1
126Sn	Sludge Solid	AR (Solid)		1.71E-01	Ci		Template Engineering	1.34 g/ml * 89 kL * 0.000639128 uCi/g * 1 * 2.249
126Sn	Sludge Solid	P1 (Solid)		7.24E-03	Ci		Template Engineering	1.61 g/ml * 4 kL * 0.00106739 uCi/g * 1 * 1.053
129I	Sludge Solid	AR (Solid)		6.33E-03	Ci		Template Engineering	1.34 g/ml * 89 kL * 2.36e-005 uCi/g * 1 * 2.249

Table A-1. Condensed Best-Basis Calculation Detail Reports for Tank 241-A-104 Primary and Supplemental Analytes

Radionuclide Decay Date 7/1/2015

Analyte	Phase	Waste Type	Qualifier	Inventory	Units	RSD (%)	Basis	Calculation (Density*Volume* Concentration*Conversion*Multiplier)[a]
129I	Sludge Solid	P1 (Solid)		3.00E-05	Ci		Template Engineering	1.61 g/ml * 4 kL * 4.42e-006 uCi/g * 1 * 1.053
134Cs	Sludge Solid	AR (Solid)		3.31E-03	Ci		Process Knowledge	1.64 g/ml * 89 kL * 2.26712e-005 uCi/g * 1 * 1
134Cs	Sludge Solid	P1 (Solid)		1.49E-04	Ci		Process Knowledge	1.64 g/ml * 4 kL * 2.26712e-005 uCi/g * 1 * 1
137Cs	Sludge Solid	AR (Solid)		3.99E+04	Ci		Process Knowledge	1.64 g/ml * 89 kL * 273.589 uCi/g * 1 * 1
137Cs	Sludge Solid	P1 (Solid)		1.79E+03	Ci		Process Knowledge	1.64 g/ml * 4 kL * 273.589 uCi/g * 1 * 1
137mBa	Sludge Solid	AR (Solid)		3.77E+04	Ci		Calculated	137Cs * 0.944
137mBa	Sludge Solid	P1 (Solid)		1.69E+03	Ci		Calculated	137Cs * 0.944
151Sm	Sludge Solid	AR (Solid)		3.29E+04	Ci		Template Engineering	1.34 g/ml * 89 kL * 122.53 uCi/g * 1 * 2.249
151Sm	Sludge Solid	P1 (Solid)		2.31E+03	Ci		Template Engineering	1.61 g/ml * 4 kL * 340.757 uCi/g * 1 * 1.053
152Eu	Sludge Solid	AR (Solid)		3.28E+00	Ci		Template Engineering	1.34 g/mL * 89 kL * 0.0275219 uCi/g
152Eu	Sludge Solid	P1 (Solid)		1.23E+00	Ci		Template Engineering	1.61 g/mL * 4 kL * 0.190532 uCi/g
154Eu	Sludge Solid	AR (Solid)		4.30E+02	Ci		Process Knowledge	1.64 g/ml * 89 kL * 2.94284 uCi/g * 1 * 1
154Eu	Sludge Solid	P1 (Solid)		1.93E+01	Ci		Process Knowledge	1.64 g/ml * 4 kL * 2.94284 uCi/g * 1 * 1

Table A-1. Condensed Best-Basis Calculation Detail Reports for Tank 241-A-104 Primary and Supplemental Analytes

Radionuclide Decay Date 7/1/2015

Analyte	Phase	Waste Type	Qualifier	Inventory	Units	RSD (%)	Basis	Calculation (Density*Volume* Concentration*Conversion*Multiplier)[a]
155Eu	Sludge Solid	AR (Solid)		3.33E+01	Ci		Template Engineering	1.34 g/mL * 89 kL * 0.279423 uCi/g
155Eu	Sludge Solid	P1 (Solid)		1.37E+01	Ci		Template Engineering	1.61 g/mL * 4 kL * 2.13389 uCi/g
226Ra	Sludge Solid	AR (Solid)		1.63E-06	Ci		Template Engineering	1.34 g/ml * 89 kL * 6.07173e-009 uCi/g * 1 * 2.249
226Ra	Sludge Solid	P1 (Solid)		7.01E-08	Ci		Template Engineering	1.61 g/ml * 4 kL * 1.03349e-008 uCi/g * 1 * 1.053
227Ac	Sludge Solid	AR (Solid)		1.52E-05	Ci		Template Engineering	1.34 g/mL * 89 kL * 1.2753e-007 uCi/g
227Ac	Sludge Solid	P1 (Solid)		3.89E-07	Ci		Template Engineering	1.61 g/mL * 4 kL * 6.04636e-008 uCi/g
228Ra	Sludge Solid	AR (Solid)		1.63E-06	Ci		Calculated	232Th * 1
228Ra	Sludge Solid	P1 (Solid)		5.99E-13	Ci		Calculated	232Th * 1
229Th	Sludge Solid	AR (Solid)		6.40E-07	Ci		Template Engineering	1.34 g/ml * 89 kL * 2.38671e-009 uCi/g * 1 * 2.249
229Th	Sludge Solid	P1 (Solid)		4.27E-10	Ci		Template Engineering	1.61 g/ml * 4 kL * 6.29134e-011 uCi/g * 1 * 1.053
231Pa	Sludge Solid	AR (Solid)		2.27E-05	Ci		Template Engineering	1.34 g/ml * 89 kL * 8.46741e-008 uCi/g * 1 * 2.249
231Pa	Sludge Solid	P1 (Solid)		4.98E-07	Ci		Template Engineering	1.61 g/ml * 4 kL * 7.34775e-008 uCi/g * 1 * 1.053
232Th	Sludge Solid	AR (Solid)		1.63E-06	Ci		Template Engineering	1.34 g/ml * 89 kL * 6.08e-009 uCi/g * 1 * 2.249

Table A-1. Condensed Best-Basis Calculation Detail Reports for Tank 241-A-104 Primary and Supplemental Analytes

Radionuclide Decay Date 7/1/2015

Analyte	Phase	Waste Type	Qualifier	Inventory	Units	RSD (%)	Basis	Calculation (Density*Volume* Concentration*Conversion*Multiplier)[a]
232Th	Sludge Solid	P1 (Solid)		5.99E-13	Ci		Template Engineering	1.61 g/ml * 4 kL * 8.84e-014 uCi/g * 1 * 1.053
232U	Sludge Solid	AR (Solid)		2.74E-03	Ci		Template Engineering	1.34 g/mL * 89 kL * 2.29806e-005 uCi/g
232U	Sludge Solid	P1 (Solid)		3.99E-07	Ci		Template Engineering	1.61 g/mL * 4 kL * 6.20051e-008 uCi/g
233U	Sludge Solid	AR (Solid)		1.94E-01	Ci		Template Engineering	1.34 g/mL * 89 kL * 0.00162368 uCi/g
233U	Sludge Solid	P1 (Solid)		8.34E-07	Ci		Template Engineering	1.61 g/mL * 4 kL * 1.29511e-007 uCi/g
234U	Sludge Solid	AR (Solid)		5.04E-01	Ci		Template Engineering	1.34 g/mL * 89 kL * 0.00422795 uCi/g
234U	Sludge Solid	P1 (Solid)		5.91E-03	Ci		Template Engineering	1.61 g/mL * 4 kL * 0.000917126 uCi/g
235U	Sludge Solid	AR (Solid)		2.12E-02	Ci		Template Engineering	1.34 g/mL * 89 kL * 0.000177896 uCi/g
235U	Sludge Solid	P1 (Solid)		2.47E-04	Ci		Template Engineering	1.61 g/mL * 4 kL * 3.83292e-005 uCi/g
236U	Sludge Solid	AR (Solid)		1.21E-02	Ci		Template Engineering	1.34 g/mL * 89 kL * 0.00010143 uCi/g
236U	Sludge Solid	P1 (Solid)		1.52E-04	Ci		Template Engineering	1.61 g/mL * 4 kL * 2.35872e-005 uCi/g
237Np	Sludge Solid	AR (Solid)		4.91E-02	Ci		Template Engineering	1.34 g/ml * 89 kL * 0.000182999 uCi/g * 1 * 2.249
237Np	Sludge Solid	P1 (Solid)		1.34E-03	Ci		Template Engineering	1.61 g/ml * 4 kL * 0.000197999 uCi/g * 1 * 1.053

Table A-1. Condensed Best-Basis Calculation Detail Reports for Tank 241-A-104 Primary and Supplemental Analytes

Radionuclide Decay Date 7/1/2015

Analyte	Phase	Waste Type	Qualifier	Inventory	Units	RSD (%)	Basis	Calculation (Density*Volume* Concentration*Conversion*Multiplier)[a]
238Pu	Sludge Solid	AR (Solid)		1.71E+01	Ci		Calculated	1.64 g/mL * 89 kL * 0.116841 uCi/g
238Pu	Sludge Solid	P1 (Solid)		1.08E+00	Ci		Calculated	1.64 g/mL * 4 kL * 0.164455 uCi/g
238U	Sludge Solid	AR (Solid)		5.02E-01	Ci		Template Engineering	1.34 g/mL * 89 kL * 0.00420563 uCi/g
238U	Sludge Solid	P1 (Solid)		5.77E-03	Ci		Template Engineering	1.61 g/mL * 4 kL * 0.000896103 uCi/g
239/240Pu	Sludge Solid	AR (Solid)		6.98E+02	Ci		Process Knowledge	1.64 g/ml * 89 kL * 4.78 uCi/g * 1 * 1
239/240Pu	Sludge Solid	P1 (Solid)		3.14E+01	Ci		Process Knowledge	1.64 g/ml * 4 kL * 4.78 uCi/g * 1 * 1
239Pu	Sludge Solid	AR (Solid)		5.72E+02	Ci		Calculated	1.64 g/mL * 89 kL * 3.91973 uCi/g
239Pu	Sludge Solid	P1 (Solid)		2.51E+01	Ci		Calculated	1.64 g/mL * 4 kL * 3.83192 uCi/g
240Pu	Sludge Solid	AR (Solid)		1.24E+02	Ci		Calculated	1.64 g/mL * 89 kL * 0.851977 uCi/g
240Pu	Sludge Solid	P1 (Solid)		6.16E+00	Ci		Calculated	1.64 g/mL * 4 kL * 0.939515 uCi/g
241Am	Sludge Solid	AR (Solid)		6.11E+02	Ci		Template Engineering	1.34 g/mL * 89 kL * 5.12125 uCi/g
241Am	Sludge Solid	P1 (Solid)		9.83E+01	Ci		Template Engineering	1.61 g/mL * 4 kL * 15.2621 uCi/g
241Pu	Sludge Solid	AR (Solid)		3.93E+02	Ci		Calculated	1.64 g/mL * 89 kL * 2.69216 uCi/g
241Pu	Sludge Solid	P1 (Solid)		2.74E+01	Ci		Calculated	1.64 g/mL * 4 kL * 4.17033 uCi/g
242Cm	Sludge Solid	AR (Solid)		3.60E-01	Ci		Template Engineering	1.34 g/mL * 89 kL * 0.00301583 uCi/g
242Cm	Sludge Solid	P1 (Solid)		8.34E-02	Ci		Template Engineering	1.61 g/mL * 4 kL * 0.0129437 uCi/g

Table A-1. Condensed Best-Basis Calculation Detail Reports for Tank 241-A-104 Primary and Supplemental Analytes

Radionuclide Decay Date 7/1/2015

Analyte	Phase	Waste Type	Qualifier	Inventory	Units	RSD (%)	Basis	Calculation (Density*Volume* Concentration*Conversion*Multiplier)[a]
242Pu	Sludge Solid	AR (Solid)		6.10E-03	Ci		Calculated	1.64 g/mL * 89 kL * 4.17771e-005 uCi/g
242Pu	Sludge Solid	P1 (Solid)		4.47E-04	Ci		Calculated	1.64 g/mL * 4 kL * 6.81012e-005 uCi/g
243Am	Sludge Solid	AR (Solid)		3.05E-01	Ci		Template Engineering	1.34 g/mL * 89 kL * 0.00256037 uCi/g
243Am	Sludge Solid	P1 (Solid)		5.30E-02	Ci		Template Engineering	1.61 g/mL * 4 kL * 0.00823376 uCi/g
243Cm	Sludge Solid	AR (Solid)		1.26E-02	Ci		Template Engineering	1.34 g/mL * 89 kL * 0.000105417 uCi/g
243Cm	Sludge Solid	P1 (Solid)		3.79E-03	Ci		Template Engineering	1.61 g/mL * 4 kL * 0.000589004 uCi/g
244Cm	Sludge Solid	AR (Solid)		2.43E-01	Ci		Template Engineering	1.34 g/mL * 89 kL * 0.0020398 uCi/g
244Cm	Sludge Solid	P1 (Solid)		7.20E-02	Ci		Template Engineering	1.61 g/mL * 4 kL * 0.0111825 uCi/g
Component wt% water	Sludge Solid	AR		42.3	%			
Component wt% water	Sludge Solid	P1		42.3	%			
Component density	Sludge Solid	AR		1.64	g/ml			
Component density	Sludge Solid	P1		1.64	g/ml			

Notes:

Ci = Curies

g/mL = grams per milliliter

kg = kilograms

Table A-1. Condensed Best-Basis Calculation Detail Reports for Tank 241-A-104 Primary and Supplemental Analytes

Radionuclide Decay Date 7/1/2015

Analyte	Phase	Waste Type	Qualifier	Inventory	Units	RSD (%)	Basis	Calculation (Density*Volume* Concentration*Conversion*Multiplier)[a]

kL = kiloliters

RSD = relative standard deviation

uCi/g = microcuries per gram

ug/g = micrograms per gram

Wt% = weight percent

INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

Part I: Background Information

Title: Derivation of Best-Basis Inventory for Tank 241-A-104 as of February 1, 2016	Information Category: ☐ Abstract ☐ Journal Article ☐ Summary ☐ Internet ☐ Visual Aid ☐ Software ☐ Full Paper ☑ Report ☐ Other
Publish to OSTI? ☐ Yes ☑ No	

	Yes	NA
Trademark/Copyright "Right to Use" Information or Permission Documentation	☐	☑

Document Number: RPP-RPT-58857 Revision 1	Date: March 2016
Author: Tabor, Cindy L	

Part II: External/Public Presentation Information

Conference Name:			
Sponsoring Organization(s): WRPS			
Date of Conference:	Conference Location:		
Will Material be Handed Out? ☐ Yes ☑ No	Will Information be Published? ☐ Yes ☑ No	*(If Yes, attach copy of Conference format instructions/guidance.)*	

Part III: WRPS Document Originator Checklist

Description	*Yes*	*N/A*	*Print/Sign/Date*
Information Product meets requirements in TFC-BSM-AD-C-01?	☐	☑	
Document Release Criteria in TFC-ENG-DESIGN-C-25 completed? (Attach checklist)	☐	☑	
If product contains pictures, safety review completed?	☑	☐	Roberts, Sheryl K Approved - IDMS data file att.

Part IV: WRPS Internal Review

Function	*Organization*	*Date*	*Print Name/Signature/Date*
Subject Matter Expert	WRPS	08/10/2020	Tabor, Cindy L Approved - IDMS data file att.
Responsible Manager	WRPS	08/04/2020	Rutland, Paul L Approved - IDMS data file att.
Other:			

Part V: IRM Clearance Services Review

Description	*Yes*	*No*	*Print Name/Signature*
Document Contains Classified Information?	☐	☒	If Answer is "Yes," ADC Approval Required Print Name/Signature/Date
Document Contains Information Restricted by DOE Operational Security Guidelines?	☐	☒	Reviewer Signature: Print Name/Signature/Date
Document is Subject to Release Restrictions? *If the answer is "Yes," please mark category at right and describe limitation or responsible organization below:*	☐	☒	Document contains: ☐ Applied Technology ☐ Protected CRADA ☐ Personal/Private ☐ Export Controlled ☐ Proprietary ☐ Procurement – Sensitive ☐ Patentable Info. ☐ OUO ☐ Predecisional Info. ☐ UCNI ☐ Restricted by Operational Security Guidelines ☐ Other (Specify)
Additional Comments from Information Clearance Specialist Review?	☐	☒	Information Clearance Specialist Approval APPROVED By Sarah Harrison at 3:17 pm, Aug 20, 2020 Print Name/Signature/Date

When IRM Clearance Review is Complete – Return to WRPS Originator for Final Signature Routing (Part VI)

INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

Part VI: Final Review and Approvals

Description	*Approved for Release*		*Print Name/Signature*
	Yes	*N/A*	
WRPS External Affairs	☒	☐	Mc Cune, Hal C Approved - IDMS data file att.
WRPS Office of Chief Counsel	☒	☐	Roden, Mari L Approved - IDMS data file att.
DOE – ORP Public Affairs/Communications	☒	☐	Levardi, Yvonne M / Tyree, Geoff T Approved - IDMS data file att.
Other: ORP OCC	☒	☐	King, Grace J Approved - IDMS data file att.
Other: ORP SME	☒	☐	Blackwell, Becky Approved - IDMS data file att.

Comments Required for WRPS-Indicate Purpose of Document:

This document reports the change in the best-basis inventory (BBI) for Tank 241-A-104 for the second quarter of fiscal year 2016. The change was needed to correct densities and process knowledge-based inventories in Appendix A. Process knowledge (template)-based inventories increased by about 50% compared to the previous BBI.

APPROVED
By Sarah Harrison at 3:18 pm, Aug 20, 2020

Approved for Public Release; Further Dissemination Unlimited

Information Release Station

Was/Is Information Product Approved for Release? ☒ Yes ☐ No

If Yes, what is the Level of Releaser? ☑ Public/Unrestricted ☐ Other (Specify) _____

Date Information Product Stamped/Marked for Release: 08/20/2020

Was/Is Information Product Transferred to OSTI? ☐ Yes ☒ No

Forward Copies of Completed Form to WRPS Originator

```
- <workflow name="(SEH) Normal - RPP-RPT-58857 Rev1" id="266100911">
  - <task name="Clearance Process" id="0" date-initiated="20200804T1449"
      performer="Sarah E Harrison" performer-id="252341659"
      username="h5635746">
      <comments>Due Tuesday August 18th 2020 - COB Please approve the
        Derivation of Best-Basis Inventory for Tank 241-A-104 as of February 1,
        2016, Revision 1, submitted by Cindy Tabor for public external release.
        Thank you, Sarah Harrison Information Clearance</comments>
    </task>
    <task name="Add XML" id="1" date-done="20200804T1449" />
    <task name="Manager Approval" id="41" date-due="20200807T1449" date-
      done="20200804T1451" performer="Paul L Rutland" performer-id="140633218"
      username="h4494439" disposition="Approve" authentication="true" />
    <task name="Document Reviewer2" id="53" date-due="20200807T1451" date-
      done="20200804T1502" performer="Hal C Mc Cune" performer-id="226350486"
      username="h7687509" disposition="Public Release" authentication="true" />
    <task name="Document Reviewer1" id="54" date-due="20200807T1451" date-
      done="20200805T1558" performer="Sheryl K Roberts" performer-
      id="171787680" username="h0081997" disposition="Public Release"
      authentication="true" />
    <task name="Document Reviewer3" id="52" date-due="20200807T1451" date-
      done="20200806T0646" performer="Mari L Roden" performer-id="262637370"
      username="h0048955" disposition="Public Release" authentication="true" />
    <task name="Document Reviewer4" id="51" date-due="20200807T1451" date-
      done="20200806T1645" performer="Rebecca I Blackwell" performer-
      id="242759597" username="h9138590" disposition="Public Release"
      authentication="true" />
    <task name="Doc Owner Clearance Review" id="13" date-due="20200807T1645"
      date-done="20200810T0706" performer="Cynthia L Tabor" performer-
      id="173738849" username="h6436378" disposition="Send On"
      authentication="true" />
    <task name="Milestone 1" id="24" date-done="20200810T0706" />
    <task name="ORP Document Reviewer2" id="58" date-due="20200812T0706"
      date-done="20200813T1009" performer="Yvonne M Levardi" performer-
      id="185346745" username="h7131303" disposition="Public Release"
      authentication="true" />
    <task name="ORP Document Reviewer1" id="57" date-due="20200812T0706"
      date-done="20200814T1235" performer="Geoff T Tyree" performer-
      id="6158846" username="h0068565" disposition="Public Release"
      authentication="true" />
    <task name="ORP Document Reviewer3" id="59" date-due="20200812T0706"
      date-done="20200820T1005" performer="Grace J King" performer-
      id="211901436" username="h9807759" disposition="Public Release"
      authentication="true" />
    <task name="Doc Owner Reviews ORP Comments" id="61" date-
      due="20200821T1005" date-done="20200820T1227" performer="Cynthia L
      Tabor" performer-id="173738849" username="h6436378" disposition="Send On"
      authentication="true" />
    <task name="Milestone 2" id="62" date-done="20200820T1227" />
    <task name="Verify Doc Consistency" id="4" date-due="20200821T1227" date-
      done="20200820T1444" performer="Sarah E Harrison" performer-
      id="252341659" username="h5635746" disposition="Cleared"
      authentication="true" />
  </workflow>
```