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

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: Oct 25,2019 HANFORD RELEASE

1. **Doc No:** RPP-RPT-42323 **Rev.** 04

2. **Title:**
HANFORD C-FARM TANK AND ANCILLARY EQUIPMENT RESIDUAL WASTE INVENTORY

3. **Project Number:** ☒N/A

4. **Design Verification Required:** ☐Yes ☒No

5. **USQ Number:** ☒ N/A RPP-27195

6. **PrHA Number** **Rev.** ☒ N/A

Clearance Review Restriction Type: public

7. **Approvals**

Title	Name	Signature	Date
Checker	Singleton, Kristin M	*Singleton, Kristin M*	10/17/2019
Clearance Review	Aardal, Janis D	*Aardal, Janis D*	10/25/2019
Document Control Approval	Alvarez, Efren	*Alvarez, Efren*	10/24/2019
Originator	Field, Jim G	*Field, Jim G*	10/17/2019
Other Approver	Bergeron, Marcel P	*Bergeron, Marcel P*	10/17/2019
Responsible Manager	Rutland, Paul L	*Rutland, Paul L*	10/18/2019

8. **Description of Change and Justification**

Updated to 2019 BBI to incorporate C-105 residual sample results and post-retrieval residual volumes.

9. **TBDs or Holds** ☒N/A

10. **Related Structures, Systems, and Components**

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

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

Document Number	Rev.	Title

12. **Impacted Documents (Outside SPF):**

N/A

13. **Related Documents** ☒N/A

Document Number	Rev.	Title

14. **Distribution**

Name	Organization
Bergeron, Marcel P	CLOSURE & INTERIM MEASURES
Deford, Douglas K	CLOSURE & INTERIM MEASURES
Hiergesell, Bob A	CLOSURE & INTERIM MEASURES
Rutland, Paul L	CLOSURE & INTERIM MEASURES
Singleton, Kristin M	CLOSURE & INTERIM MEASURES
Tabor, Cindy L	CLOSURE & INTERIM MEASURES

INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

Part I: Background Information

Title: Hanford C-Farm Tank and Ancillary Equipment Residual Waste Inventory

Information Category:
☐ Abstract ☐ Journal Article ☐ Summary
☐ Internet ☐ Visual Aid ☐ Software
☐ Full Paper ☑ Report ☐ Other

Publish to OSTI? ☐ Yes ☑ No

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

Document Number: RPP-RPT-42323 Revision 4 Date: October 2019

Author: Field, Jim G

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?	☑	☐	Field, Jim G IDMS Data File att. 10/07/2019
Document Release Criteria in TFC-ENG-DESIGN-C-25 completed? (Attach checklist)	☑	☐	Field, Jim G IDMS Data File att. 10/07/2019
If product contains pictures, safety review completed?	☑	☐	Field, Jim G IDMS Data File att. 10/07/2019

Part IV: WRPS Internal Review

Function	*Organization*	*Date*	*Print Name/Signature/Date*
Subject Matter Expert	WRPS	10/09/2019	Field, Jim G IDMS Data File att.
Responsible Manager	WRPS	10/01/2019	Rutland, Paul L 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 Janis D. Aardal at 2:20 pm, Oct 11, 2019 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	☒	☐	IDMS Data File att.	Mc Cune, Hal C
WRPS Office of Chief Counsel	☒	☐	IDMS Data File att.	Cherry, Stephen B
DOE – ORP Public Affairs/Communications	☒	☐	IDMS Data File att.	Levardi, Yvonne M/Tyree, Geoff T
Other: ORP SME	☒	☐	IDMS Data File att.	Lobos, Rodrigo A
Other: DOE OCC	☒	☐	IDMS Data File att.	Zelen, Benjamin J

Comments Required for WRPS-Indicate Purpose of Document:

Support document for WMA-C performance assessment and Waste Incidental to Reprocessing (WIR).
Revised to include final C farm retrieval residual volume and inventory results.

APPROVED
By Janis D. Aardal at 2:21 pm, Oct 11, 2019

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: 10/11/2019

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

Forward Copies of Completed Form to WRPS Originator

```
- <workflow name="(JDA) Normal - RPP-RPT-42323 R4_C-FarmAncilEquipResWst"
    id="250339121">
  - <task name="Clearance Process" id="0" date-initiated="20191001T1039"
      performer="Janis D Aardal" performer-id="267960" username="h0090683">
      <comments>Due Monday, October 14, 2019 - COB Please approve the Rev.
        4, Hanford C-Farm Tank and Ancillary Equipment Residual Waste
        Inventory, by Jim Field for public release. Thank you, Janis Aardal
        Information Clearance</comments>
    </task>
    <task name="Add XML" id="1" date-done="20191001T1039" />
    <task name="Manager Approval" id="41" date-due="20191004T1039" date-
      done="20191001T1047" performer="Paul L Rutland" performer-id="140633218"
      username="h4494439" disposition="Approve" authentication="true" />
    <task name="Document Reviewer1" id="54" date-due="20191004T1047" date-
      done="20191001T1137" performer="Hal C Mc Cune" performer-id="226350486"
      username="h7687509" disposition="Public Release" authentication="true" />
    <task name="Document Reviewer2" id="53" date-due="20191004T1047" date-
      done="20191003T1117" performer="Stephen B Cherry" performer-id="1382719"
      username="h0374767" disposition="Public Release" authentication="true" />
    <task name="Document Reviewer3" id="52" date-due="20191004T1047" date-
      done="20191003T1622" performer="Rod (Rodrigo) A Lobos" performer-
      id="232334741" username="h2488419" disposition="Public Release"
      authentication="true" />
    <task name="Doc Owner Clearance Review" id="13" date-due="20191004T1623"
      date-done="20191007T0627" performer="Jim G Field" performer-id="262566"
      username="h0022161" disposition="Send On" authentication="true" />
    <task name="Milestone 1" id="24" date-done="20191007T0627" />
  - <task name="ORP Document Reviewer2" id="58" date-due="20191009T0627"
      date-done="20191007T1020" performer="Yvonne M Levardi" performer-
      id="185346745" username="h7131303" disposition="Public Release"
      authentication="true">
      <comments>no comments</comments>
    </task>
    <task name="ORP Document Reviewer1" id="57" date-due="20191009T0627"
      date-done="20191007T1034" performer="Benjamin J Zelen" performer-
      id="141965018" username="h1214744" disposition="Public Release"
      authentication="true" />
    <task name="ORP Document Reviewer3" id="59" date-due="20191009T0627"
      date-done="20191009T1314" performer="Geoff T Tyree" performer-
      id="6158846" username="h0068565" disposition="Public Release"
      authentication="true" />
    <task name="Doc Owner Reviews ORP Comments" id="61" date-
      due="20191010T1314" date-done="20191009T1545" performer="Jim G Field"
      performer-id="262566" username="h0022161" disposition="Send On"
      authentication="true" />
    <task name="Milestone 2" id="62" date-done="20191009T1546" />
    <task name="Verify Doc Consistency" id="4" date-due="20191010T1545" date-
      done="20191011T1335" performer="Janis D Aardal" performer-id="267960"
      username="h0090683" disposition="Cleared" authentication="true" />
  </workflow>
```

RPP-RPT-42323
Revision 4

Post-Closure Hanford C-Farm Tank and Ancillary Equipment Residual Waste Inventory Estimates

J. G. Field
K. M. Singleton
Washington River Protection Solutions LLC

Date Published
October 2019

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

Contract No. DE-AC27-08RV14800

Approved for Public Release;
Further Dissemination Unlimited

This page intentionally left blank.

EXECUTIVE SUMMARY

The purpose of this report is to provide updated radiological and non-radiological inventory estimates as of January 1, 2019 for waste residuals in tanks and ancillary equipment in 241-C Tank Farm (C-Farm) at the time of closure. These updated inventory estimates will be compared with inventories used in the Tank Closure and Waste Management (TC & WM) Environmental Impact Statement (EIS) and Waste Management Area C (C-Farm) Performance Assessment. These updated estimates will also provide a technical basis for a reassessment of the WMA C PA for potential impacts from waste residuals remaining in C-Farm tanks and ancillary equipment after site closure. Inventory estimates and associated potential impacts are expected to be revised as additional information is obtained.

Inventory information in this report reflects additional information and changes since December 2002 that include the following:

- Tank waste was retrieved and residual tank waste constituents sampled and analyzed
- New tank and ancillary equipment sample data and information were obtained
- Hanford tank waste process model estimates were updated
- RPP-23403, *Single-Shell Tank Component Closure Data Quality Objectives* was published.

Revision 3 of this report included residual inventories based on information available and conditions through September 1, 2014 that provided the basis for inventory estimates in the initial Waste Management Area C performance assessment (RPP-ENV-58782, *Performance Assessment of Waste Management Area C, Hanford Site, Washington*).

This revision of the report incorporates additional data obtained and changes in tank inventories through January 1, 2019 and presents chemical and radiological inventory estimates for residual waste remaining in C-Farm single-shell tanks (SSTs) and associated transfer equipment after tank waste is retrieved. Inventory estimates for radionuclides are decayed to January 1, 2020 (previously decayed to January 1, 2001). These inventory estimates provide comparison cases with the environmental impact statement (EIS) assessments and RPP-ENV-58782. Residual inventory estimates are important to environmental assessments and closure decisions as most environmental impacts are linearly proportional to the amount of soluble contaminants left in tanks/equipment (this document) or the amount of contaminant released to the soil (RPP-RPT-42294, *Hanford Waste Management Area C Soil Contamination Inventory Estimates*).

Inventories for Alternative 2B of the Tank Closure and Waste Management (TC & WM) EIS (DOE/EIS-0391, *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*) have been used as a point of comparison for the Waste Management Area C performance assessment. Alternative 2B reflects the U.S. Department of Energy's preferred alternative for landfill closure of tank farms. The EIS estimates are based on information and conditions as of December 2002. Residual waste inventory estimates in the EIS were determined by multiplying the inventory estimate for a tank

on December 1, 2002 by a factor of 0.01 (99% retrieval assumed). Inventory estimates and descriptions of the EIS are reported in DOE/EIS-0391.

Figure ES-1 shows major components of C-Farm expected to contain residual waste including:

- 16 SSTs used for waste retrieval and storage and
- Ancillary equipment, including catch tanks, pipelines, pits and diversion boxes used to transfer waste to and from the SSTs.

The C-Farm SSTs were constructed to store process waste from Hanford nuclear operations. Millions of gallons of nuclear waste were stored in the C-Farm tanks. In the late 1990s and early 2000s liquid waste was pumped out of the tanks, reducing the inventory of soluble constituents in the drainable liquid and mobile constituents in the tanks. Waste retrieval operations then commenced to remove remaining waste from the SSTs to the limit of technology. As of January 1, 2019, waste has been retrieved from all 16 of the SSTs in C-Farm (241-C-101, 241-C-102, 241-C-103, 241-C-104, 241-C-105, 241-C-106, 241-C-107, 241-C-108, 241-C-109, 241-C-110, 241-C-111, 241-C-112, 241-C-201, 241-C-202, 241-C-203, and 241-C-204). For purposes of this evaluation, a retrieved tank is a tank for which waste has been removed from the tank, the residual waste volume has been estimated, and retrieval completion has been approved by State of Washington Department of Ecology or a request to approve retrieval completion is in progress.

Inventory estimates for “retrieved” tanks are based on post-retrieval samples obtained per RPP-23403.

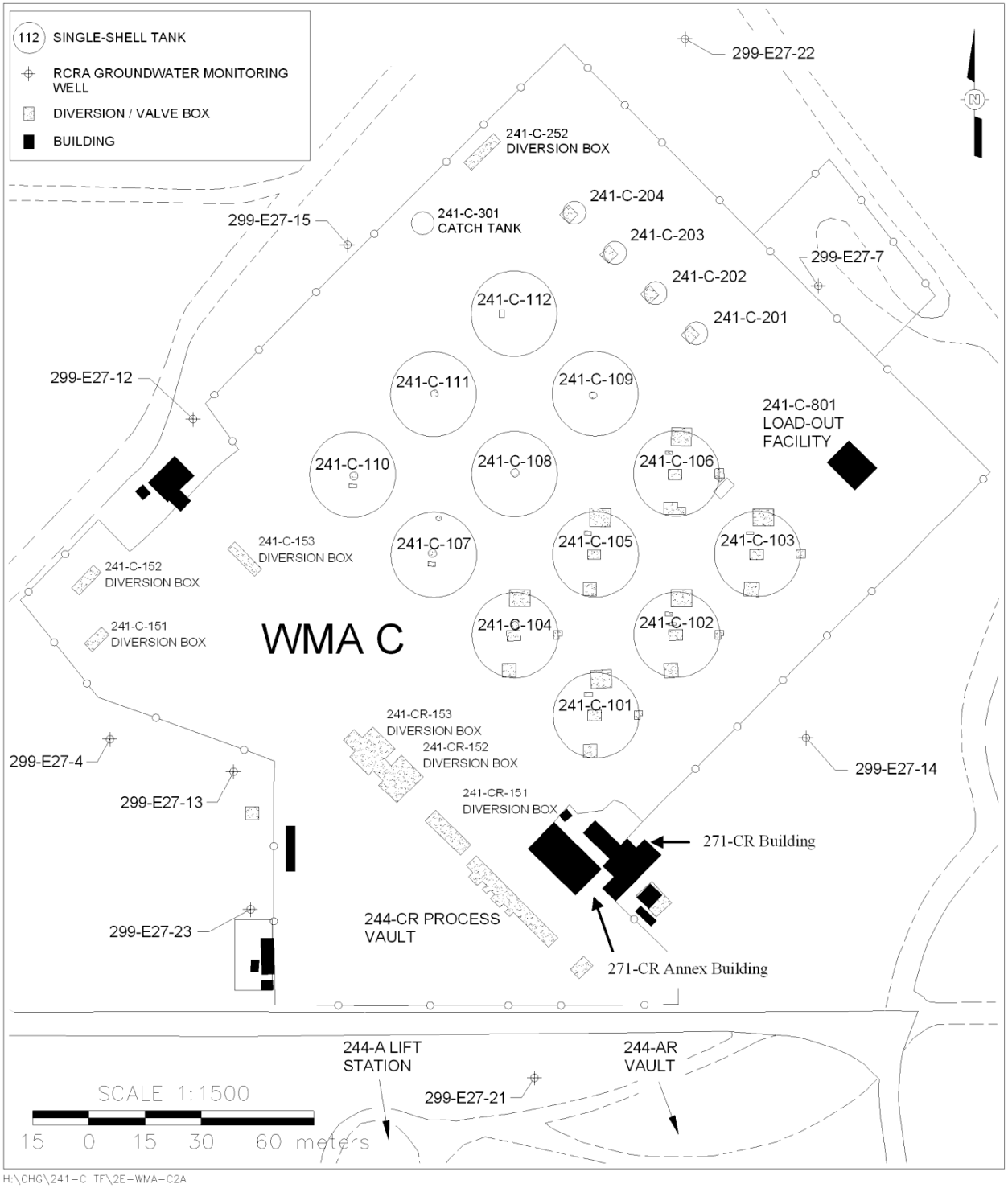
Following retrieval, the SSTs, infrastructure and surrounding soils, referred to as Waste Management Area C, will be closed in accordance with applicable State and Federal regulations. Waste Management Area C will be the first tank farm closed at the Hanford Waste Site.

Figure ES-2 illustrates the overall process to estimate current and post-retrieval C-Farm residual inventories. The figure shows three major process steps:

1. estimate tank waste inventory,
2. estimate residual waste in tanks, and
3. estimate residual waste in catch tanks and pipelines.

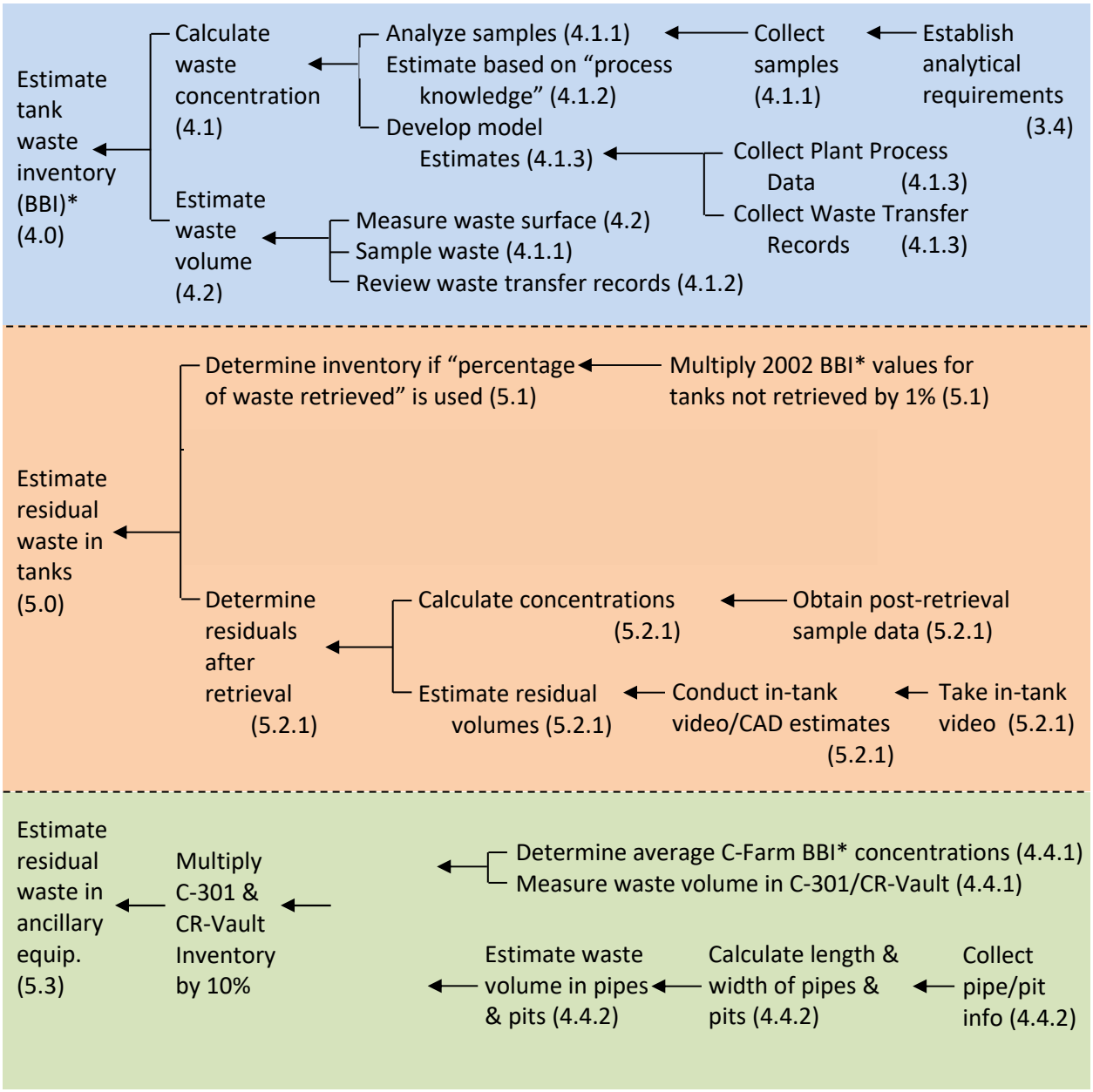
The first major process step is to estimate the current tank waste inventory. The best-basis inventory (BBI) process was established to estimate current tank waste inventories for a standard set of chemicals and radionuclides (RPP-7625, *Guidelines for Updating Best-Basis Inventory*). In the BBI process, waste concentration and volume estimates are established and combined to calculate inventories. Available analytical data are evaluated to identify which data best represent the waste concentrations in a tank. When analytical data are not available for a chemical or radionuclide, waste concentrations are estimated based on waste process information. Waste volume estimates in the BBI are based on tank measurements and/or waste transfer information.

Figure ES-1. Location Map of Waste Management Area C (241-C Tank Farm) and Surrounding Area



RCRA = *Resource Conservation and Recovery Act of 1976* WMA = Waste Management Area

Figure ES-2. Process to Estimate Residual Waste Inventories



*Except as noted in Section 5, BBI uses residual waste estimates after post-retrieval sampling and analyses.

The next major process step is to estimate residual waste in tanks. Tank inventories were estimated for the following:

1. TC & WM EIS residual inventory estimates (with radionuclides decayed to January 1, 2020),

2. Residual inventory measurements or estimates as of January 1, 2019.

The TC & WM EIS residual waste inventory estimates were determined by multiplying the BBI inventory estimate for a tank on December 1, 2002 by a factor of 0.01 (99% retrieval assumed).

Residual estimates updated for 2019 were determined for tanks retrieved as of January 1, 2019. Tanks retrieved to the limits of technology were sampled and analyzed and residual volumes estimated using a video/computer-aided design system. In addition to standard chemical and radionuclide BBI inventory estimates, inventories were developed for many other constituents after sampling tank residuals.

The third major process step was to estimate waste residuals in catch tanks and pipelines. As for the SSTs, the first step is to estimate the current inventory of waste in catch tanks and pipelines. Because little information is available for waste in catch tanks and pipelines, it was assumed that the composition of waste in pipelines and catch tanks is the same as the average composition of waste in the BBI for C-Farm SSTs. Waste volumes for catch tank C-301 and the 244-CR Vault were based on measurements. However, the amount of waste remaining in pipelines is unknown. Based on operations information, most of the waste has been flushed from the pipelines. Hence, the residual waste volume in pipelines is expected to be small compared to catch tank and SST post-retrieval residuals. A volume estimate for pipelines was developed based on the length and size of pipelines in the farms and operations information.

This report describes the assumptions, technical basis and uncertainty for each of the three major process steps to estimate residual waste inventories. The uncertainty of estimates varies depending on the quality and completeness of available information and includes retrieval uncertainties, model and process knowledge uncertainties, analytical uncertainty, and residual volume uncertainties.

Uncertainty in residual tank waste inventory estimates is on the order of 15 to 30% for most constituents.

This report provides the basis for the following sets of inventory estimates:

Single-Shell Tanks
Average January 1, 2019 BBI/retrieval data report (RDR)* Inventories
Upper Confidence Limit January 1, 2019 BBI/RDR Inventories
* Note: BBI and RDR average inventories are based on post-retrieval sample results and are essentially the same for the same constituents. The RDRs include analytical results for many constituents that are not in the BBI and the BBI includes some process-based inventory estimates for constituents not in RDRs.

Residual Inventory for Catch Tank C-301 and 244-CR Vault
Average January 1, 2019 BBI concentration for C-Farm SSTs, with assumed 90% retrieval (~2,200 gal).
Average January 1, 2019 BBI concentration for C-Farm SSTs, assuming no retrieval of catch tank C-301 or 244-CR Vault (~22,000 gal).

Residual Inventory for Diversion Boxes and Pits
Average January 1, 2019 BBI concentration for C-Farm SSTs with waste volume estimate of ~32 gal for pits and 62 gal for diversion boxes.

Residual Inventory for Pipelines
Average January 1, 2019 BBI concentration for C-Farm SSTs with assumed waste volume estimate of ~1,600 gal (no retrieval).

Table ES-1 shows the 2019 residual volume, and chemical and radionuclide inventory estimates for measured residual inventories for tanks retrieved, and inventory estimates for tanks not yet retrieved. The appendices provide inventory estimates standard deviations and 95% upper confidence limits for each tank, each catch tank, and for the set of C-Farm pipelines for 25 chemicals and 46 radionuclides reported in the BBI process and for additional chemicals and radionuclides for tank waste for which analytical results are available.

Table ES-1. Estimated 2019 241-C Tank Farm Residual Inventories at Closure.

Total Residual Inventory Estimate	2019 Estimates		
	Volume (kL [kgal])	Chemicals (kg)	Radionuclides (Ci)[c]
Retrieved Single-Shell Tanks	238 (63)	1.52E5	4.26E5
Catch tank C-301 and 244-CR Vault [a]	8.2 (2.2)	5.8E3	1.55E4
Pits [b]	0.12 (0.03)	85	228
Diversion Boxes [b]	0.24 (0.06)	165	441
Pipelines [b]	6.1 (1.6)	4,260	11,400

[a] Assumes 90% retrieval for catch tank C-301 and 244-CR Vault. Note: Current volumes and inventories for these tanks are 10 times the values shown in this table.

[b] Current waste volume and inventory estimates for pits, diversion boxes and pipelines (assumes no retrieval).

[c] Radionuclides are decayed to January 1, 2020 for 241-C Tank Farm closure assessments.

TABLE OF CONTENTS

1. INTRODUCTION 1-1

1.1 OVERVIEW 1-1

1.2 BACKGROUND 1-2

1.2.1 Description of 241-C Tank Farm 1-2
1.2.2 History of 241-C Tank Farm 1-2
1.2.3 Interim Stabilization 1-9
1.2.4 Waste Retrieval 1-9

2. PURPOSE AND SCOPE 2-1

3. ASSUMPTIONS AND BASIS FOR INVENTORY ESTIMATES 3-1

3.1 TANK CLOSURE AND WASTE MANAGEMENT ENVIRONMENTAL IMPACT STATEMENT ASSUMPTIONS 3-1

3.2 UPDATED INVENTORY ESTIMATES 3-2

3.3 CONSTITUENTS OF INTEREST 3-2

3.4 DATA QUALITY OBJECTIVES 3-4

4. CURRENT TANK INVENTORY ESTIMATES 4-1

4.1 TANK WASTE COMPOSITION ESTIMATES 4-2

4.1.1 Sample Data 4-4
4.1.2 Process Knowledge 4-6
4.1.3 Hanford Defined Waste Model-Based Inventories 4-6

4.2 TANK WASTE VOLUME ESTIMATES 4-7

4.3 BEST-BASIS INVENTORIES 4-8

4.4 WASTE INVENTORIES IN ANCILLARY FACILITIES 4-12

4.4.1 2002 Ancillary Equipment Volume and Inventory Estimates 4-12
4.4.2 2019 Ancillary Equipment Volume and Inventory Estimates 4-14

5. RESIDUAL WASTE INVENTORY ESTIMATES 5-1

5.1 TANK CLOSURE AND WASTE MANAGEMENT ENVIRONMENTAL IMPACT STATEMENT INVENTORY ESTIMATES 5-1

5.2 2019 POST-CLOSURE TANK RESIDUAL INVENTORY ESTIMATES 5-2

5.2.1 Post-Retrieval Sample and Volume Measurements 5-3

5.3 ANCILLARY EQUIPMENT RESIDUAL INVENTORIES 5-12

6. INVENTORY UNCERTAINTY 6-1

6.1 BEST-BASIS INVENTORY UNCERTAINTY 6-1

6.1.1 Concentration Uncertainty 6-2

6.1.2 Density Uncertainty 6-4

6.1.3 Volume Uncertainty 6-4

7. REFERENCES 7-1

APPENDIXES

A Ancillary Facilities Inventory Estimates ..... A-i

B C-Farm Best Basis Inventory Tank Waste Inventory Estimates ..... B-i

C C-Farm Tank Residual Inventory Estimates ..... C-i

D Inventory Uncertainty Estimates ..... D-i

LIST OF FIGURES

Figure 1-1. Location Map of Waste Management Area C in the 200 East Area of the Hanford Site. 1-3

Figure 1-2. Nominal 530,000-Gallon Capacity 75-Foot Diameter Single-Shell Tank. 1-4

Figure 1-3. Nominal 55,000-Gallon Capacity Single-Shell Tank. 1-5

Figure 2-1. Process to Estimate Residual Waste Inventories. 2-2

Figure 4-1. Best-Basis Inventory Flow Process. 4-1

Figure 4-2. Tank 241-C-107 Core Sample Profile. 4-5

Figure 4-3. Process to Estimate Starting Waste Inventory in Ancillary Equipment. 4-12

Figure 5-1. Process to Estimate Residual Waste Inventory in Tanks, Catch Tanks and Pipelines. 5-2

Figure 5-2. Clamshell Sampler. 5-4

Figure 5-3. Finger Trap Sampler. 5-5

Figure 5-4. Off-Riser Sampling System Sampler. 5-6

Figure 5-5. Off-Riser Sampling System Sampling Locations for Tank 241-C-103. 5-7

Figure 5-6. Photograph of Tank 241-C-204 Post-Retrieval Residual Waste 5-9

Figure 5-7. Single-Shell Tank 241-C-103 Land Desktop Post-Retrieval Tank Waste Volume Contour Map 5-10

Figure 5-8. Photo from Video for Computer/Computer-Aided Design Modeling System Volume Estimates of Tank 241-C-103 5-11

Figure 5-9. Tank 241-C-103 Waste on Walls and Stiffener Rings. 5-12

LIST OF TABLES

Table 2-1. Updated Residual Inventories Used by the Waste Management Area C Performance Assessment. 2-1

Table 3-1. Primary Inorganic Constituents in RPP-23403. 3-3

Table 3-2. Secondary Inorganic Constituents in RPP-23403. 3-3

Table 3-3. Primary Volatile Organic Compounds in RPP-23403 3-5

Table 3-4. Primary Semivolatile Organic Parameters in RPP-23403. 3-6

Table 3-5. Secondary Organic Constituents in RPP-23403 (no inventory or concentration estimates for these). 3-7

Table 3-6. Primary Radiological Parameters in RPP-23403 (inventory or concentrations are available for all of these). 3-8

Table 3-7. Required Organic Analytes for Remaining 241-C Farm Tanks. 3-9

Table 3-8. Data Quality Objectives Applied to 241-C Farm Tank Samples. 3-10

Table 4-1. Standard Best-Basis Inventory Constituents. 4-2

Table 4-2. Supplemental Constituents for 241-C Tank Farm. 4-3

Table 4-3. Waste Types in 241-C Farm Tanks. 4-7

Table 4-4. Comparison of 2002 and 2019 241-C Tank Farm Waste Volumes by Tank. 4-8

Table 4-5. Comparison of 2002 and 2019 241-C Tank Farm Best-Basis Inventory Estimates. 4-9

Table 4-6. Comparison of 2002 and 2019 Ancillary Equipment Waste Volume Estimates. 4-12

Table 4-7. Ancillary Equipment Constituent Inventories for Selected Constituents. 4-13

Table 4-8. Comparison of 2019 and 2002 Catch Tank C-301 and 244-CR Vault Waste Volume Estimates 4-14

Table 5-1. Analyses Performed 5-8

Table 5-2. 2019 241-C Tank Farm Post-Retrieval Waste Volume Estimates (cubic feet). 5-13

Table 6-1. Sample-Based Templates Used to Calculate Relative Standard Deviations for 241-C Tank Farm Solid Waste Types. 6-3

Table 6-2. Relative Standard Deviations for Bulk Density and Specific Gravity by Type of Tank and Waste Phase. 6-4

Table 6-3. 95% Upper Confidence Limit Post-Retrieval Waste Volume Estimates (cubic feet) for 241-C Farm Tanks Retrieved before 2009. 6-5

Table 6-4. 95% Upper Confidence Limit Post-Retrieval Waste Volume Estimates (cubic feet) for 241-C Farm Tanks Retrieved after 2009. 6-7

LIST OF TERMS

Abbreviations and Acronyms

ANOVA	analysis of variance
$BiPO_4$	bismuth phosphate
BBI	best-basis inventory
CAD	computer-aided design
CCMS	camera/CAD modeling system
CFR	*Code of Federal Regulations*
COI	constituent of interest
CWZr1	PUREX/REDOX zirconium cladding waste (1968-1972)
DOE	U.S. Department of Energy
DQO	data quality objective
DST	double-shell tank
Ecology	State of Washington Department of Ecology
EIS	environmental impact statement
FIC	Food Instrument Corporation
HDW	Hanford Defined Waste
HFFACO	*Hanford Federal Facility Agreement and Consent Order*
HS	Hot Semiworks waste (1961-1968)
IMUST	inactive miscellaneous underground storage tank
MW1	BiPO4 metal waste (1944-1949)
ORIGEN2	Oak Ridge Isotope Generation 2
P1	Plutonium-Uranium Extraction high-level waste (1956-1962)

P2	Plutonium-Uranium Extraction high-level waste (1963-1967)
PA	performance assessment
PAS	PUREX acidified sludge
PCB	polychlorinated biphenyl
PNNL	Pacific Northwest National Laboratory
PUREX	Plutonium-Uranium Extraction (facility)
RCRA	*Resource Conservation and Recovery Act of 1976*
RDR	retrieval data report
REDOX	Reduction-Oxidation (S Plant)
RSD	relative standard deviation
SD	standard deviation
SST	single-shell tank
TBP	tributyl phosphate
TC & WM	Tank Closure and Waste Management
TFeCN	ferrocyanide-treated TBP (waste)
TS	Sample-Based Template
wt%	weight percent
UCL	upper confidence limit
WAC	*Washington Administrative Code*
WMA	Waste Management Area
WTP	Hanford Tank Waste Treatment and Immobilization Plant

1. INTRODUCTION

1.1 OVERVIEW

This report provides inventory estimates for waste residuals remaining in 241-C Tank Farm (C-Farm) tanks and ancillary equipment at the time of closure. The estimates are based on knowledge of tank farm inventories as of January 1, 2019. Current knowledge includes tank waste volume measurements and estimates, process knowledge estimates of tank waste composition, analysis of single-shell tank waste residuals, and estimates for the volume and composition of waste in ancillary equipment. Residual inventory estimates are important to environmental assessments and closure decisions as most environmental impacts are linearly proportional to the amount of contaminant left in tanks/equipment (this document) or the amount of contaminant released to the soil (RPP-RPT-42294, *Hanford Waste Management Area C Soil Contamination Inventory Estimates*).

Residual waste inventories were previously estimated in support of the Tank Closure and Waste Management (TC & WM) Environmental Impact Statement (EIS) (DOE/EIS-0391, *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*). The EIS estimates, based on information available as of December 1, 2002, serve as a comparison case for the Waste Management Area (WMA) C performance assessment (PA). The updated inventory estimates summarized in this document provide a technical basis for a reassessment the WMA C PA for potential impacts from waste residuals remaining in C-Farm tanks and ancillary equipment after site closure. Inventory estimates and associated potential impacts are expected to be revised as additional information is obtained.

This report presents updated residual waste inventory estimates based on more current information. In addition to completing the EIS, updates since December 1, 2002 include the following:

a. As of January 1, 2019 waste retrieval has been completed for all single-shell tanks (SSTs) in C-Farm (241-C-101 [C-101], 241-C-102 [C-102], 241-C-103 [C-103], 241-C-104 [C-104], 241-C-105 [C-105], 241-C-106 [C-106], 241-C-107 [C-107], 241-C-108 [C-108], 241-C-109 [C-109], 241-C-110 [C-110], 241-C-111 [C-111], 241-C-112 [C-112], 241-C-201 [C-201], 241-C-202 [C-202], 241-C-203 [C-203], and 241-C-204 [C-204]). Residual tank waste constituents and/or hard heel constituents after retrieval were sampled and analyzed. New tank and ancillary equipment data and information were obtained.

b. Hanford tank waste process model estimates were updated (RPP-19822, *Hanford Defined Waste Model – Revision 5.0*).

c. A soil inventory model estimating past leaks was revised (RPP-19822).

d. Additional pipeline waste studies were completed.

This report describes the assumptions, technical basis and uncertainty for updated residual waste inventory estimates. Chapter 1 presents an overview and background for the report. Chapter 2 presents the purpose and scope of the report. Inventory estimates were determined for constituents identified in data quality objectives (DQOs) and a C-Farm characterization work plan for which sample data or process knowledge concentration estimates were available. Assumptions and constituents of interest (COIs) identified in DQOs are presented in Chapter 3. Chapter 4 describes the technical basis and inventory estimates for C-Farm tanks as of January 1, 2019. Residual waste inventory estimates for tanks retrieved are presented in Chapter 5. Also presented in Chapter 5 are inventory estimates for other C-Farm facilities (catch tanks, diversion boxes, and pipelines). The uncertainty of estimates presented varies depending on the quality and completeness of available information and includes retrieval uncertainties, model and process knowledge uncertainties, analytical uncertainty, and residual volume uncertainties. Chapter 6 discusses inventory uncertainty.

1.2 BACKGROUND

1.2.1 Description of 241-C Tank Farm

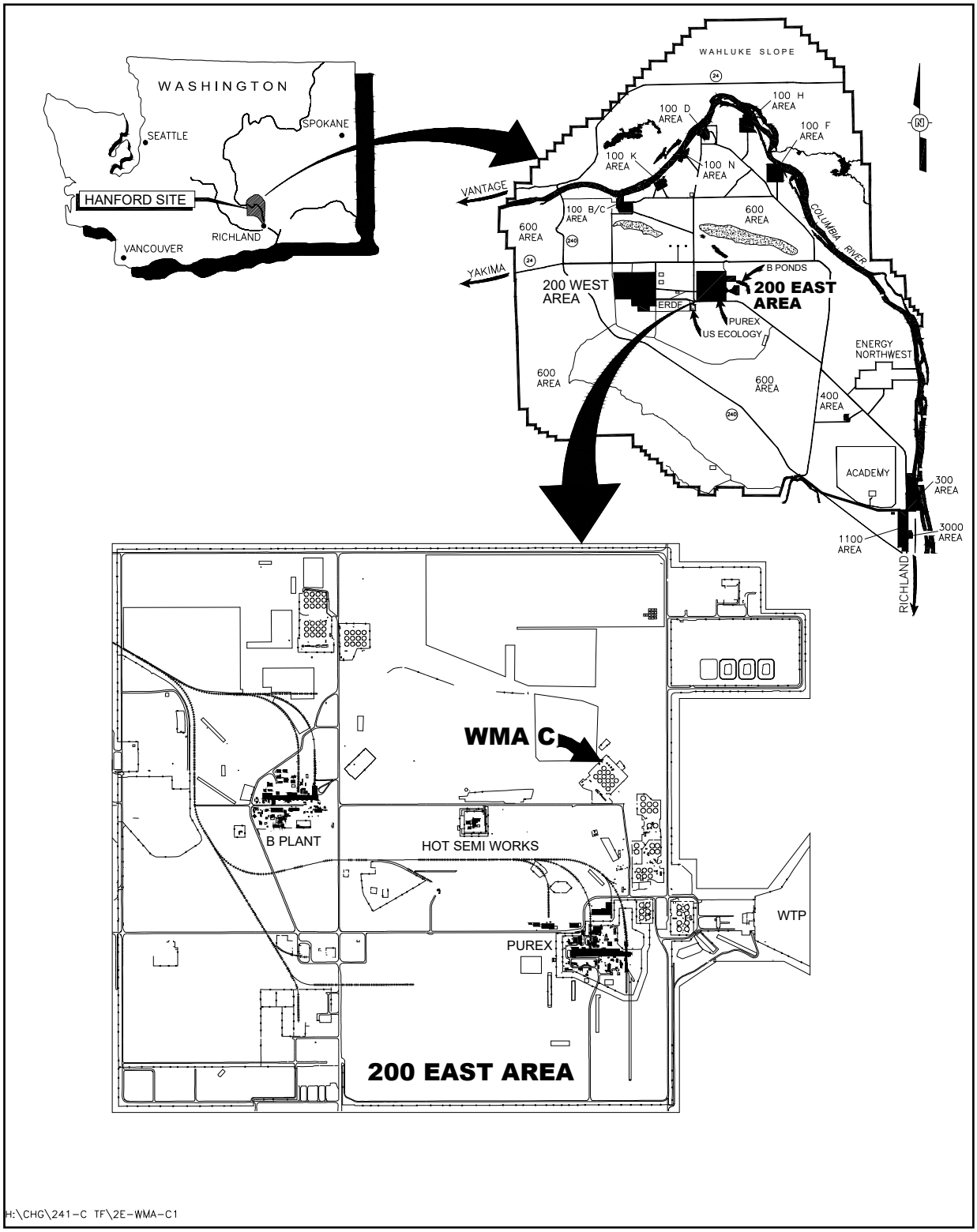
The C-Farm (also known as Waste Management Area [WMA] C) is located in the 200 East Area of the Central Plateau of the Hanford Site (Figure 1-1). It was constructed from 1944 to 1945 and consists of 12 nominally 2,000-kL (530-kgal)-capacity SSTs and four nominally 210-kL (55-kgal)-capacity SSTs. The larger capacity SSTs are referred to as the 100-series SSTs and the smaller SSTs are referred to as the 200-series SSTs. The C-Farm also consists of catch tank 241-C-301 (C-301), seven diversion boxes (241-C-151, 241-C-152, 241-C-153, 241-C-252, 241-CR-151, 241-CR-152 and 241-CR-153), and interconnecting pipelines. The general layout of C-Farm is shown in Figure ES-1. Drawings of 100-series and 200-series SSTs are shown in Figures 1-2 and 1-3. A list of ancillary equipment in C-Farm and descriptions of catch tanks and inactive miscellaneous underground storage tanks (IMUSTs) are included in Appendix A.

Tank wastes are grouped into three types based on physical properties: supernate, saltcake, and sludge. Supernate is surface liquid waste. Saltcake is a solid phase formed by the precipitation of ionic materials (i.e., salts). Sludge is a solid phase formed by the precipitation of oxides, hydroxides, and metals. Both saltcake and sludge contain interstitial liquid. The C-Farm tanks contained little saltcake, and most of the C-Farm supernate was pumped out as part of interim stabilization.

1.2.2 History of 241-C Tank Farm

1.2.2.1 Original Purpose. The C-Farm was originally designated to receive waste from the planned 221-C Bismuth Phosphate Plant. However, the 221-C Bismuth Phosphate Plant was canceled shortly after excavating the plant foundation. Additional infrastructure added afterwards include diversion boxes CR-151, CR-152, CR-153, and the 244-CR Vault (CR-Vault) in the southern part of C-Farm and the C-801 load out building in the eastern part of the tank farm.

Figure 1-1. Location Map of Waste Management Area C in the 200 East Area of the Hanford Site.



PUREX = Plutonium-Uranium Extraction (facility)
WMA = Waste Management Area WTP = Hanford Tank Waste Treatment and Immobilization Plant

Figure 1-2. Nominal 530,000-Gallon Capacity 75-Foot Diameter Single-Shell Tank.

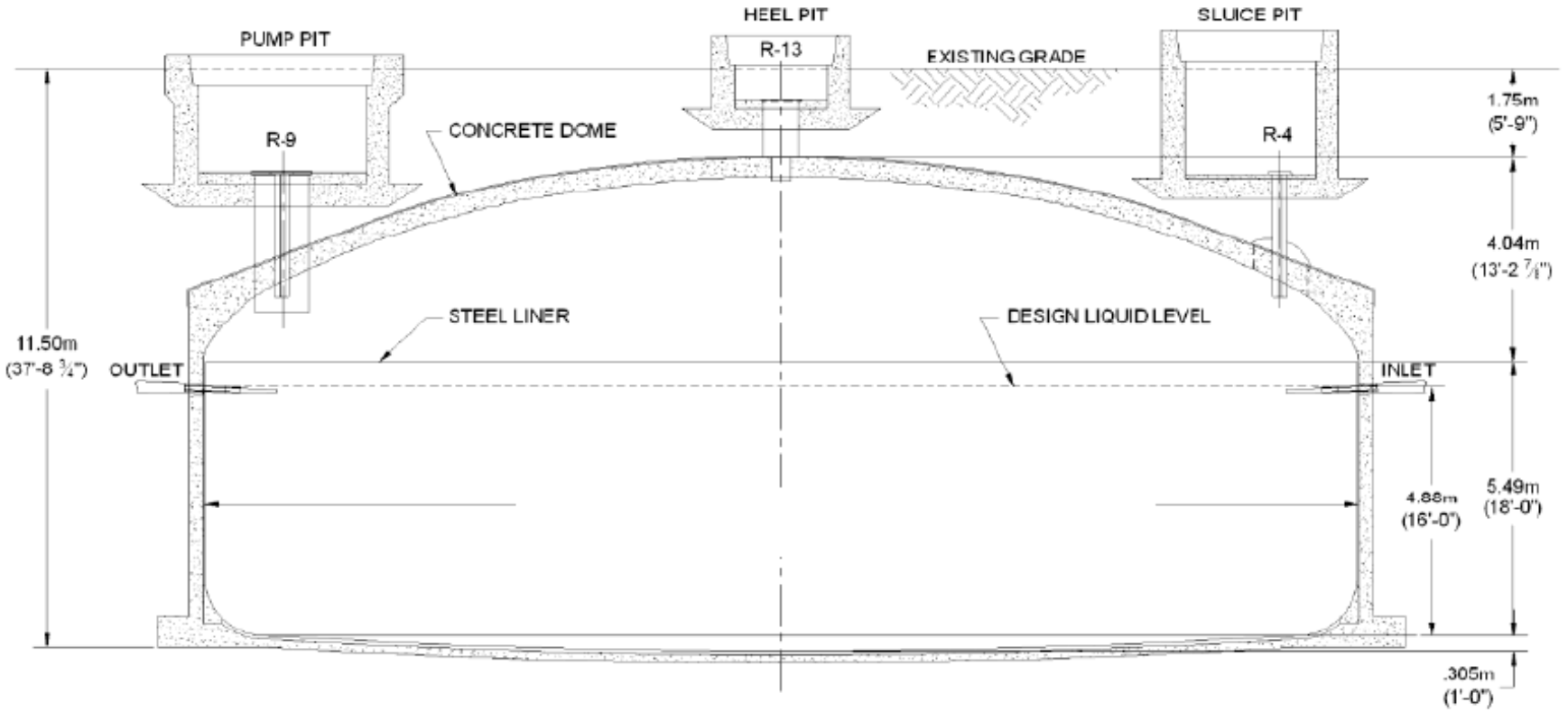
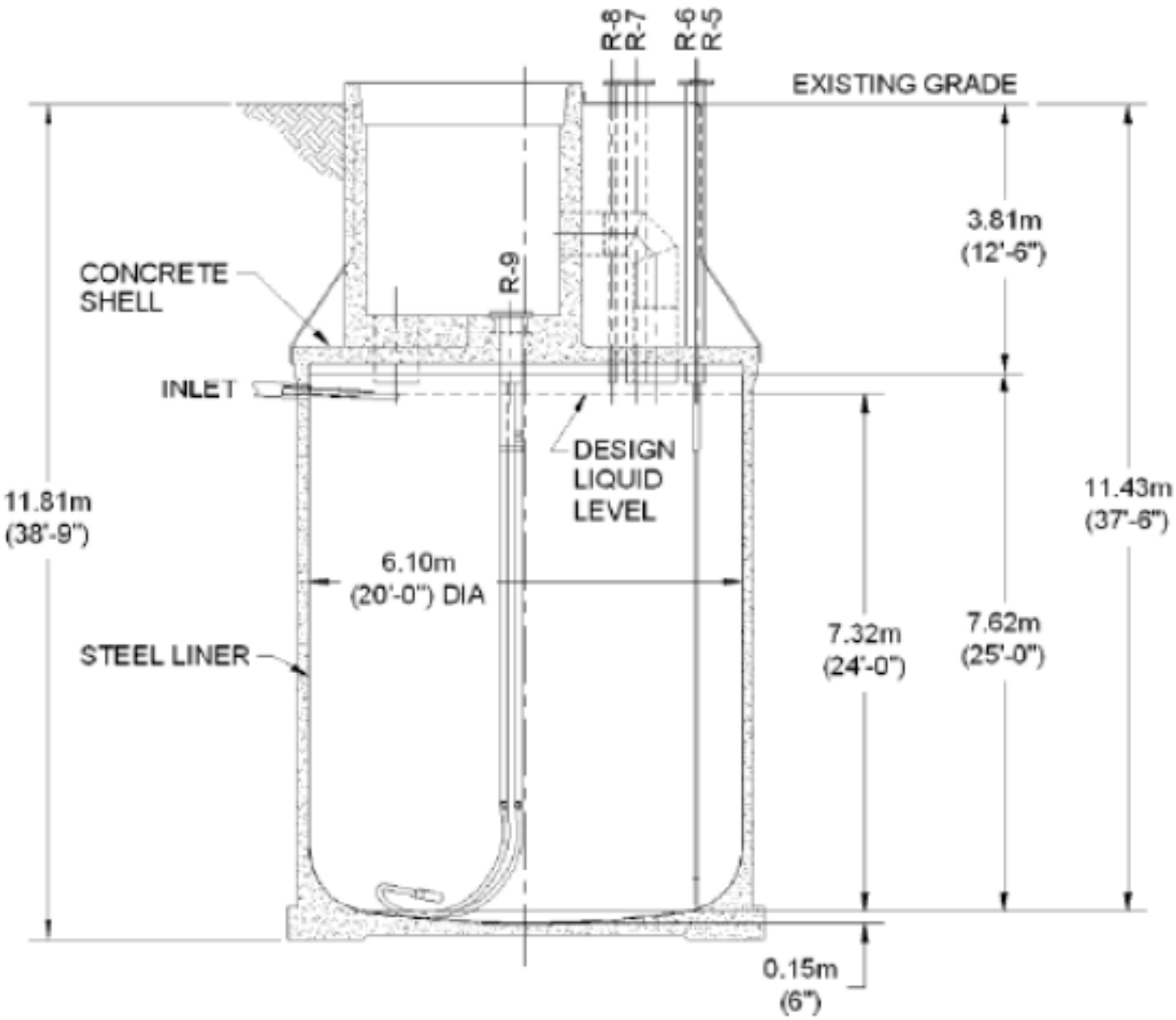


Figure 1-3. Nominal 55,000-Gallon Capacity Single-Shell Tank.



To utilize the tanks in C-Farm, diversion box 241-B-154 was installed to enable connections from the 221-B Bismuth Phosphate Plant to either the 241-B or 241-C Tank Farms (HW-10475 C-DEL, *Hanford Technical Manual Section C*, pp. 906 and 910). Two pipelines (8902 and V130) were installed in late 1945 from diversion box 241-B-154 to diversion boxes 241-C-151 and 241-C-152 to enable use of the tanks in C-Farm (Drawing H-2-432, *Piping Between 241B and 241C*). Construction of C-Farm was completed and turnover of the tank farm structures to Operations was conducted on February 10, 1945 (HW-7-1388-DEL, *Hanford Engineer Works Monthly Report February 1945*, pp. 16; and INDC-356-VOL3, *Construction Hanford Engineer Works, U.S. Contract No. W-7412-ENG-1, du Pont Project 9536, History of the Project, Volume III*, pp. 840).

Following completion of construction, the tanks in C-Farm were put into service in March 1946, beginning with receipt of waste into the 100-series tanks, and receipt of waste in the 200-series tanks in September 1947. Additional facilities were constructed in C-Farm in 1951 through 1952. The Hot Semiworks Valve Pit constructed in 1951 was used to route waste (Reduction-Oxidation [S Plant] [REDOX] and Plutonium-Uranium Extraction [PUREX] trial runs) to the CR-Vault and C-Farm tanks from the 201-C Strontium Semiworks building (Hot Semiworks) (DOE/RL-92-18, *Semiworks Source Aggregate Area Management Study Report*, pp. 2-21), and REDOX waste was routed to C-Farm between 1952 and 1953 (DOE/RL-92-18, pp. 29).

1.2.2.2 Metal Waste Retrieval. The CR-Vault, diversion boxes 241-CR-151, 241-CR-152, and 241-CR-153, concrete-encased pipelines, and concrete pits atop tanks C-101 through C-106 (heel jet, pump, and sluicing pits) were constructed from 1951 to 1952 in C-Farm. These C-Farm facilities were used to retrieve and process metal wastes to recover uranium (HW-19140, *Uranium Recovery Technical Manual*). The pits atop the tanks connect via concrete-encased underground pipelines to the 241-CR-152 and 241-CR-153 cascade diversion boxes, which have underground piping connections to the 241-CR-151 master diversion box. The 241-CR-151 master diversion box has concrete-encased underground pipelines connecting to the CR-Vault.

The CR-Vault contains a sludge accumulation tank (TK-CR-001), two sludge dissolution tanks (TK-CR-002 and TK-CR-003), and a process pump tank (TK-CR-011). An aboveground nitric acid tank (TK-CR-004) was used to add nitric acid to tanks TK-CR-002 and TK-CR-003 for acidifying sludge. Tank TK-CR-004 was relocated into the 271-CR annex building in 1963. The CR-Vault was originally equipped with an air supply and exhaust system that included a glass wool filter, exhaust fan, and stack (291-CR). A control house, building 241-CR-271 (271-CR), was also constructed to contain instrumentation, motor control centers, air compressors, ventilation, and operations and administrative facilities for operation of the CR-Vault and metal waste retrieval equipment.

Metal waste sluicing in C-Farm began in October 1952 and was completed in March 1955. All waste transfers used the installed underground pipelines and the three diversion boxes, 241-CR-151, 241-CR-152, and 241-CR-153.

The retrieval and processing of metal waste from the C-200-series tanks was similar to that of the 100-series tanks with the exception of the retrieval equipment. From December 1953 through

February 1955, the metal waste supernate and sludges present in tanks C-201 through C-204 were intermittently retrieved and transferred to CR-Vault. Processing of the metal waste slurry in the CR-Vault was the same as for the metal waste slurries retrieved from the 100-series tanks.

1.2.2.3 Ferrocyanide Treatment of Tank Wastes. The CR-Vault, previously used for metal waste recovery, was reused for precipitation of ^{137}Cs, ^{90}Sr, and ^{60}Co from tributyl phosphate (TBP) wastes. A new chemical make-up facility, 241-C-601 building, was constructed adjacent to the 271-CR control room building, underground transfer piping was installed to the CR-Vault, and necessary jumpers were installed in diversion boxes (HW-34487, *Scavenging of Stored TBP Waste*). The 241-C-601 building has since been removed from C-Farm.

Ferrocyanide precipitation processing in the CR-Vault started on November 9, 1955 (HW-38955-REV, *"In-Farm Scavenging" Operating Procedure and Control Data*) and completed in January 1958. The ferrocyanide-treated TBP waste, referred to as TFeCN waste, was transferred from CR-Vault to tanks C-108, C-109, C-111, and C-112 for settling of the precipitates before discharge to the 216-BC trenches and cribs.

1.2.2.4 Strontium/Rare Earth Fission Products Processing. The CR-Vault, the head-end section of the 202-A PUREX Plant, and the 201-C Strontium Semiworks building was used in 1961 through 1963 to recover ^{90}Sr from high-level waste solutions (HW-66297, *Strontium-90 – Recovery and Lag Storage Interim Program*, and HW-72666, *Hot Semiworks Strontium-90 Recovery Program*). Beginning in August 1963, B Plant was used in conjunction with the former three facilities to separate ^{90}Sr and rare earth fission products (^{144}Ce and ^{147}Pm) from high-level waste solutions. The strontium and rare earth processing activities were conducted from August 1963 through February 1967 (RPP-16015, *Origin of Wastes in Single-Shell Tanks 241-B-110 and 241-B-111*). Tanks C-107, C-108, C-109, C-111, and C-112 received waste from the strontium and rare earth purification processing conducted in the 201-C Strontium Semiworks building.

Processing of strontium and rare earth solutions within B Plant continued until June 1966 (HAN-95105-DEL, *Monthly Status and Progress Report June, 1966*, pp. 15). Separations of strontium and rare earths from the first cycle raffinate solution continued to be conducted in the head-end section of the PUREX facility through February 8, 1967 (HAN-96805-DEL, *Monthly Status and Progress Report February 1967*, pp. AIII-4). The strontium and rare earth solution was transferred from PUREX to the CR-Vault for storage from July 1966 through February 1967 while equipment modifications were conducted at B Plant. In 1967 the rare earth metal recovery waste from Hot Semiworks and B Plant included promethium recovery campaign waste via the 241-C-154 diversion box (DOE/RL-92-18, pp. 2-22; ISO-100, *Waste Management Technical Manual*, pp. 958).

1.2.2.5 Plutonium-Uranium Extraction Acidified Sludge Processing. The sludges stored in the 241-A and 241-AX Tank Farms contained high concentrations of ^{90}Sr that required removal to reduce the heat load in these tanks. The sludges in these tanks were sluiced from 1968 through 1978 (SD-WM-TI-302, *Hanford Waste Tank Sluicing History*, section 3), with the sludge collected in the 244-AR Vault. The ^{90}Sr-bearing sludge was washed to remove soluble salts and ^{137}Cs and then dissolved in nitric acid in the 244-AR Vault. The dissolved sludge,

designated as PUREX acidified sludge solution, was transferred to the CR-Vault. From the CR-Vault, the PUREX acidified sludge solution was transferred to B Plant for centrifugation and ^{90}Sr processing using solvent extraction (ARH-CD-691, *Strontium Recovery from PUREX Acidified Sludge*).

1.2.2.6 241-A Tank Farm Process Condensate Treatment Testing. A micro-pilot plant was installed in the 271-CR building and was operated from January 1960 through March 1963 to evaluate activated carbon and ion exchange materials for separating organics and fission products from the 241-A Tank Farm process condensate. The micro-pilot plant was shut down in March 1963 and replaced by an engineering-scale pilot plant that was constructed from 1962 through September 1963 in an annex building adjacent to the 271-CR building. The engineering-scale pilot plant in the 271-CR annex was operated from September 1963 through March 1965 and included a steam stripper, a vertical leaf filter, an electrodialysis unit, and a thin bed ion exchanger (RPP-RPT-29191, *Supplemental Information Hanford Tank Waste Leaks*).

Floor and process drains in the 271-CR and 271-CR annex buildings connected to an underground vitrified clay pipeline that discharged to the 216-C-8 crib. RPP-RPT-29191 summarizes the analyses of the 241-A Tank Farm process condensate waste stream located in reference documents as well as the various tests conducted in the 271-CR and 271-CR annex buildings. Although process records are incomplete, a minimum of 121 kL (32 kgal) of treated 241-A Tank Farm process condensate was discharged to the crib 216-C-8 from January 1960 through March 1965.

1.2.2.7 241-C-801 Cask Loading Building. In 1962, building 241-C-801 (or 801-C) was constructed to enable recovery of ^{137}Cs from PUREX high-level waste solutions. The 241-C-801 building was used from 1963 through 1968 to load cesium and occasionally technetium onto casks containing ion exchange material [Interoffice memo 7G400-03-SMM-003, “Shipments of Cesium-137 and Strontium-90 from the Hanford Site (1961 through 1977)”].

A cask was connected to waste transfer piping at a shielded enclosure within the 241-C-801 building. Tank waste (PUREX high-level waste from 1956-1962 [P1] and 1963-1967 [P2] campaigns) was transferred from tank C-103 through underground piping to a valve pit located inside the 241-C-801 building. The tank waste would then flow into the cask, the target radionuclide would be absorbed by the ion exchange material, and then waste would flow back to tank C-102.

The 201-C Strontium Semiworks building was also used in conjunction with the 801-C cask station to demonstrate the separation of ^{99}Tc from alkaline high-level waste solutions. Approximately 1 kg of ^{99}Tc was separated from high-level waste that was stored in C-Farm SSTs in October 1963 (HW-79377, *Hanford Laboratories Monthly Activities Report October, 1963*, pp. C-7, and HW-79480, *Chemical Processing Department Monthly Report for October, 1963*, pp. G-2). The high-level waste solution was passed through a shielded cask in the 801-C building that contained ion exchange material to separate cesium. The effluent solution from the cesium cask was then passed through a separate shielded cask in the 801-C building that contained ion exchange material, which adsorbed technetium from the waste solution. The Hot

Semiworks received the cask that was loaded with technetium in November 1963; the technetium was eluted and concentrated, then loaded into a smaller cask for transfer to the Hanford Laboratories located in the 300 Area (HW-79768, *Chemical Processing Department Monthly Report for November, 1963*, pp. G-2). A second campaign to recover an additional 1 kg of ^{99}Tc from high-level waste stored in C-Farm was conducted in August through September 1964 in the same manner as the first campaign (HW-83876, *Chemical Processing Department Monthly Report for August, 1964*, pp. B-2, and HW-84354, *Chemical Processing Department Monthly Report September 1964*, pp. B-1).

The cask loading area within the 241-C-801 building has a drain line connecting to the valve pit. The valve pit and cask loading area have separate drain lines connecting to a drywell located outside of the tank farm fence (Drawings H-2-4573, *Engineering Flow Diagram, C-Farm Cesium Loadout Facility*, and H-2-4554, *Vent Filter VF-E1 Strontium Storage and Loadout Facility*). This drywell is located ~23 m (75 ft) north of the 241-C-801 building, outside the tank farm fence (DOE/RL-88-30, *Hanford Site Waste Management Units Report*, pp. 1971). No record was located that provides information on the volume and types of wastes potentially discharged to this drywell. An unknown amount of PUREX P1 and P2 waste types along with decontamination solutions may have been discharged to this drywell as a result of operations conducted at the 241-C-801 building.

1.2.3 Interim Stabilization

During nuclear operations, millions of gallons of nuclear waste were transferred to the C-Farm tanks. Based on measured liquid level decreases in the tanks and geophysical monitoring data from soils around the tanks, seven tanks in C-Farm were suspected of leaking. To reduce the potential for future SST leaks, supernate and interstitial liquid was pumped out of 100-series and 200-series SSTs. The remaining interstitial liquid was in pore spaces in the remaining salt or sludge solid material. A Consent Decree (*Washington v. DOE*, Case No. CT-99-5076-EFS [September 9, 2003]) between the U.S. Department of Energy (DOE) and State of Washington Department of Ecology (Ecology) was established specifying the requirements to stabilize the tanks. The criteria to stabilize a tank are that the tank must contain less than 18.9 kL (5 kgal) of supernate, 190 kL (50 kgal) of drainable interstitial liquid, and the pump flow must be at 0.19 L/min (0.05 gal/min) or less before pumping could be discontinued. Due to system failure, some tanks were declared stabilized before a 0.05 gal/min flow rate was reached. In March 2004, liquid pumping to interim stabilize tanks covered by the Consent Decree was completed. Tank C-106 was not included in the Consent Decree and was not interim stabilized (HNF-EP-0182, Rev. 249, *Waste Tank Summary Report for Month Ending December 31, 2008*, pp. 9).

1.2.4 Waste Retrieval

As of January 1, 2019 retrieval operations are completed for all 16 SSTs in C-Farm. Retrieval methods and results are described in retrieval data reports and retrieval completion certification reports. Waste retrieval residual volume estimates and sample analyses are discussed in Section 5.2.

Retrieval goals are specified in Milestone M-45-00 in the *Hanford Federal Facility Agreement and Consent Order* (HFFACO) (Ecology et al. 1989) and consent decree (Consent Decree No. 08-5085-FVS, now 08-5085-RMP). The HFFACO states, "Closure will follow retrieval of as much tank waste as technically possible, with tank waste residues not to exceed 360 cubic feet (cu. ft.) in each of the 100 series tanks, 30 cu. ft. in each of the 200 series tanks, or the limit of waste retrieval technology capability, whichever is less."

For tanks retrieved under the consent decree (C-101, C-102, C-104, C-105, C-106, C-107, C-108, C-109, C-110, C-111 and C-112), retrieval is defined as complete if the HFFACO retrieval goal is met, if three technologies are deployed to the limit of technology (whether the HFFACO goal is met or not) or if two technologies are deployed to the limit of technology and Ecology concurs with a practicability assessment to forego a third technology.

The retrieval goals were met for the C-200 tanks and tanks C-103, C-104, C-105, C-109 and C-110. However, the retrieval goals were not met for tank C-106, resulting in documentation as specified in HFFACO Appendix H to show why the goal could not be met (RPP-20658, *Basis for Exception to the Hanford Federal Facility Agreement and Consent Order Waste Retrieval Criteria for Single-Shell Tank 241-C-106*). Retrieval goals were also exceeded for tanks C-101, C-102, C-107, C-108, C-111 and C-112, resulting in practicability evaluations being submitted and approved to forego a third retrieval technology for tanks C-101 (RPP-55849, *Practicability Evaluation Request to Forego a Third Retrieval Technology for Tank 241-C-101*), C-102 (RPP-RPT-58676, *Practicability Evaluation Request to Forego a Third Retrieval Technology for Tank 241-C-102*), C-108 (RPP-52290, *Practicability Evaluation Request to Forego a Third Retrieval Technology for Tank 241-C-108*) and C-112 (RPP-56935, *Practicability Evaluation Request to Forego a Third Retrieval Technology for Tank 241-C-112*). Three different technologies were deployed to retrieve tanks C-107 and C-111; as a result, practicability evaluation requests were not required for these tanks.

Ecology has concurred that residual waste volume limits set forth in the HFFACO have been met for tanks C-103, C-201, C-202, C-203, and C-204 [Letter 0075083, "Department of Ecology Letter of Completion for Retrieval Data Reports (RDR) for Single-Shell Tanks (SST) 241-C-103, 241-C-201, 241-C-202, 241-C-203, and 241-C-204"]. Certificates of retrieval completion have been issued for tanks C-101 (RPP-57570, *Retrieval Completion Certification Report for Tank 241-C-101*), C-104 (RPP-53823, *Retrieval Completion Certification for Tank 241-C-104*), C-108 (RPP-53869, *Retrieval Completion Certification Report for Tank 241-C-108*), C-109 (RPP-53824, *Retrieval Completion Certification Report for Tank 241-C-109*), C-110 (RPP-56214, *Retrieval Completion Certification Report for Tank 241-C-110*), C-107 (RPP-RPT-58150, *Retrieval Completion Certification Report for Tank 241-C-107*), C-102 (RPP-RPT-58788, *Retrieval Completion Certification Report for Tank 241-C-102*), C-111 (RPP-RPT-59363, *Retrieval Completion Certification Report for Tank 241-C-111*) and C-105 (RPP-RPT-60717, *Retrieval Completion Certification Report for Tank 241-C-105*). Concurrence for completion of C-106 retrievals and RPP-20658 is pending.

2. PURPOSE AND SCOPE

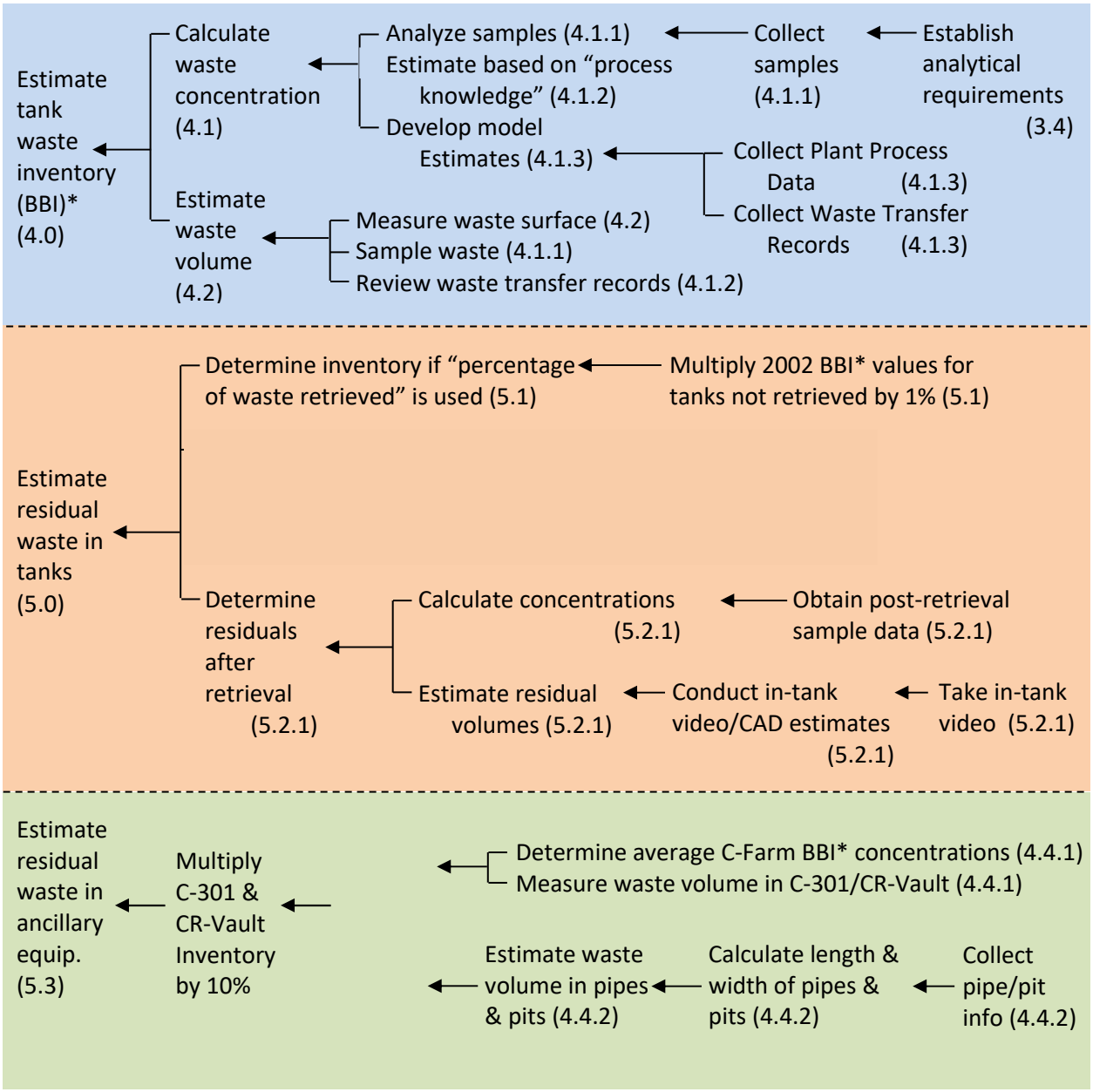
The purpose of this report is to provide updated radiological and nonradiological inventory estimates for waste residuals in tanks and ancillary equipment in C-Farm at the time of closure, for comparison with inventories used for EIS assessments (DOE/EIS-0391) and inventories from Rev. 3 of this report used in RPP-ENV-58782, *Performance Assessment of Waste Management Area C, Hanford Site, Washington*. This report provides the basis for the sets of inventory estimates shown in Table 2-1.

Table 2-1. Updated Residual Inventories for the Waste Management Area C Performance Assessment.

Single-Shell Tanks
Average Best-Basis Inventory (BBI)/Retrieval Data Report (RDR)* Inventories (January 1, 2019).
Upper Confidence Limit BBI/RDR Inventories (January 1, 2019).
*Note: BBI and RDR average inventories are based on post-retrieval sample results and are essentially the same for the same constituents. The RDRs include analytical results for many constituents that are not in the BBI and the BBI includes some process-based inventory estimates for constituents not in RDRs.
Residual Inventory for Catch Tank C-301 and 244-CR Vault
Average January 1, 2019 BBI concentration for 241-C Tank Farm (C-Farm) single-shell tanks (SSTs), with assumed 90% retrieval (~2,200 gal).
Average January 1, 2109 BBI concentration for C-Farm SSTs, and volume assuming no retrieval of Catch Tank C-301 or 244-CR Vault (~22,000 gal).
Residual Inventory for Diversion Boxes and Pits
Average January 1, 2109 BBI concentration for C-Farm SSTs, with assumed waste volume estimate of ~32 gal for pits and ~64 gal for diversion boxes (no retrieval).
Residual Inventory for Pipelines
Average January 1, 2109 BBI concentration for C-Farm SSTs, with assumed waste volume estimate of ~1,600 gal based on pipeline feasibility study (RPP-PLAN-47559, *Single-Shell Tank Waste Management Area C Pipeline Feasibility Evaluation*) (no pipeline retrieval).

This report includes post-retrieval inventory estimates from Alternative 2B of the TC & WM EIS (DOE/EIS-0391) and updated post-retrieval residual inventory estimates based on data obtained as of January 1, 2019. Inventory estimates for tank contents as of January 1, 2019 are shown in the best-basis inventory (BBI) and in retrieval data reports (RDRs) and are included in Appendix B.2 and Appendix D.1. Chapter 4 describes the BBI process and inventory estimates for tanks and ancillary equipment currently in C-Farm (see Figure 2-1). Additional detail for the BBI inventory process is provided in RPP-7625, *Guidelines for Updating Best-Basis Inventory*.

Figure 2-1. Process to Estimate Residual Waste Inventories.



*Except as noted in Section 5, BBI uses residual waste estimates after post-retrieval sampling and analyses.

The approach used to estimate residual waste in tanks, catch tanks, pipelines, and other ancillary equipment in C-Farm (see Figure 2-1) at the time of closure is described in Chapter 5.

This report provides only residual inventory estimates for waste contained in tanks and ancillary equipment in C-Farm. Other reports address soil inventories including C-Farm leak estimates and unplanned releases, PA modeling, conceptual models, and modeling parameters for waste release and waste transport pathways (including recharge rates, and solubility or K_D factors for residuals and contaminants in soils).

3. ASSUMPTIONS AND BASIS FOR INVENTORY ESTIMATES

Assumptions were made for two separate sets of inventory estimates:

a. Inventory estimates for C-Farm using assumptions and information provided in the TC & WM EIS (DOE/EIS-0391)

b. Revised inventory estimates for C-Farm system contents based on information available as of January 1, 2019.

Rationale and justification for the assumptions are discussed in applicable sections of this report.

3.1 TANK CLOSURE AND WASTE MANAGEMENT ENVIRONMENTAL IMPACT STATEMENT ASSUMPTIONS

Key enabling assumptions for inventory estimates for Alternative 2B (Note: This Tank Closure alternative reflects DOE's alternative for landfill closure of tank farms) in the TC & WM EIS (DOE/EIS-0391) include the following.

a. Pre-retrieval tank inventories presented were conditions in the farm as of December 1, 2002.

b. The TC & WM EIS radionuclide values were decayed to January 1, 2020 for this report.

c. A 99% retrieval by mass was estimated. This was calculated as 99% of the mass of each chemical constituent and 99% of the activity for each radionuclide in each C-Farm tank listed in the 2002 BBI (Appendix B.1 of this report). The average BBI concentrations for constituents in a tank before retrieval were assumed to represent residual waste concentrations in tanks after retrieval.

d. Waste concentrations in ancillary equipment were assumed to be bounded by the average concentration of waste in C-Farm tanks. Little concentration data exists for ancillary equipment.

e. Residual waste inventory in pits and pipelines was assumed to remain unchanged after retrieval.

Pipeline residual waste volume assumptions are presented in Section 4.4.4. Additional assumptions are identified in applicable sections in this report.

The assumption in the EIS that post-retrieval residual waste concentrations are the same as pre-retrieval concentrations was a simplifying assumption given the limited retrieval experience and uncertainty in the BBI waste concentrations and residual volume estimates (see Chapter 6). This assumption will tend to overestimate the remaining soluble and more mobile constituents (for example, groundwater risk drivers such as ^{99}Tc and ^{129}I) that are preferentially removed by sluicing and underestimate the inventory for high-density insoluble and less mobile constituents.

3.2 UPDATED INVENTORY ESTIMATES

Key enabling assumptions for updated inventory estimates include the following.

a. Tank inventories presented are conditions in C-Farm as of January 1, 2019.

b. Radionuclides were decayed to January 1, 2020. Therefore, the values presented will differ from the 2014 BBI values, which are decayed to January 1, 2008.

c. The retrieval volumes and inventories documented in applicable RDRs andresidual inventory reports are the assumed inventories in C-Farm SSTs at closure.

d. Waste concentrations in ancillary equipment are assumed to be represented by the average concentration of waste in C-Farm tanks retrieved and sampled.

e. It is assumed that waste in the C-301 catch tank and CR-Vault will be retrieved prior to closure (no direction has been given at this time and no limits established). Retrieval of 90% of the waste was assumed for CR-Vault and C-301 catch tank. The average residual concentration for C-Farm tank residual samples was assumed for these tanks.

Pipeline residual waste volume assumptions are presented in Section 4.4.4.

The updated assumptions apply additional information gained since the EIS was prepared. The BBI was updated, more tanks have been retrieved in C-Farm and residual samples were obtained that were not previously available. However, the updated estimates still have several sources of uncertainty, described in Chapter 6.

3.3 CONSTITUENTS OF INTEREST

C-Farm tank residual COIs are specified in RPP-23403, *Single-Shell Tank Component Closure Data Quality Objectives*.

Inventory estimates in this report are limited to those constituents for which analytical inventory data or process model estimates were available.

“Primary” constituents for analysis in RPP-23403 (Tables 3-1 through 3-6) were identified from: the *Hanford Facility Dangerous Waste Part A Permit Application, Form 3, Revision 8, for the Single-Shell Tank System* (CH2M HILL 2003) (Part A); underlying hazardous constituents, and Title 10, *Code of Federal Regulations*, Part 61, “Licensing Requirements for Land Disposal of Radioactive Waste,” Subpart D—Technical Requirements for Land Disposal Facilities, § 61.55, Waste Classification (10 CFR 61.55).

Table 3-1. Primary Inorganic Constituents in RPP-23403.

Constituent	Inventory Estimate Included	Constituent	Inventory or Concentration Included
Acetate – $C_2H_3O_2^-$	Yes [1]	Iron – Fe	Yes
Aluminum – Al	Yes [1]	Lead – Pb	Yes [2]
Ammonium – NH_4^+	Yes	Manganese – Mn	Yes
Antimony – Sb	Yes [1,2]	Mercury – Hg	Yes [2]
Arsenic – As	Yes [1]	Nickel – Ni	Yes [2]
Barium – Ba	Yes [1,2]	Nitrate – NO_3^-	Yes
Beryllium – Be	Yes [1,2]	Nitrite – NO_2^-	Yes
Cadmium – Cd	Yes [1,2]	Oxalate – $C_2O_4^{2-}$	Yes
Chromium – Cr	Yes	pH	Yes
Cobalt – Co	Yes [1]	Selenium – Se	Yes [1,2]
Copper – Cu	Yes [1]	Silver – Ag	Yes [1, 2]
Cyanide – CN^-	Yes [1]	Strontium – Sr	Yes
Ferrocyanide – $Fe(CN)_6^{4-}$	Yes [1]	Thallium – Tl	Yes [1]
Fluoride – F^-	Yes [2]	Uranium – U	Yes
Formate – CHO_2^-	Yes [1]	Vanadium – V	Yes [1]
Glycolate – $C_2H_3O_3^-$	Yes [1]	Zinc – Zn	Yes [1]

[1] Inventory or Concentration provided only for tanks analyzed for this constituent.
[2] Dangerous Waste Constituent, listed in *Hanford Facility Dangerous Waste Part A Permit Application, Form 3, Revision 8, for the Single-Shell Tank System* (CH2M HILL 2003).

Reference: RPP-23403, *Single-Shell Tank Component Closure Data Quality Objectives*, Rev. 6.

Table 3-2. Secondary Inorganic Constituents in RPP-23403.

Constituent[1]		Constituent[1]		Constituent[1]	
Bismuth – Bi	Yes	Niobium – Nb	Yes [2]	Sodium – Na	Yes
Boron – B	Yes [2]	Palladium – Pd	Yes [2]	Sulfur – S	Yes [2]
Bromide – Br^-	Yes [2]	Phosphate – PO_4^{3-}	Yes	Sulfate – SO_4^{2-}	Yes
Calcium – Ca	Yes	Phosphorus – P	Yes [2]	Tantalum – Ta	Yes [2]
Chloride – Cl^-	Yes [2]	Potassium – K	Yes	Tellurium – Te	Yes [2]
Cerium – Ce	Yes [2]	Praseodymium – Pr	Yes [2]	Thorium – Th	Yes [2]
Europium – Eu	Yes [2]	Rhodium – Rh	Yes [2]	Tin – Sn	Yes [2]
Lanthanum – La	Yes	Rubidium – Rb	Yes [2]	Titanium – Ti	Yes [2]
Lithium – Li	Yes [2]	Ruthenium – Ru	Yes [2]	Tungsten – W	Yes [2]

Table 3-2. Secondary Inorganic Constituents in RPP-23403.

Constituent[1]		Constituent[1]		Constituent[1]	
Magnesium – Mg	Yes	Samarium – Sm	Yes [2]	Yttrium – Y	Yes [2]
Molybdenum – Mo	Yes [2]	Silicon – Si	Yes	Zirconium – Zr	Yes
Neodymium – Nd	Yes [2]				

[1] None of these constituents are listed as Dangerous Waste Constituents in *Washington Administrative Code* 173-303-9905, "Dangerous Waste Constituents List."

Yes = Inventory or concentration in this report
Yes [2] = Inventory or concentrationonly for tanks with analysis

Reference: RPP-23403, *Single-Shell Tank Component Closure Data Quality Objectives*, Rev. 6.

Tables 3-3 to 3-5 list organic compounds required for initial C-Farm retrievals. In addition to the organic compounds listed in these tables, polychlorinated biphenyls (PCBs) were analyzed as primary constituents. As part of an iterative DQO process, the list of required organic analytes was re-evaluated using sample data collected from residual solids in C-Farm tanks retrieved through January, 2013. Only a small subset of the volatile organic compounds and semivolatile organic compounds identified in Tables 3-3 to 3-5 were detected in these samples and all results were measured at concentrations near the laboratory detection limits. As a result, the list of required organic analytes for C-Farm tanks C-101, C-102, C-104, C-105, C-107, C-109, C-110, C-111, and C-112 was reduced to only those shown in Table 3-7.

3.4 DATA QUALITY OBJECTIVES

The DQO Process (EPA/600/R-96/055, *Guidance for the Data Quality Objectives Process EPA QA/G-4*, August 2000 as revised) is a strategic planning approach based on the Scientific Method to prepare for a data collection activity. It provides a systematic procedure to define the criteria that a data collection design should satisfy, including when to collect samples, where to collect samples, the tolerable level of decision error for the study, and how many samples to collect. The DQO Process establishes the requirements for sample results used in the BBI (Chapter 4).

Data quality objectives are qualitative and quantitative statements derived from the outputs of the first six steps of the DQO Process that:

1. Clarify the study objective;

2. Define the most appropriate type of data to collect;

3. Determine the most appropriate conditions from which to collect the data; and

Specify tolerable limits on decision errors which will be used as the basis for establishing the quantity and quality of data needed to support the decision.

Table 3-3. Primary Volatile Organic Compounds in RPP-23403.

Constituent	Inventory or Concentration in Report
1,1,1-Trichloroethane	Yes [1,2]
1,1,2,2-Tetrachloroethene	No [2]
1,1,2,2-Tetrachloroethane	Yes [1,2]
1,1,2-Trichloro-1,2,2-trifluoroethane	Yes [1]
1,1,2-Trichloroethane	Yes [1,2]
1,1,2-Trichloroethylene	No
1,1-Dichloroethene	Yes [1]
1,2-Dichloroethane	Yes [1,2]
Chloroethene (vinyl chloride)	Yes [1,2]
2-Butanone (MEK)	Yes [1,2]
2-Nitropropane	Yes [1,2]
2-Propanone (Acetone)	Yes [1]
4-Methyl-2-pentanone (MIBK)	Yes [1]
Benzene	Yes [1,2]
Carbon disulfide	Yes [1,2]
Carbon tetrachloride	Yes [1,2]
Chlorobenzene	Yes [1,2]
Chloroform	Yes [1,2]
Dichloromethane (methylene chloride)	Yes [2]
Ethyl Acetate	Yes [1]
Ethylbenzene	Yes [1]
Diethyl ether	No
Isobutanol	Yes [1]
Methanol	No
n-Butyl alcohol (1-butanol)	Yes [1]
Toluene	Yes [1,2]
trans-1,3-dichloropropene	Yes [1,2]
Trichlorofluoromethane	Yes [1,2]
Xylenes	Yes [1]
o-Xylene	Yes [1]
m-Xylene	Yes [1]
p-Xylene	Yes [1]

Yes [1] = Inventory or concentration for tanks with analysis

[2] Dangerous Waste Constituent, listed in *Hanford Facility Dangerous Waste Part A Permit Application, Form 3, Revision 8, for the Single-Shell Tank System* (CH2M HILL 2003).

Reference: RPP-23403, *Single-Shell Tank Component Closure Data Quality Objectives*, Rev. 5.

Table 3-4. Primary Semivolatile Organic Parameters in RPP-23403.

Constituent	Inventory or Concentration in Report
1,2,4-Trichlorobenzene	Yes [1,2]
2,4-Dinitrotoluene	Yes [1,2]
2,4,5-Trichlorophenol	Yes [1,2]
2,4,6-Trichlorophenol	Yes [1,2]
2,6-Bis (tert-butyl)-4-methylphenol	Yes [1]
2-Chlorophenol	Yes [1,2]
2-Ethoxyethanol	Yes [1,2]
2-Methylphenol (o-cresol)	Yes [1]
4-Methylphenol (p-cresol)	No
Acenaphthene	Yes [1]
Butylbenzylphthalate	Yes [1]
Cresylic acid (cresol, mixed isomers)	No [2]
Cyclohexanone	Yes [1]
Di-n-butylphthalate	Yes [1]
Di-n-octylphthalate	Yes [1]
N-nitroso-di-n-propylamine	Yes [1,2]
Ethylene glycol	No [2]
Fluoranthene	Yes [1,2]
Hexachlorobutadiene	Yes [1,2]
Hexachloroethane	Yes [1,2]
m-Cresol (3-Methylphenol)	Yes [1]
Naphthalene	Yes [1,2]
Nitrobenzene	Yes [1,2]
n-Nitrosomorpholine	No [2]
o-Dichlorobenzene	No [2]
o-Nitrophenol	No
p-Chloro-m-cresol (4-Chloro-3-methylphenol)	Yes [1]
Pyrene	Yes [1]
Pyridine	Yes [1,2]
Tributyl phosphate	Yes [1]

Yes [1] = Inventory or concentration for tanks with analysis
[2] Dangerous Waste Constituent, listed in *Hanford Facility Dangerous Waste Part A Permit Application, Form 3, Revision 8, for the Single-Shell Tank System* (CH2M HILL 2003).

Reference: RPP-23403, *Single-Shell Tank Component Closure Data Quality Objectives*, Rev. 5.

Table 3-5. Secondary Organic Constituents in RPP-23403 (no inventory or concentration estimates for these). (2 sheets)

Constituent	Constituent
cis-1,3-Dichloropropene [1]	p-Nitrochlorobenzene
Ethylene dibromide (1,2, Dibromoethane)[1]	1,4-Dinitrobenzene
Butane	1,4-Dichlorobenzene[1]
1,3-Butadiene [1]	Phenol[1]
Acrolein (2-propenal)[1]	Hexachlorobenzene[1]
3-Chloropropene (Allyl chloride)[1]	N,N-Diphenylamine
Propionitrile (Ethyl cyanide)[1]	Pentachloronaphthalene
Acrylonitrile[1]	Hexachloronaphtahlene
2-Pentanone	Tetrachloronaphthalene
Methylcyclohexane	Octachloronaphthalene
n-Pentane	Isodrin
5-Methyl-2-hexanone	Benzo[a]pyrene[1]
2-Heptanone	Dibenz[a,h]anthracene[1]
n-Hexane	1,3-Dichlorobenzene[1]
Cyclohexane	3-Methyl-2-butanone
n-Octane	N-Nitroso-N,N-dimethylamine[1]
4-Heptanone	Hexafluoroacetone
Acetic acid, n-butylester	Pentachloronitrobenzene (PCNB)[1]
1,4-Dioxane[1]	Pentachlorophenol[1]
n-Heptane	2-sec-Butyl-4,6-dinitrophenol (Dinoseb)[1]
Cyclopentane	1,1'-Biphenyl
Ethyl alcohol	Acetophenone[1]
2-Propyl alcohol	Toxaphene[1]
n-propyl alcohol (1-propanol)	Nitric acid, propyl ester
Bromomethane[1]	Aldrin[1]
Chloroethane	alpha-BHC[1]
Acetonitrile[1]	beta-BHC[1]
1,1 Dichloroethane[1]	gamma-BHC (Lindane)[1]

Table 3-5. Secondary Organic Constituents in RPP-23403 (no inventory or concentration estimates for these). (2 sheets)

Constituent	Constituent
Dichlorofluromethane	Dieldrin[1]
Chlorodifluoromethane	Endrin[1]
3-Methy-2-butanone	1,1-Dimethylhydrazine[1]
Hexafluoroacetone	Methylhydrazine[1]
2-Butenaldehyde (2-Butenal)	n-Nitrosomethylethylamine[1]
Methyl isocyanate[1]	n-Nitrosodi-n-butylamine[1]
n-Propionaldehyde	Triethylamine[1]
3-Heptanone	Oxirane[1]
Chloromethane[1]	2-Methyl-2-propanol
n-Nonane	Dichlorodifluoromethane[1]
Styrene	1,2-Dichloro-1,1,2,2-tetrafluoroethane
Tetrahydrofuran	Heptachlor[1]
Cyclohexene	1,2-Dichloropropane[1]
2-Methyl-2-propenenitrile	1-Methylpropyl alcohol
2-Hexanone	3-Pentanone

[1] Dangerous Waste Constituent per *Washington Administrative Code* 173-303-9905, "Dangerous Waste Constituents List."

Reference: RPP-23403, Rev. 6, *Single-Shell Tank Component Closure Data Quality Objectives*.

Table 3-6. Primary Radiological Parameters in RPP-23403 (inventory or concentrations are available for all of these).

Constituent	Analytical Method	Alternate Method
^{137}Cs	Gamma energy analysis	—
^{60}Co	Gamma energy analysis	—
^{152}Eu	Gamma energy analysis	—
^{154}Eu	Gamma energy analysis	—
^{155}Eu	Gamma energy analysis	—
^{14}C	Liquid scintillation counting	—
^{3}H	Liquid scintillation counting	—
^{129}I	Low energy gamma counting	—

Table 3-6. Primary Radiological Parameters in RPP-23403 (inventory or concentrations are available for all of these).

Constituent	Analytical Method	Alternate Method
^{63}Ni	Liquid scintillation counting	—
^{90}Sr	Beta proportional counting	—
^{99}Tc	Inductively coupled plasma/Mass spectrometry	Liquid scintillation counting
^{125}Sb	Gamma energy analysis	—
^{79}Se	Liquid scintillation counting	—
^{126}Sn	Inductively coupled plasma/Mass spectrometry	—
^{233}U	Inductively coupled plasma/Mass spectrometry	—
^{234}U	Inductively coupled plasma/Mass spectrometry	—
^{235}U	Inductively coupled plasma/Mass spectrometry	—
^{236}U	Inductively coupled plasma/Mass spectrometry	—
^{238}U	Inductively coupled plasma/Mass spectrometry	—
^{237}Np	Inductively coupled plasma/Mass spectrometry	—
^{238}Pu	Alpha energy analysis	Inductively coupled plasma/Mass spectrometry
$^{239/240}$Pu	Alpha energy analysis	Inductively coupled plasma/Mass spectrometry as ^{239}Pu and ^{240}Pu
^{241}Pu	Calculate from ^{238}Pu and $^{239/240}$Pu	Liquid scintillation counting
^{242}Pu	Inductively coupled plasma/Mass spectrometry	—
^{241}Am	Alpha energy analysis	Inductively coupled plasma/Mass spectrometry
^{242}Cm	Alpha energy analysis	—
^{243}Cm	Alpha energy analysis	—
^{244}Cm	Alpha energy analysis	—
^{228}Th	Calculation	Separation/Alpha Energy Analysis
^{230}Th	Inductively coupled plasma/Mass spectrometry	—
^{232}Th	Inductively coupled plasma/Mass spectrometry	—

Reference: RPP-23403, *Single-Shell Tank Component Closure Data Quality Objectives*, Rev. 6.

Table 3-1. Required Organic Analytes for Remaining 241-C Farm Tanks.

Organic Analyte	Chemical Abstracts Service Number	Analysis Method
1,1,2-Trichloroethylene	79-01-6	Method 8260 for VOA
2-Butanone (MEK)	78-93-3	Method 8260 for VOA
2-Propanone (Acetone)	67-64-1	Method 8260 for VOA
4-Methyl-2-pentanone (MIBK)	108-10-1	Method 8260 for VOA

Xylenes (Mixed isomers of o-, m-, and p-)	1330-20-7	Method 8260 for VOA
o-Xylene	95-47-6	Method 8260 for VOA
m-Xylene[1]	108-38-3	Method 8260 for VOA
p-Xylene[1]	106-42-3	Method 8260 for VOA
Tributyl phosphate	126-73-8	Method 8270 for SVOA
Polychlorinated biphenyls	11104-28-2-1221 11141-16-5-1232 12674-11-2 53469-21-9 12672-29-6-1248 11097-69-1-1254 11096-82-5-1260	Method 8082 for Aroclors

SVOA = semivolatile organic analysis VOA = volatile organic analysis

[1] m-xylene and p-xylenes will be reported together as xylenes (m+p).

The DQO Process assures that the type, quantity, and quality of environmental data used in decision making will be appropriate for the intended application, resulting in environmental decisions that are technically and scientifically sound and legally defensible. In addition, the DQO Process guards against committing resources to data collection efforts that do not support a defensible decision.

Appendix I Section 2.1.6 of the HFFACO states "Before tank waste field retrieval activities are initiated, DOE will develop a tank or component specific retrieval data quality objectives (DQO) document for the residual tank waste characterization in coordination with Ecology. As part of the DQO process, DOE will also develop a sampling and analysis plan for post-retrieval and closure sampling." Similarly, DOE O 435.1, *Radioactive Waste Management* places a requirement on using the DQO Process. Based on the DQOs, sampling and analysis activities were performed in accordance with the following EPA documents:

- EPA/600/R-96/055
- EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans EPA QA/R-5*, March 2001 as revised.

The DQOs applied to C-Farm tank samples are shown in Table 3-8.

Table 3-2. Data Quality Objectives Applied to 241-C Farm Tank Samples. (2 sheets)

Document Topic and Number	Document Title	Document Scope	241-C Farm Tanks where applied
Safety Screening WHC-SD-WM-SP-004	Tank Safety Screening Data Quality Objective	Data needs to determine safe storage of tank waste.	All except C-102

Table 3-2. Data Quality Objectives Applied to 241-C Farm Tank Samples. (2 sheets)

Document Topic and Number	Document Title	Document Scope	241-C Farm Tanks where applied
Waste Compatibility HNF-SD-WM-DQO-001	Data Quality Objectives for Tank Farms Waste Compatibility Program	Data needed for waste transfers in the tank farms	C-103, C-106, C-108, C-109, C-110, C-201, C-202, C-203, C-204
SST Component Closure DQO RPP-23403	Single-Shell Tank Component Closure Data Quality Objectives	Post-retrieval data obtained for tank closure requirements	C-101,C-102, C-103, C-104, C-107, C-108, C-109, C-110, C-112
Criticality DQO for cores RPP-SPEC-25386	Criticality Data Quality Objectives for Tank Core Samples	Criticality data required from the solid waste portion of tank core samples.	No core samples for C-101, C-102, C-106, C-202 or C-203
C-106 Component Closure RPP-13889	Tank 241-C-106 Component Closure Action Data Quality Objectives	Data to support closure of tank 241-C-106 (preceded RPP-23403).	C-106
Polychlorinated biphenyls (PCBs) RPP-7614	Data Quality Objectives to Support PCB Management in the Double-Shell Tank System	Data needed to manage PCBs in DST system and waste feed to the waste treatment plant.	C-101, C-102, C-103, C-105, C-106, C-107, C-108, C-111, C-201, C-202, C-203, C-204
Organic Solvent HNF-SD-WM-DQO-026	Data Quality Objective to Support Resolution of the Organic Solvent Safety Issue	Data needs to resolve the safety issue of organic solvent pools in the tanks.	C-103, C-104
Historical Data Acquisition Model Verification WHC-SD-WM-DQO-018	Historical Model Evaluation Data Requirements	Data needs supporting the historical model for tank grouping.	C-104, C-105
Organic Complexant WHC-SD-WM-DQO-006	Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue	Data needs to resolve the organic complexant issue.	C-103, C-104
Pretreatment WHC-SD-WM-DQO-022	Data Needs and Attendant Data Quality Objectives for Tank Waste Pretreatment and Disposal	Data needs to support enhanced sludge washing, solids/liquid separation, cesium removal, strontium removal, TRU removal, and technetium removal.	C-103, C-104, C-105, C-107, C-108, C-109, C-112
C-106 High Heat WHC-EP-0723	Tank 241-C-106 Sampling Data Requirements Developed Through the Data Quality Objectives (DQO) Process	Data needs to help resolve high heat issue in C-106.	C-106

Note: Shaded rows indicate DQOs that are no longer active.

DQO = data quality objective
DST = double-shell tank
SST = single-shell tank
TRU = transuranic (waste)

This page intentionally left blank.

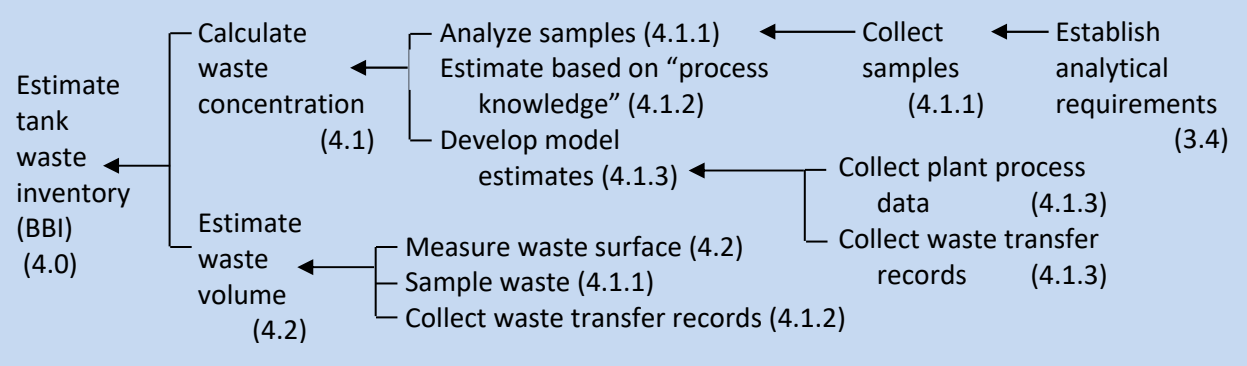
4. CURRENT TANK INVENTORY ESTIMATES

The BBI process is the official inventory database for the Hanford Site tanks. This section describes the BBI process used to estimate C-Farm SST waste inventories. Inventory estimates for C-Farm tanks and ancillary equipment are also provided.

The BBI process, illustrated in Figure 4-1, uses the best available information to estimate tank compositions and inventories for double-shell tanks (DSTs) and SSTs at Hanford. Most of the BBI inventories for C-Farm tanks are based on post-retrieval sample analyses. Analytical data is not available for some BBI radionuclide constituents; these inventory estimates are based on process information. The BBI process, described in RPP-7625, involves the following steps:

1. Review available waste volume and composition information for a tank
2. Estimate waste volumes and concentrations for each waste type within a tank
3. Combine volume and concentration estimates to calculate inventories and uncertainties
4. Document basis for inventory estimates, and
5. Issue inventory estimates and BBI documentation.

Figure 4-1. Best-Basis Inventory Flow Process.



The BBI includes inventory estimates for 25 chemicals and 46 radionuclides for all SSTs and DSTs (Table 4-1). Inventories for additional or "supplemental" constituents are also provided for tanks for which analytical data is available. Because sample data is not available for many constituents, the standard constituents in BBI are limited to those constituents included in historical waste process models. The standard analytes account for ~99 weight percent (wt%) of the chemical inventory (not including percent water, free hydroxide, bound hydroxide or oxygen associated with metallic oxides) and the radionuclides account for over 99% of the activity (Ci), in terms of short and long-term risk (WHC-SD-WM-TI-731, *Predominant Radionuclides in Hanford Site Waste Tanks*). Table 4-2 lists supplemental constituents in the BBI for one or more C-Farm tanks (Note: only supplemental analytes required in RPP-23403 are included in Appendix D). Specific sample analyses and volume estimates performed for post-retrieval BBI inventory estimates are described in Chapter 5, Residual Waste Inventory Estimates.

The BBI is maintained under configuration control and updated on a quarterly basis, as needed, to incorporate new data and waste transfer information. Updated BBI tank waste volume

estimates are documented in monthly tank waste summary reports (HNF-EP-0182). Appendix B lists estimated volumes, concentrations and inventories of waste in C-Farm SSTs as of December 1, 2002 and January 1, 2019. Chapter 6 discusses uncertainty in the BBI estimates. Uncertainty values for BBI are presented in Appendix D.

Table 4-1. Standard Best-Basis Inventory Constituents.

Constituents		Radionuclides		
Al	Na	^{3}H	^{134}Cs	^{234}U
Bi	Ni	^{14}C	^{137}Cs	^{235}U
Ca	NO_2	^{59}Ni	^{137m}Ba	^{236}U
Cl	NO_3	^{60}Co	^{151}Sm	^{237}Np
CO_3	Oxalate	^{63}Ni	^{152}Eu	^{238}Pu
Cr	Pb	^{79}Se	^{154}Eu	^{238}U
F	PO_4	^{90}Sr	^{155}Eu	^{239}Pu
Fe	Si	^{90}Y	^{226}Ra	^{240}Pu
Hg	SO_4	^{93}Zr	^{227}Ac	^{241}Am
K	Sr	^{93m}Nb	^{228}Ra	^{241}Pu
La	Total organic carbon	^{99}Tc	^{229Th}	^{242}Cm
Mn	U-TOTAL	^{106}Ru	^{231}Pa	^{242}Pu
	Zr	^{113m}Cd	^{232}Th	^{243}Am
		^{125}Sb	^{232}U	^{243}Cm
		^{126}Sn	^{233}U	^{244}Cm
		^{129}I		

4.1 TANK WASTE COMPOSITION ESTIMATES

Best-basis inventory waste composition estimates are based on:

1. First, sample data, if sample data is available

2. Next, process knowledge (i.e., historical sample data pre-1989, sample data from other tanks that received similar waste types, and isotope calculations)

3. Then, model data based on the information described in Section 4.1.3.

An array of concentration values from a single information source (e.g., a sample event or model estimate) is referred to as a vector. Expert judgment is used to determine the BBI waste

composition estimates. The value and justification for each estimate are documented in BBI summary reports.

Table 4-2. Supplemental Constituents for 241-C Tank Farm. (2 sheets)

Supplemental Constituents (112)		
Total alpha*	Ti	Cresol
$^{239/240}$Pu*	Tl	Cyclohexanone
$^{243/244}$Cm*	Va	Diethyl ether
^{144}Ce/Pr	W	Di-n-butylphthalate
^{228}Ac	Y	Di-n-octylphthalate
^{228}Th	Zn	Ethyl acetate
^{230}Th	1,1-Dichloroethane	Ethylbenzene
^{94}Nb	1,1,1-Trichloroethane	Ferrocyanide
Aroclors (total PCB)	1,1,2,2-Tetrachloroethane	Fluoranthene
Ag	1,1,2-Trichloro-1,2,2-trifluoroethane	Formate
As	1,1,2-Trichloroethane	Glycolate
B	1,1,2-Trichloroethylene	Hexachlorobutadiene
Ba	1,2,4-Trichlorobenzene	Hexachloroethane
Be	1,2-Dichlorobenzene	Hexone
Br	1,2-Dichloroethane	Isobutanol
Cd	1,4-Dichlorobenzene	m-Cresol
Ce	1-Butanol	Methylene chloride
CN	2,4,5-Trichlorophenol	Morpholine, 4-nitroso-
Co	2,4,6-Trichlorophenol	Naphthalene
Cu	2,4-Dinitrotoluene	Nitrobenzene
Eu	2,6-Bis(1,1-dimethylethyl)-4-methylphenol	N-Nitroso-di-n-propylamine
Free OH	2-Butanone	n-Nitrosomorpholine
Li	2-Chlorophenol	o-Dichlorobenzene
Mg	2-Ethoxyethanol	o-Nitrophenol
Mo	2-Methylphenol	Pentachlorophenol
Nb	2-Nitrophenol	Phenol
Nd	2-Nitropropane	Pyrene
NH_3	4-Chloro-3-methylphenol	Pyridine

Table 4-2. Supplemental Constituents for 241-C Tank Farm. (2 sheets)

Supplemental Constituents (112)		
Pd	4-Methyl-2-pentanone (MIBK)	Sulfide
Pr	4-Methylphenol	Tetrachloroethylene
Rb	Acenaphthene	Toluene
Rh	Acetate	Trans-1,3-Dichloropropene
Ru	Acetone	Tributyl phosphate
Sb	Benzene	Trichloroethene
Sa	Butylbenzylphthalate	Trichlorofluoromethane
Se	Carbon disulfide	Vinyl chloride
Sn	Carbon tetrachloride	Xylene (m & p)
Te	Chlorobenzene	Xylene (o)
Ta	Chlorobenzene	Xylenes (total)
Th	Chloroform	

* Analysis used to calculate specific radioisotopes. Analysis may not be available for all waste phases.

PCB = polychlorinated biphenyl

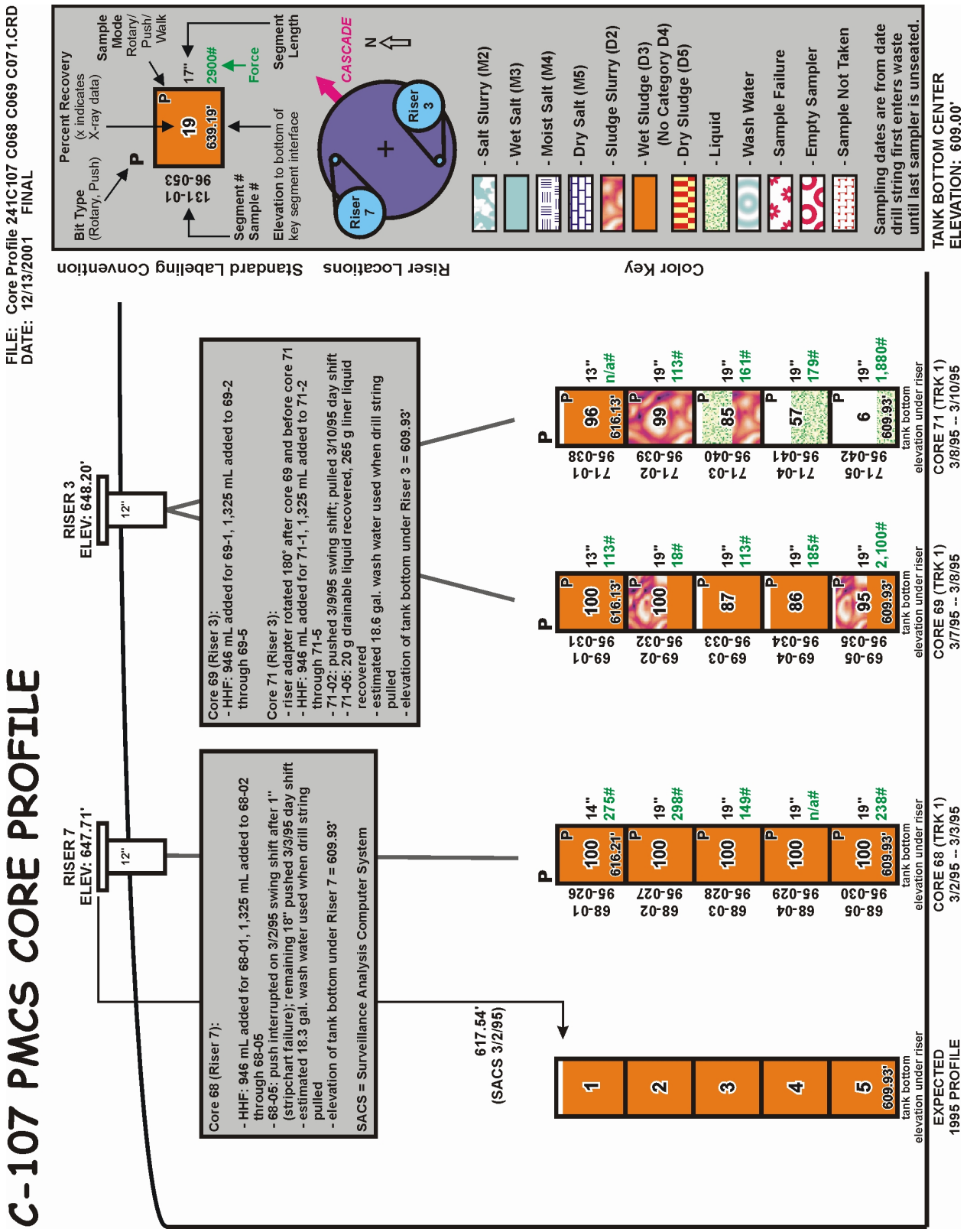
4.1.1 Sample Data

Waste samples have been obtained from all of the C-Farm SSTs. Over 50,000 analytical results from over 450 separate sample events have been obtained from C-Farm tanks since 1989. Sampling and analysis of C-Farm tanks were driven by needs specified in DQOs (Table 3-8).

Supernate liquid grab samples are generally assumed to be homogeneous and are taken from one or more risers at multiple depths. Average and standard deviations for the sample sets are derived from grab sample data. Core samples and/or auger samples are taken from two or more risers (ceiling access ports) from opposite sides of the tank in an attempt to account for heterogeneity. For core samples, 19-in. sample segments are obtained. Averages are calculated by first averaging primary and duplicate samples in a segment, then averaging segments representative of a waste type, and finally averaging across multiple risers. Of the C-Farm tanks, the inventory estimates for tanks C-101, C-102, C-105, C-107, C-111 and C-112 are based partly on core samples. Figure 4-2 shows an example of core samples for tank C-107.

Because of the small amount of waste remaining, post-retrieval residual samples are collected as grab samples using an off-riser, finger trap or clamshell sampler (see Section 5.2.1) as specified in the DQO (Section 3.4).

Figure 4-2. Tank 241-C-107 Core Sample Profile.



Sample measurements that represent post-retrieval tank contents are the preferred source of waste concentration information for the BBI. However, no analytical data was obtained for some of the "standard" radionuclides. Consequently, a complete inventory of C-Farm tank waste cannot be determined based on samples only; process knowledge (Section 4.1.2) or model-based estimates (Section 4.1.3) are needed to complete standard inventory estimates.

4.1.2 Process Knowledge

Process knowledge concentration estimates are derived from:

- historical tank sample data (pre-1989 data),
- sample data from other tanks, and
- isotope calculations.

Historical sample data generally have a lower level of quality assurance/quality control and are therefore considered process knowledge information rather than a sample-based estimate.

Sample-based template values were developed from a review of sample data for tanks with similar process histories and at least one waste layer from the same waste process (i.e., same waste type). The Hanford Site has had many different fuel reprocessing systems that generated many waste streams (WHC-MR-0132, *A History of the 200 Area Tank Farms*). Table 4-3 lists waste types transferred to C-Farm tanks and assumed to remain in tank residuals after retrieval. The decision to include tank data in a template was based on tank transfer records indicating the expected waste type and depth in a tank and a comparison with expected analytical concentrations for a given waste type, and is documented in each update of the BBI for that tank. Sample templates are described in RPP-8847, *Best-Basis Inventory Template Compositions of Common Tank Waste Layers*. Waste type uncertainties are presented in Chapter 6.

In the absence of specific sample data, some isotope values were estimated from measured values. For example, plutonium, americium and curium isotopes were estimated based on Hanford Defined Waste (HDW) model ratios from total alpha values for similar waste types; uranium isotopes were estimated based on HDW model ratios from total uranium measurements for similar waste types; and ^{137m}Ba and ^{90}Y were decay calculations from measured values for ^{137}Cs and ^{90}Sr, respectively.

4.1.3 Hanford Defined Waste Model-Based Inventories

The HDW model Rev. 5 concentration estimates are used in BBI to fill gaps if sample data for a given waste type are not available and when sample data are below detection limits higher than HDW estimates.Although all of the C-Farm tanks have been sampled and analyzed in accordance with the Closure DQO (RPP-23403), analyses for some chemicals and radionuclides in the BBI are not required by the DQO or analytical results were below detection limits. As a result, inventories for a few chemicals and many of the radionuclides are based on HDW Rev. 5 model concentration estimates (RPP-19822).

Table 4-3. Waste Types in 241-C Farm Tanks.

Waste Type	Description	Tanks
AR	Water washed PUREX sludge (1967-1976)	**C-103, 106**
BL	B Plant low activity waste (1963-1972)	**C-106**
1C	First cycle $BiPO_4$ coating waste (1944-1956)	**C-107, 108, 109, 110, 111, 112**
CWP1	PUREX aluminum cladding waste (1956-1960)	C-101, 102, **103**, 104, 105, **106**, 111, 112
CWP2	PUREX aluminum cladding waste (1961-1972)	C-102, **104**, 107, 112
CWZr1	PUREX/REDOX zirconium cladding waste (1968-1972)	C-102, 104
HS	Hot Semiworks waste (1961-1968)	C-111, 112, **201, 202, 203, 204**
MW1	$BiPO_4$ metal waste (1944-1949)	**C-102**
OWW3	PUREX organic wash waste (1968-1972)	C-104
SRR	Strontium recovery waste (1969-1985)	**C-104, C-107**
TBP (UR)	Tributyl phosphate/uranium recovery waste (1952-1957)	**C-101, 102, 105, 106**
TFeCN	Ferrocyanide sludge (1955-1958)	C-111, 112
TH1	Thoria process waste (1966)	C-102
TH2	Thoria process waste (1970)	C-104

$BiPO_4$ = bismuth phosphate
PUREX = Plutonium-Uranium Extraction (facility)
REDOX = Reduction-Oxidation (S Plant)

Note: **Bold font** indicates the waste type is assumed to remain in tank residuals.

The HDW model uses a spreadsheet format to combine tank waste process information with Hanford Site irradiated fuel and separation plant process records from the Oak Ridge Isotope Generation 2 (ORIGEN2) model (RPP-13489, *Activity of Fuel Batches Processed Through Hanford Separations Plants, 1944 Through 1989*) to produce total chemical and radionuclide compositions by waste type. These estimates comprise 46 radionuclides (the standard radioisotopes in the BBI) and 33 nonradioactive species (24 of the 25 standard chemicals from the BBI plus citrate, N-[hydroxyethyl]-ethylenediaminetriacetic acid, ethylenediaminetetraacetic acid, glycolate, acetate, dibutyl phosphate, butanol, ammonia, and ferrocyanide) and four properties (density, water wt%, total organic carbon wt% and sludge void fraction [total organic carbon is a standard constituent in BBI]).

4.2 TANK WASTE VOLUME ESTIMATES

Best-basis inventory waste volume estimates for C-Farm are based on tank waste measurements. Table 4-4 shows estimated waste phase volumes in December 2002 and January 1, 2019 for each C-Farm tank. Volume differences are due largely to waste retrieved since December 2002.

Post-retrieval in-tank videos were evaluated to estimate waste volumes used in the BBI (see Section 5.2.1).

4.3 BEST-BASIS INVENTORIES

Best-basis inventories are determined for each tank by multiplying the concentration of each constituent in a given layer (based on a waste type) by the volume of that layer, and summing over the layers in a tank.

Table 4-5 contains a summary of inventories in 2002 and 2019 by constituent for C-Farm SSTs. Most of the BBI inventory estimates were higher in the 2002 estimates. This is mostly due to removal of waste since then and partly due to changes in the BBI based on new sample results and HDW model changes. All of the total chemical inventory estimates were higher in 2002. The ratios between the 2002 and 2019 inventories ranged from <0.1% to 16%. The 2002 inventories for many of the constituents were largely HDW model-based estimates and were replaced by sample values (Chapter 5) for the 2019 inventories. The ^{99}Tc BBI inventory decreased from 351 Ci in the 2002 BBI to 2.3 Ci in 2019 (a ratio of 0.7%). This indicates most of the ^{99}Tc was removed from the tanks during retrieval. Standard inventories and concentrations for each waste phase or waste type in each tank in C-Farm are provided in Appendix B.

Table 4-4. Comparison of 2002 and 2019 241-C Tank Farm Waste Volumes by Tank.

Tank	12/1/2002 (EIS) Waste Phase (kL)		1/2019 Waste Phase (kL)*	
	Sludge	Supernate**	Sludge	Supernate**
241-C-101	333	0	20.7	0
241-C-102	1,196	0	59	0
241-C-103	474	290	8.64	0.93
241-C-104	980	0	7.2	0
241-C-105	500	0	5.5	0
241-C-106	23	115	10.5	0.3
241-C-107	940	0	39	0
241-C-108	250	0	12.9	0
241-C-109	240	0	7.6	0
241-C-110	670	4	8.0	0
241-C-111	217	0	18.5	0
241-C-112	393	0	37.5	0
241-C-201	4	0	0.5	0
241-C-202	4	0	0.6	0

Table 4-4. Comparison of 2002 and 2019 241-C Tank Farm Waste Volumes by Tank.

Tank	12/1/2002 (EIS) Waste Phase (kL)		1/2019 Waste Phase (kL)*	
	Sludge	Supernate**	Sludge	Supernate**
241-C-203	10	0	0.5	0
241-C-204	10	0	0.5	0
Total	6,653		238	

Note: Volumes reflect tank status as of December 1, 2002 and January 1, 2019.

.
EIS = Environmental Impact Statement

*Waste volumes from Best-Basis Inventory downloaded January 3, 2019.
** Separate supernate volumes were only determined for tanks with supernate samples.

Table 4-5. Comparison of 2002 and 2019 241-C Tank Farm Best-Basis Inventory Estimates. (3 sheets)

Constituent	Units	EIS[a] C-Farm Tank Inventory	1/1/2019[b] C-Farm Tank Inventory	Ratio[c] (%)
Al	Kg	7.03E+05	7.39E+04	11
Bi	Kg	3.85E+04	3.61E+02	1
Ca	Kg	4.71E+04	6.42E+02	1
Cl	Kg	7.44E+03	3.98E+01	1
Total inorganic carbon as CO_3	Kg	2.53E+05	9.41E+03	4
Cr	Kg	5.60E+03	6.73E+01	1
F	Kg	5.80E+04	1.51E+03	3
Fe	Kg	2.35E+05	3.96E+03	2
Hg	Kg	3.93E+02	7.40E+00	2
K	Kg	6.77E+03	7.68E+01	1
La	Kg	1.46E+03	1.02E+01	1
Mn	Kg	1.75E+04	7.58E+02	4
Na	Kg	7.20E+05	2.65E+04	4
Ni	Kg	3.95E+04	7.14E+02	2
$NO_2 + NO_3$	Kg	6.56E+05	2.74E+03	1
Pb	Kg	2.32E+04	3.42E+02	1
Oxalate	Kg	NA	7.23E+02	NA
PO_4	Kg	2.89E+05	1.70E+04	6

Table 4-5. Comparison of 2002 and 2019 241-C Tank Farm Best-Basis Inventory Estimates. (3 sheets)

Constituent	Units	EIS[a] C-Farm Tank Inventory	1/1/2019[b] C-Farm Tank Inventory	Ratio[c] (%)
Si	Kg	1.30E+05	1.42E+03	1
SO_4	Kg	5.59E+04	3.16E+02	1
Sr	Kg	1.75E+03	1.16E+02	7
Total organic carbon	Kg	3.62E+04	6.37E+02	2
U TOTAL	Kg	1.13E+05	1.04E+04	9
Zr	Ci	7.90E+04	1.03E+02	0.1
^{106}Ru	Ci	2.86E-08	1.17E-09	4.1
^{113m}Cd	Ci	5.00E+02	2.22E+00	0.4
^{125}Sb	Ci	1.67E+00	1.09E-02	0.7
^{126}Sn	Ci	7.93E+01	2.00E+00	2.5
^{129}I	Ci	9.93E-01	1.39E-02	1.4
^{134}Cs	Ci	1.86E-03	2.27E-05	1.2
^{137}Cs	Ci	6.41E+05	9.20E+03	1.4
^{137m}Ba	Ci	5.72E+05	8.19E+03	1.4
^{14}C	Ci	1.57E+01	9.12E-02	0.6
^{151}Sm	Ci	6.24E+05	2.63E+04	4.2
^{152}Eu	Ci	5.63E+01	2.06E+00	3.7
^{154}Eu	Ci	1.88E+03	2.58E+01	1.4
^{155}Eu	Ci	3.54E+02	8.40E+00	2.4
^{226}Ra	Ci	3.21E-02	5.28E-04	1.6
^{227}Ac	Ci	7.06E+01	2.31E-03	0.0
^{228}Ra	Ci	2.57E+00	4.27E-03	0.2
^{229}Th	Ci	1.10E+00	1.92E-05	0.0
^{231}Pa	Ci	2.69E+02	2.78E-03	0.0
^{232}Th	Ci	5.69E+00	7.34E-03	0.1
^{232}U	Ci	1.63E+01	3.59E-02	0.2
^{233}U	Ci	4.15E+02	2.58E+00	0.6
^{234}U	Ci	4.39E+01	2.97E+00	6.8

Table 4-5. Comparison of 2002 and 2019 241-C Tank Farm Best-Basis Inventory Estimates. (3 sheets)

Constituent	Units	EIS[a] C-Farm Tank Inventory	1/1/2019[b] C-Farm Tank Inventory	Ratio[c] (%)
^{235}U	Ci	1.72E+00	1.54E-01	9.0
^{236}U	Ci	1.10E+00	4.30E-02	3.9
^{237}Np	Ci	5.72E+00	1.97E-01	3.4
^{238}Pu	Ci	4.42E+02	6.82E+00	1.5
^{238}U	Ci	3.76E+01	3.46E+00	9.2
^{239}Pu	Ci	1.83E+04	1.76E+02	1.0
^{240}Pu	Ci	3.22E+03	2.46E+01	0.8
^{241}Am	Ci	1.90E+04	1.49E+02	0.8
^{241}Pu	Ci	1.21E+04	9.61E+01	0.8
^{242}Cm	Ci	2.05E+01	3.91E-01	1.9
^{242}Pu	Ci	1.87E-01	3.07E-02	16.4
^{243}Am	Ci	7.52E-01	1.42E-02	1.9
^{243}Cm	Ci	8.34E-01	7.04E-02	8.4
^{244}Cm	Ci	1.63E+01	1.01E+00	6.2
^{3}H	Ci	3.77E+01	2.40E-01	0.6
^{59}Ni	Ci	3.96E+02	1.07E+01	2.7
^{60}Co	Ci	1.21E+02	2.63E+00	2.2
^{63}Ni	Ci	3.24E+04	1.17E+03	3.6
^{79}Se	Ci	2.69E+01	2.17E-02	0.1
^{90}Sr	Ci	5.81E+06	1.90E+05	3.3
^{90}Y	Ci	5.81E+06	1.90E+05	3.3
^{93m}Nb	Ci	3.49E+02	8.89E+00	2.5
^{93}Zr	Ci	8.77E+02	1.12E+01	1.3
^{99}Tc	Ci	3.51E+02	2.31E+00	0.7

[a] From DOE/ORP-2003-02, *Environmental Impact Statement for Retrieval, Treatment, and Disposal of Tank Waste and Closure of Single-Shell Tanks at the Hanford Site, Richland, WA Inventory and Source Term Data Package*. Estimates based on January 1, 2002 best-basis inventory decayed to January 1, 2020.

[b] January 1, 2019 best-basis inventory estimates; radionuclides decayed to January 1, 2020.

[c] Ratio % = 2019 inventory/2002 inventory × 100.

4.4 WASTE INVENTORIES IN ANCILLARY FACILITIES

The BBI does not include estimates for waste inventories in ancillary facilities. Ancillary equipment in C-Farm are described in RPP-10466, *Status of Facilities and Waste Transfer Lines Within Single Shell Tank Farms*. Ancillary equipment includes catch tanks, pits, diversion boxes and pipelines within the SST system.

Table 4-6 provides 2002 and 2019 waste volume estimates for ancillary facilities in C-Farm. The bases for these estimates are provided in the following sections:

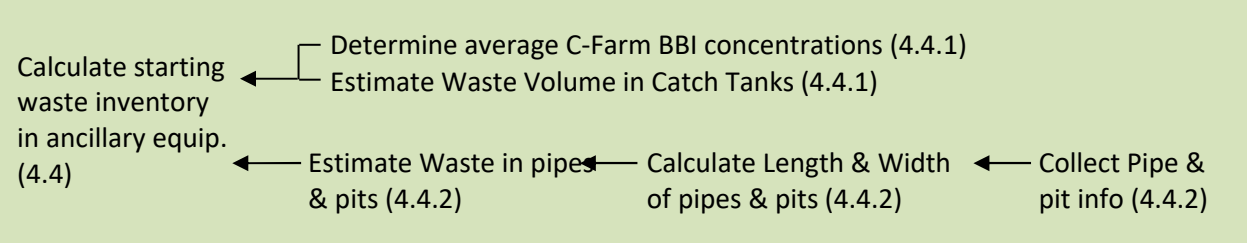
- Catch Tank C-301 and CR-Vault (Section 4.4.2.1)
- Pits (Section 4.4.2.2)
- Diversion Boxes (Section 4.4.2.3)
- Transfer Piping (Section 4.4.2.4).

Table 4-6. Comparison of 2002 and 2019 Ancillary Equipment Waste Volume Estimates.

Structure	12/2002 Estimate kL (kgal)	1/2019 kL (kgal)
Catch tank C-301 and 244-CR Vault	1.8 (4.7)	8.2 (2.2)
Pits and Diversion Boxes	0.1(0.03)	0.36 (0.1)
Transfer piping	0.5 (0.12)	6.1 (1.6)

Figure 4-3 illustrates the process to estimate starting waste inventories in ancillary equipment.

Figure 4-3. Process to Estimate Starting Waste Inventory in Ancillary Equipment.



The following sections describe the basis for 2002 and 2019 ancillary equipment volume and inventory estimates.

4.4.1 2002 Ancillary Equipment Volume and Inventory Estimates

The 2002 ancillary equipment volume estimates provided in Table 4-6 and Table 4-7 were provided in RPP-15043, *Single-Shell Tank System Description* and the TC & WM EIS inventory data package (DOE/ORP-2003-02, *Environmental Impact Statement for Retrieval, Treatment,*

and Disposal of Tank Waste and Closure of Single-Shell Tanks at the Hanford Site, Richland, WA Inventory and Source Term Data Package).

In the final version of the EIS (DOE/EIS-0391), the volume of waste in the ancillary equipment for a given tank farm was calculated as the product of total waste volume in ancillary equipment for all farms (3.09×10^5 gal, given in RPP-15043) times the number of tanks in a given farm (16 for C-Farm) divided by the total number of tanks in the entire SST and DST systems (177).

The waste concentrations in C-Farm ancillary equipment were assumed to be the same as average residual waste concentrations in C-Farm tanks. The inventories of radioactive and nonradioactive constituents in the ancillary equipment for C-Farm were calculated as the volume of waste in the ancillary equipment for C-Farm times the average BBI concentration of constituents for C-Farm tanks.

Table 4-7. Ancillary Equipment Constituent Inventories for Selected Constituents.

Analyte	Units	Initial Inventory (taken from DOE/EIS-0391, Tables D-9 and D-10)
Chromium	g	7.90E+04
Mercury	g	5.55E+03
Nitrate	g	9.25E+06
Lead	g	3.27E+05
Uranium	g	1.59E+06
Acetonitrile	g	0
Benzene	g	0
Butanol	g	0
PCBs	g	6.59E+02
2,4,6-TCP	g	0
H-3 (tritium)	Ci	1.55
C-14	Ci	2.22E-01
Sr-90	Ci	1.29E+05
Tc-99	Ci	4.95
I-129	Ci	1.40E-02
Cs-137	Ci	1.40E+04
U-233, U-234, U-235, U-238	Ci	7.03
Np-237	Ci	8.08E-02
Pu-239, Pu-240	Ci	3.04E+02

Source: DOE/EIS-0391, *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*, from Tables D-9, D-10, and M-22.

Ancillary equipment 2002 residual inventory tables based on RPP-15043 volume estimates are provided in Appendix C.1. Table 4-7 shows the initial inventory estimates for selected constituents provided in the EIS (DOE/EIS-0391, Tables D-9 and D-10).

4.4.2 2019 Ancillary Equipment Volume and Inventory Estimates

4.4.2.1 C-301 and CR-Vault. Waste volume estimates for C-Farm catch tank C-301 and the CR-Vault are shown in Table 4-8. The C-301 catch tank and CR-Vault are described in Appendix A.

Table 4-8. Comparison of 2019 and 2002 Catch Tank C-301 and 244-CR Vault Waste Volume Estimates.

Structure	Capacity kL (kgal)	1/2019[1]			12/2002 RPP-15043[2]
		Liquid L (gal)	Solid L (gal)	Total kL (kgal)	Total kL (kgal)
Vault					
244-CR Cell 1	NA	290 (77)	0	0.29 (0.08)	3.8 (1)
244-CR Cell 2	NA	380 (100)	3.8 (1)	0.38 (0.1)	3.8 (1)
244-CR Cell 3	NA	344 (91)	34 (9)	0.38(0.1)	1.5 (4)
244-CR Cell 4	NA	0 (0)	20 (4)	0.02 (0.004)	3.8 (1)
244-CR-001	150 (40)	18,000 (4,760)[3]	1,680 (443)	5.2 (1.4)[3]	7.6 (2)
244-CR-002	57 (15)	1,000 (270)	1,830 (483)	2.8 (0.74)	5.7 (1.5)
244-CR-003	57 (15)	6,400 (1,690)	2,700 (714)	9.1 (2.4)	15 (4.0)
244-CR-011	150 (40)	0 (0)	15,100 (3,990)	15.1 (4)	140 (36)
Inactive Miscellaneous Underground Storage Tank					
241-C-301	140 (36)	43,100 (11,400)	6,100 (1,600)	49 (13)	40 (10.5)

References:

[1] HNF-EP-0182, Rev. 372, *Waste Tank Summary Report for Month Ending December 31, 2018.* Solids volumes from RPP-RPT-24257, *244-CR Vault Liquid Level Assessment and Video Inspection Completion Report.*

[2] RPP-15043, *Single-Shell Tank System Description*.

[3] The increase in liquid volume from 932 gal to 4,760 gal in 2019 is attributed to water intrusions. Total volume and inventory estimates for 244-CR-001 are based on 932 gal liquid plus solids = 5.2 kL (1.4 kgal).

4.4.2.2 Pits. The estimate for current content of the pits will vary during retrieval of tanks. It was assumed that the 2002 estimate of 120 L (32 gal) of waste would remain in the pits at closure. This estimate was determined by multiplying the wetted surface area of the pits by a waste thickness of 0.040 cm (0.0156 in.) times a grout formation factor (void space) of 0.30 (RPP-15043). This estimate assumes waste is held in the concrete surfaces as an adsorbed layer; waste is flushed and drained in normal operations activities; waste is returned to the SSTs or catch tanks via drain lines; and waste penetration is to a depth of 0.04 cm (0.0156 in.). The

surface area of the pits in C-Farm was estimated by multiplying the total volume of waste in all SST Farms (450 gal, RPP-15043, Table A-1) by the ratio of the number of pits in C-Farm (23, Table A-2) and the total number of pits in the SST farms (322, RPP-15043).

4.4.2.3 Diversion Boxes. Diversion boxes are flushed and drained after use and tank farm operators indicate that little or no waste remains in the diversion boxes following retrieval. Like the estimate for tank pits, a waste volume was estimated assuming waste is held in the concrete surfaces of the diversion boxes as an adsorbed layer and waste penetration is to a depth of 0.04 cm (0.0156 in.) (RPP-15043). The seven diversion boxes in C-Farm have a combined surface area of 6,424 ft^2 as calculated for the sides and bottom of the diversion boxes using dimensions from drawings presented in RPP-RPT-49701, *Waste Management Area C Closure – Conceptual Design Report*, Appendix M, Attachment 1. The surface area multiplied by the depth of penetration and a grout formation factor of 0.30 (assumed concrete void space) equates to an estimated 62 gal of waste remaining on the walls and floor in C-Farm diversion boxes.

4.4.2.4 Transfer Piping. Over 7 miles and 230 separate pipelines with different diameters and lengths exist in C-Farm (RPP-PLAN-47559, *Single-Shell Tank Waste Management Area C Pipeline Feasibility Evaluation*). After their use, pipelines were flushed in an attempt to remove residual waste and it is expected that little residual waste remains in the pipelines. However, some pipelines may have been plugged, some leaked, and little characterization of pipelines has been performed to date.

The WMA C Closure Action Plan (Appendix C of RPP-13774, *Single-Shell Tank System Closure Plan*) assumed that the average line is 3 in. in diameter and that 25% of the lines (~20,000 linear ft) were blocked or plugged. This resulted in an estimate of 250 ft^3 of waste or 1,900 gal in C-Farm. Although deemed conservative, the approach used in RPP-13774 was used for the WMA C Closure Action Plan because the impacts resulting from pipeline residuals were deemed minimal compared to the risk posed from other tank sources. However, RPP-PLAN-47599 indicates that this volume for residual waste in the transfer piping is unrealistically conservative.

The pipeline residual waste volume estimate in RPP-15043 is based on estimated pipe surface area, adsorption of a thin layer of waste (1,000 angstroms) after flushing, and an estimate for fixed waste and waste trapped by clogging. Based on field information, residual waste is expected to reside in only 4% of the total piping. It was assumed to have a cross section area of 1.9 cm^2 (0.29 $in.^2$) with less than 0.1 cm thickness (WHC-SD-WM-ES-259, *Single-Shell Tank Saltwell Transfer Piping Evaluation*). RPP-15043 identified only five plugged transfer lines in all the farms and assumed the plugged lines were ¼ full of waste. Thus, RPP-15043 estimated 4,500 L (1,200 gal) of adsorbed and fixed residual waste may remain in 1,414 pipelines in all the SST farms (Table A-1, RPP-15043). Multiplying the total volume times the fraction of lines in C-Farm (145 lines in C-Farm/1,414 total), the residual volume estimate for C-Farm pipelines was 450 L (120 gal) calculated in 2002. In contrast, RPP-25113, *Residual Waste Inventories in the Plugged and Abandoned Pipelines at the Hanford Site* estimated a residual waste volume of only 28 L (7.4 gal) based on information about the actual conditions of the pipeline systems in C-Farm. This estimate assumed waste residuals in pipelines were insignificant except for the residuals in a plugged cascade line between tanks C-110 and C-111; and because pipelines were

designed to drain by gravity, even the plugged cascade line was expected to have only a small inventory of residual waste.

DOE/RL-2003-11, *Remedial Investigation Report for the 200-CW-5 U Pond/Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-SC-1 Steam Condensate Group Operable Units* conducted a characterization study of two vitrified clay pipelines that discharged effluent from the 231-Z Building to the Z Ditches. These pipelines consisted of 45.7-cm (18-in.)-diameter and 38.1-cm (15-in.)-diameter gravity flow pipes. The study reported that 1.5 and 1.25 in. of residual waste material existed in these pipelines, respectively. This residual waste represents ~4% of the total volume.

This type of line operation represents a condition in which there would be an expectation of residual volume that settled out, which would be higher than in a pressurized pipeline in which the velocity and turbulence of the transported liquid within the pipeline would not be conducive to having residuals settling out. Considering these differences in the hydraulics and sediment transport mechanisms between the vitrified clay pipe and the steel waste transfer pipeline, it is reasonable to conclude that the residuals observed in the vitrified clay pipe would be greater than residuals that would accumulate in the waste transfer pipelines in WMA C.

For the purposes of revising the WMA C pipeline residual estimate, a conservative percent volume of residual was established. Waste Management Area C gravity-fed pipelines (i.e., the cascade lines between the 100-series SSTs) and the one known plugged pipeline (V122) will be assumed to be 100% filled with residual waste for their entire length. Remaining pipelines will be assumed to be 5% filled based conservatively on observations from the residuals found in tank waste transfer pipelines in 241-SY Tank Farm (no discernible residual waste observed) and the residuals found in gravity-drained vitrified pipelines (4% observed). The assumed length of the pipelines was 6.9 miles (36,500 ft); the assumed diameter was 4.25 in. for pipelines with 5% residuals, and 3 in. for gravity-drained cascade lines and the plugged V122 pipeline. These revised assumptions result in a residual pipeline volume of ~6,000 L (~1,600 gal) (RPP-PLAN-47559). This volume was used to estimate the inventory of waste remaining in C-Farm pipelines. However, since potential future impacts of pipe residuals on groundwater will be roughly linearly related to the pipe residual inventory, the potential impacts of higher residual volumes (such as completely full pipes), can be approximated by multiplying the impacts for the 5% full condition by a corresponding factor, and will be discussed in the WMA C PA.

4.4.2.5 2019 Ancillary Equipment Waste Composition and Inventory. Limited sample data is available for catch tank C-301 and CR-Vault and no sample data is available for waste in pipelines or other ancillary equipment. Lacking sufficient data for individual catch tanks and transfer piping, post-retrieval residual waste concentrations in ancillary equipment were assumed to be similar to average residual waste concentrations in retrieved C-Farm tanks (see Appendix C.2). Pre-retrieval tank waste compositions for select tanks may be more representative of waste in plugged pipelines. However, only ~4% of the pipelines were plugged (see Section 4.4.4) and pre-retrieval sample data is limited for many of the C-Farm tanks; as a result, post-retrieval waste compositions were also used for the plugged pipelines.

Ancillary equipment residual inventory tables are shown in Appendix C.2. The current inventory for catch tank C-301 and CR-Vault tanks is 10 times higher than the residual values shown (90% retrieval is assumed). No retrieval is assumed for pits, diversion boxes and pipelines and residual and current volume estimates are assumed to be the same.

This page intentionally left blank.

5. RESIDUAL WASTE INVENTORY ESTIMATES

Chapter 4 describes and presents estimates for waste in the tanks and ancillary equipment in 2002 and 2019. This section presents the basis for estimating inventories for waste residuals that will be left in tanks and ancillary equipment after C-Farm retrievals are completed. Residual waste is defined in Appendix H of the HFFACO (Ecology et al. 1989) as

> "Tank waste remaining in the tank after all waste retrieval actions have been completed. Some materials may be excluded from residual waste volume calculations, subject to approval in the closure plan."

The HFFACO, Appendix H, requires that tanks be retrieved to less than 360 ft^3 for 100-series SSTs and 30 ft^3 for 200-series SSTs or the limit of technology, whichever is lower. The thresholds of 360 ft^3 and 30 ft^3 were the average calculated residual volumes left in each of the 100-series and 200-series SSTs, respectively, after 99% of the waste is retrieved. There are several sizes of SSTs in different tank farms; some tanks are nearly full and others are nearly empty. The C-Farm SSTs are 530,000-gal tanks (compared to 750,000- and 1 million-gal SSTs in other farms) and retrieval of 99% of the waste in C-Farm 100-series SSTs would leave an average volume of 190 ft^3 in each tank, well below 360 ft^3.

A variety of cases for residual waste will be presented (see Figure 5-1):

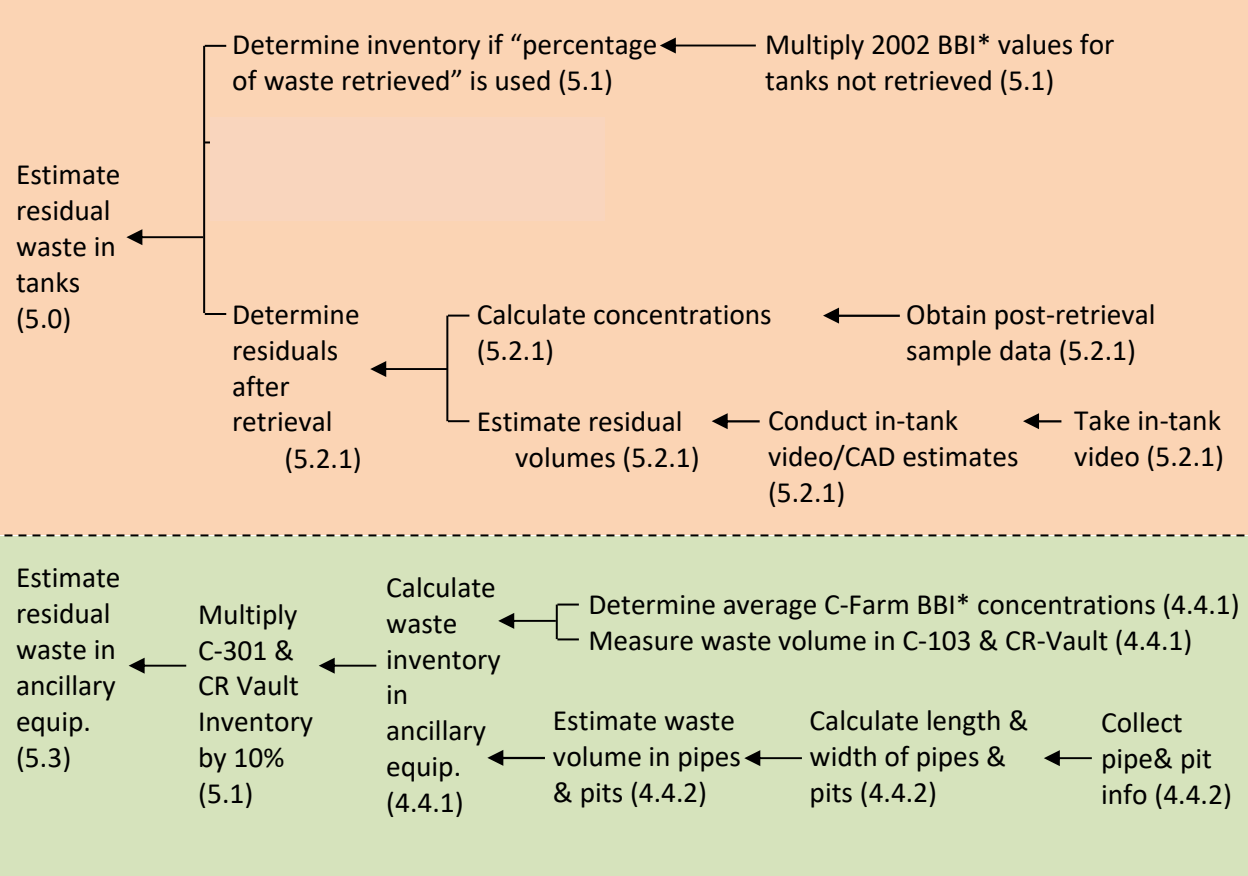
- Estimated residuals assuming 99% of the waste is retrieved (TC & WM EIS case) (Section 5.1)
- Post-retrieval residual waste inventories (Section 5.2.1)
- Residual waste in ancillary equipment (Section 5.3).

By January 1, 2019, retrieval was completed in all of the C-Farm SSTs. The waste residual volumes for these tanks were estimated using liquid displacement measurements and video/computer-aided design (CAD) technology and samples were analyzed to provide the updated 2019 inventory estimates for these tanks. The BBI estimates are based on volume measurements and post-retrieval sample analyses (Table 4-4).

5.1 TANK CLOSURE AND WASTE MANAGEMENT ENVIRONMENTAL IMPACT STATEMENT INVENTORY ESTIMATES

The TC & WM EIS used the December 2002 average BBI estimate for each tank as the assumed composition of residual waste in the C-Farm tanks following retrieval. The 2002 average BBI estimate assumes a uniform mixing of waste in the tanks during the retrieval process and does not consider waste solubility or liquid additions during retrieval. The TC & WM EIS estimated tank waste residuals assuming retrieval of 99% of the starting waste volume; inventory estimates are presented in Appendix C.

Figure 5-1. Process to Estimate Residual Waste Inventory in Tanks, Catch Tanks and Pipelines.



CAD = computer-aided design

5.2 2019 POST-CLOSURE TANK RESIDUAL INVENTORY ESTIMATES

Updated residual inventories were determined for tanks retrieved as of January 1, 2019 (Section 5.2.1).

Post-retrieval inventory estimates are presented in the BBI and in RDRs and associated closure inventory reports for applicable tanks. Closure inventories associated with RDRs are largely the same as those reported in the BBI. However, notable differences do exist for a number of reasons that include the following.

- Not all constituents required by RPP-23403 in the RDRs and closure inventory reports are reported in the BBI. Analytical results and inventory uncertainties for these constituents are included in RDRs and closure inventory reports but are not included in the BBI.

- Per RPP-23403, for analytical concentrations below detection limits, inventories provided in RDRs and closure inventory reports are based on the detection limits. However, for BBI inventories, if template or model-based concentrations are lower than analytical detection limits for a constituent, the inventories are based on the lower value. This is because inventories based on "less than detect" values may be inconsistent with available waste process knowledge. For example, for the C-200 tanks, sample results showed "less than detect values" for lanthanum. For this specific analyte, the BBI assigns a model-based onventory of "0" because process knowledge indicates that there should be no lanthanum in the waste.

Appendix B.2 shows SST residual inventory estimates for 2019 BBI standard constituents at closure. These inventory estimates provide comparison cases with the inventories evaluated in the initial PA (RPP-ENV-58782). Ancillary equipment residual inventories at closure are shown in Appendix C. Appendix D.1 shows closure residual inventory values based on analytical results. The mean estimates for inventories in Table D-1 and the upper confidence estimates provide a basis for the uncertainty in the 2019 post-closure residual inventory estimates.

5.2.1 Post-Retrieval Sample and Volume Measurements

Post-retrieval residual tank waste volumes were estimated using a video camera and CAD system and residual waste was sampled and analyzed in accordance with RPP-23403. Post-retrieval inventory estimates are included in the BBI and in RDRs. Section 5.2.1.1 describes the approach for tank residual sampling; Section 5.2.1.2 presents the laboratory analyses used to determine constituent concentration; and Sections 5.2.1.3 through 5.2.1.5 discuss the process to estimate tank residual volumes in the tank dish, on the surface (walls and stiffener rings), and in tank equipment, respectively. Section 5.2.1.6 summarizes the volume estimates.

5.2.1.1 Tank Residual Sampling. Following retrieval, samples were taken in accordance with RPP-23403 and applicable sample and analysis plans. Data quality objectives were determined following the process described in Section 3.4 of this report. Tank residual sampling methods and results are reported in applicable RDRs and summarized in this section.

Tank samples were obtained using a variety of sampling devices capable of obtaining waste from the tank bottoms. Prior to the SST retrieval program, solids were sampled primarily by a core sampling method or grab sample. New methods described below were developed to sample a thin layer of solids in the tanks.

In tank C-106 a clamshell method was used, similar to a miniature crane (Figure 5-2). Waste was successfully sampled using this method, but a large glovebox was needed to safely extract the sample for analysis.

Finger trap samplers using an articulating retrieval arm were deployed for sampling the C-200 tanks (Figure 5-3). This approach facilitated sampling of solids in piles located away from the risers. The finger trap sampler is lowered into the waste and the waste enters into the sampler.

After the sampler is removed from the waste a trap closes, holding the waste in the sampler. Because the finger trap sampler is small, multiple finger trap samples were needed.

Figure 5-2. Clamshell Sampler.

For tanks C-103, C-104, C-108 and C-109 few solids remained in the tank after retrieval, but they were present across the tank bottom and homogeneity of the solids was unknown. A remotely-operated crawler referred to as the Off-Riser Sampling System, designed to be able to collect samples from any location on the tank bottom, was deployed to sample residuals in these tanks (Figure 5-4). Samples were taken from multiple locations in the tanks. Composite samples were prepared and analyzed per applicable DQOs (see Figure 5-5).

Liquids present in Tanks C-106 and C-103 were sampled. For tank C-103 waste was sluiced with tank 241-AN-106 supernate, and liquids were present in the tank. After retrieval was complete, the residual waste in tank C-103 was triple-rinsed with water (three times the amount of solids was used for each rinse). Liquid samples were taken from the last rinse prior to the final pump-out. Samples were taken at only one location because the rinse liquid was expected to be relatively homogeneous. As expected, contaminant levels in the liquid were very low (comparison of liquid results to solids results is shown in Section 5.2.1.2). Based on the liquid results, the DQO team agreed that in the future, liquid sampling would not be required for residual waste in a tank following a triple rinse with water (RPP-23403). As a result, only solids samples were obtained for tanks C-101, C-102, C-104, C-105, C-107, C-108, C-109, C-110, C-111 and C-112.

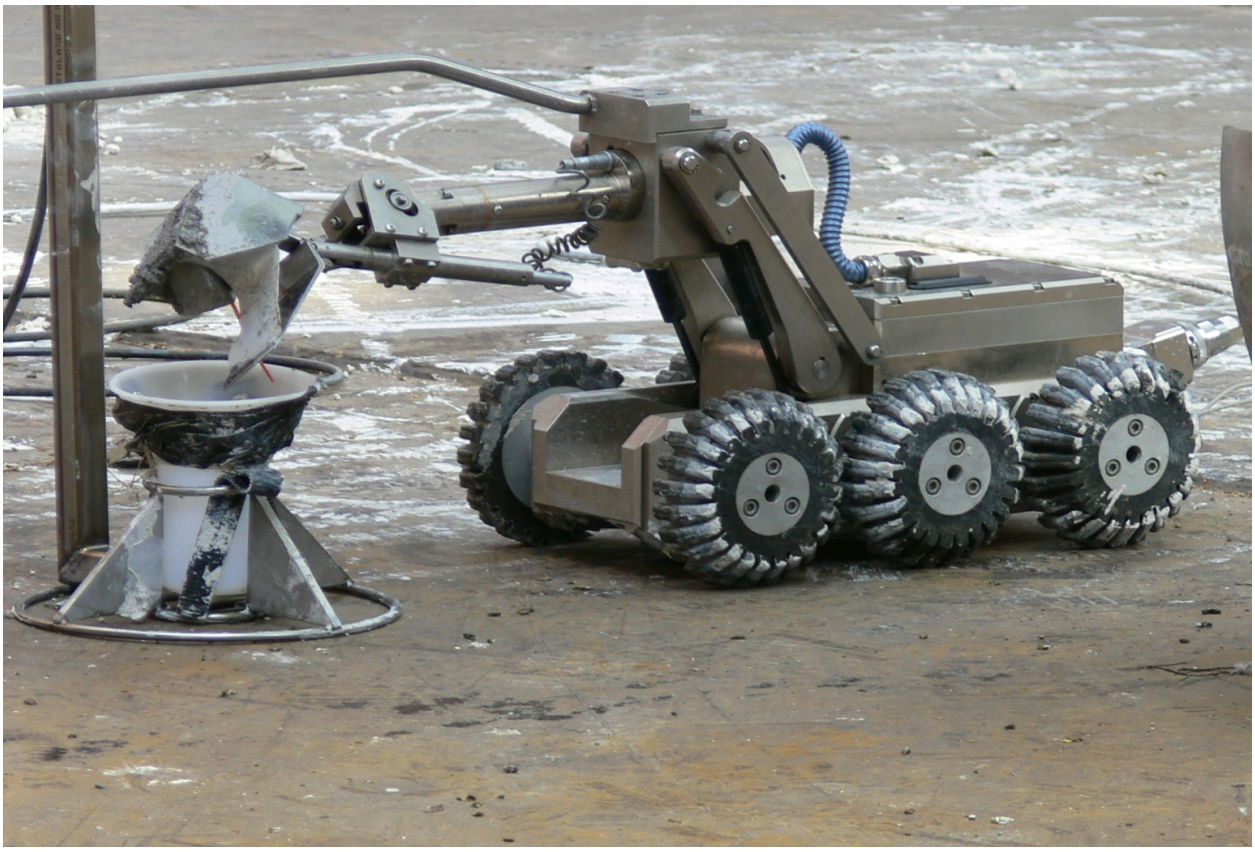
Figure 5-3. Finger Trap Sampler.

5.2.1.2 Tank Residual Analyses. In accordance with the SST Component Closure DQO (RPP-23403), the 222-S Laboratory at Hanford used 22 analysis techniques to obtain the concentration of various organic constituents, inorganic constituents, and radionuclides in the liquid and solids samples (Table 5-1). Samples were analyzed for over 150 constituents in the residual liquids and solids. A description of the analysis techniques and analytical data for tank C-103 appears in RPP-RPT-31239, *Final Report for Tank 241-C-103 Liquid Grab Samples in Support of the Single Shell Tank Component Closure Program*, and in RPP-RPT-31949, *Final Report for Tank 241-C-103 Solid Samples in Support of the Single-Shell Tank Component Closure Program*. Similar techniques were used for tank C-106 (RPP-20226, *Analytical Results for Liquid Grab Sampling and Analysis Plan for Tank 241-C-106 Component Closure Action*, and RPP-20264, *Analytical Results for Tank 241-C-106 Solid Clam Shell Samples Supporting Closure Action*) the C-200 tanks (RPP-21084, *Final Report for Tanks 241-C-201, 241-C-202, 241-C-203, and 241-C-204 Solid Grab Samples*; RPP-RPT-28734, *Final Report for Tank 241-C-202 Post Retrieval Solid Finger Trap Grab Samples*; RPP-RPT-26925, *Final Report for Tank 241-C-203 Post Retrieval Solid Finger Trap Grab Samples*; and RPP-RPT-31949) and other tanks retrieved. Following analysis and review, electronic data are loaded to an electronic database and incorporated into BBI inventory updates.

The 222-S Laboratory performed the analyses according to the quality assurance program requirements (ATL-MP-1011, *ATL Quality Assurance Project Plan for 222-S Laboratory*). In addition, the DQO (RPP-23403) specifies quality control criteria (e.g., standard recovery, matrix

spike recovery, relative difference between duplicate analyses) that are specific to the closure project. The DQO also provides direction for addressing data that do not meet the criteria.

Figure 5-4. Off-Riser Sampling System Sampler.

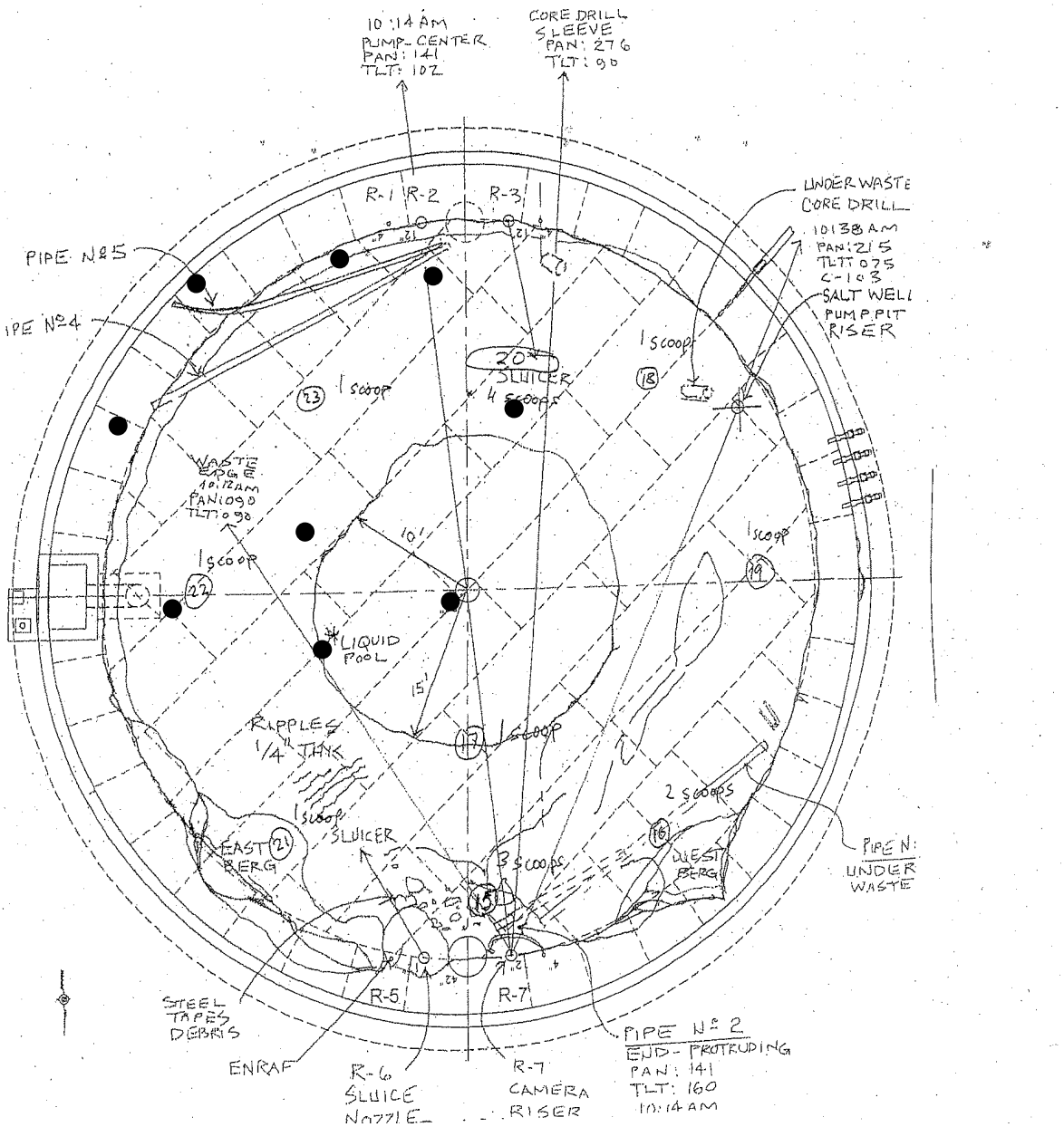


The DQO (RPP-23403) allows for the use of pre-retrieval sample results and post-retrieval waste volume to estimate the residual waste inventory in case post-retrieval sampling cannot be accomplished. However, more water was used during the actual retrieval than anticipated, resulting in the selective removal of soluble constituents. Samples taken from tank C-202 prior to and after completion of retrieval indicate concentrations of some constituents changed significantly during retrieval. The sludge in tank C-201 was sampled prior to retrieval in accordance with RPP-23403. Tank C-201 contained the same waste as tank C-202 and was retrieved using the same method. Therefore, the pre-retrieval sample data for tank C-201 likely are not reasonable estimates of the residual waste composition.

No post-retrieval samples were obtained from tank C-201 because the loss of the rotational capability of the vacuum retrieval arm prevented using it to position sampling devices over areas of waste as was done in other C-200 tanks. Consequently, tank C-201 post-retrieval residual results were estimated based on tank C-202 post-retrieval results. This was done by calculating a ratio of post-retrieval to pre-retrieval concentrations for each constituent based on tank C-202 sample results. Concentrations of tank C-201 residual (post-retrieval) waste constituents were estimated by multiplying the pre-retrieval concentrations to the appropriate tank C-202 concentration ratios. This process and results are reported in RPP-RPT-29889, *Tank 241-C-201*

Residual Waste Inventory Estimates for Component Closure Risk Assessment. This process is justified because SSTs C-201 and C-202 contained waste that was generated by the same process and they contained similar constituents in pre-retrieval samples.

Figure 5-5. Off-Riser Sampling System Sampling Locations for Tank 241-C-103 (indicated by ●).



5.2.1.3 Tank Bottom Residual Waste Volume Estimates. A Camera/CAD Modeling System (CCMS) was used to calculate the volume remaining in retrieved tanks in the tank dish, and videos were used to estimate the volume of waste on the tank wall, on stiffener rings, and in equipment void spaces. The CCMS approach is described in RPP-31159, *Post-Retrieval Waste*

Volume Determination for Single-Shell Tank 241-C-103, and results are included in applicable tank RDRs. Uncertainties in residual inventories are discussed in Chapter 6.

Table 5-1. Analyses Performed.

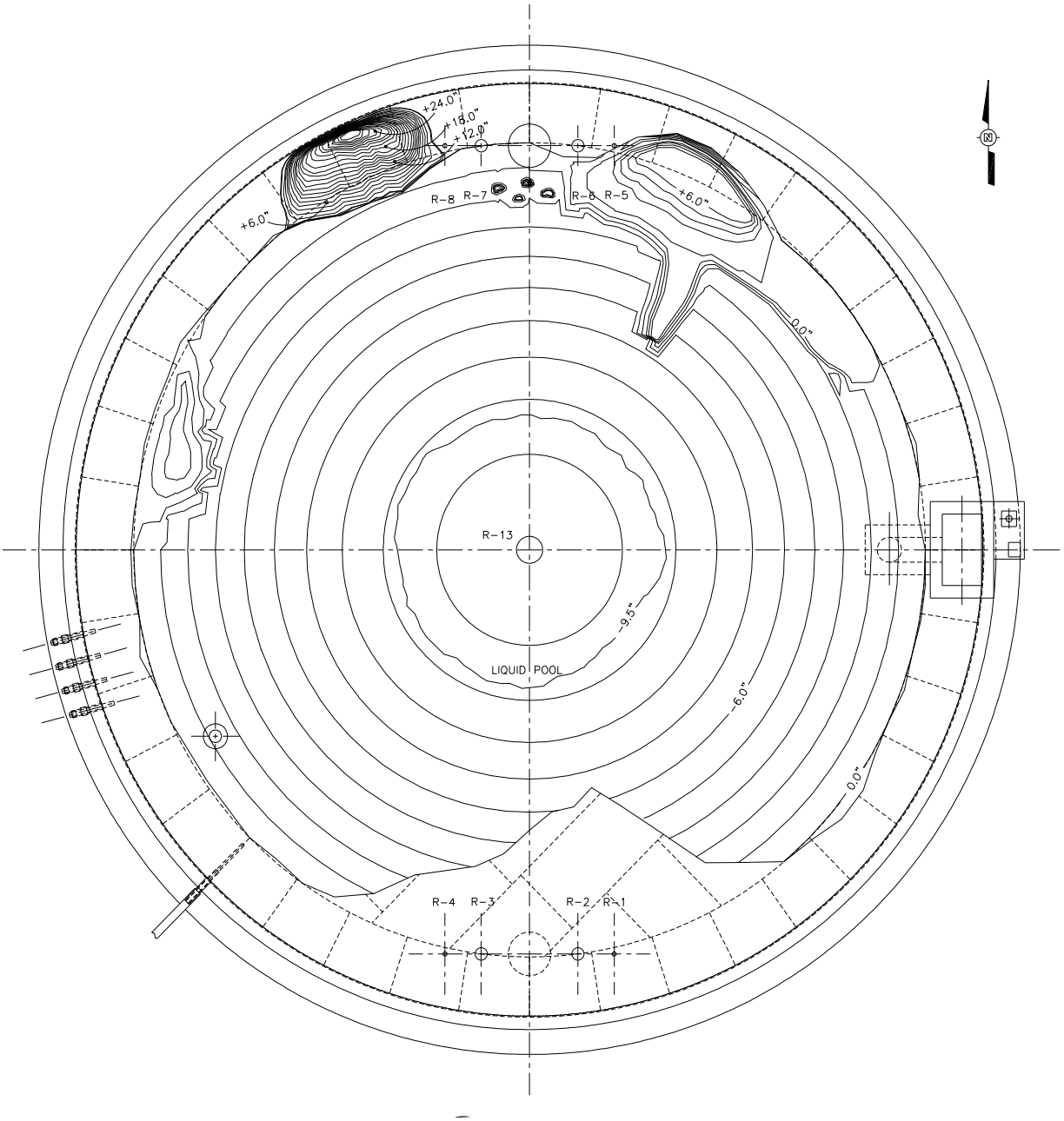
Analysis
Inorganic Analyses
Appearance
Specific gravity
pH
Sulfide – ion selective electrode
Thermogravimetric analysis – gravimetric
Cyanide – spectrophotometric
Mercury – cold vapor atomic absorption
Ammonia – ion chromatography
Ion chromatography
Inductively coupled plasma-mass spectrometry: actinides
Inductively coupled plasma-mass spectrometry: ^{99}Tc
Inductively coupled plasma
Radiochemical Analyses
Gamma energy analysis
^{90}Sr – separation/beta counting
^{14}C – liquid scintillation
^{129}I – separation/gamma energy analysis
^{79}Se – liquid scintillation
^{3}H – liquid scintillation
^{241}Am – alpha energy analysis
$^{239/240}$Pu, ^{238}Pu – alpha energy analysis
^{63}Ni – liquid scintillation
Organic Analyses
Volatile organic analysis – gas chromatography/mass spectrometry
Semivolatile organic analysis – gas chromatography/mass spectrometry
Polychlorinated biphenyl – gas chromatography/electron capture detector

To implement the CCMS method, in-tank videos of SSTs were recorded following retrieval. The videos document the location of residual solid waste and pools remaining in the tank. Figure 5-6 shows a photo of tank C-204 residual waste after retrieval. The photo shows most of the tank bottom and an old pump, a cut-off dip tube assembly, and a sludge jet educator assembly in the tank.

Figure 5-6. Photograph of Tank 241-C-204 Post-Retrieval Residual Waste.

Computer-aided design three-dimensional software was used as part of the CCMS approach. Using the software, a three-dimensional model of the SST bottom interior was built, and video of the tank waste was reviewed. Knowledge of tank construction, plate lengths and heights, the size of debris in the tanks, and other measurable features were used as a guide to estimate the area and height of waste remaining in the tank. Waste volume estimates were made by trained and qualified CCMS personnel (RPP-23403). The CCMS modelers directed the obtaining of videos and reviewed videos of the waste residuals from several angles to estimate waste areas and thickness in the tank at multiple locations. For some tanks, a crawler with known dimensions was moved near the waste at key positions to better estimate waste thickness. A rough sketch of waste area and thickness estimates was prepared and area and thickness estimates were entered into the CCMS model to calculate the volume of residual waste formations in the bottom dish. The CCMS also created a digital terrain model of the waste surface. An example digital terrain model for tank C-103 created from CCMS videos taken on August 25, September 19 and September 26, 2006 is shown in Figure 5-7. Figure 5-8 shows a still photograph taken from C-103 in-tank videos to estimate waste volume.

Figure 5-7. Single-Shell Tank 241-C-103 Land Desktop Post-Retrieval Tank Waste Volume Contour Map.



Note: Created from computer/computer-aided design modeling system videos taken on August 25, September 19 and September 26, 2006.

5.2.1.4 Estimate of Waste Remaining on Tank Surfaces. Video observations were also used to estimate the volume of waste remaining on the walls and stiffener rings (Figure 5-9). The fraction of waste on the walls and estimated thickness of the waste is determined from the video observations. The average waste thickness was determined from the contrast of the shadows cast in the video recording with the camera light. A similar approach was used to estimate the

amount of waste on the stiffener rings. The approach to estimate waste remaining on tank surfaces is further described in RPP-31159.

Figure 5-8. Photo from Video for Computer/Computer-Aided Design Modeling System Volume Estimates of Tank 241-C-103.

5.2.1.5 Estimate of Waste in Tank Equipment. The waste remaining in in-tank equipment was also determined using in-tank video. Tanks contain several pieces of equipment and a number of pipe sections and other debris. Sluicers and slurry pumps used to retrieve the waste were assumed to contain no waste. The sluicers were used to add water rinses to the tank after the completion of sluicing and were blown out to remove any remaining liquid. After the completion of sluicing, the slurry pump was used to pump rinse water and was drained after its final use. Vacuum retrieval arms in the C-200 tanks were used to remove rinse water from the tanks and were drained after final use. The sluicers, slurry pump, and the vacuum retrieval arms contained no waste. In accordance with the DQO (RPP-23403), void spaces in equipment and debris left in the tank were assumed to be filled with waste unless a compelling reason could be made that justified a change in this assumption. In tank C-103, no waste was observed between the plate at the bottom of the pump and the pump suction. A number of pipes and pipe-like equipment containing waste were observed in the videos. The volume of residual waste left in this equipment was calculated by using the videos to estimate the location and dimensions of the

equipment and process knowledge to estimate the depth to which the pump could be filled with waste (RPP-RPT-33060, *Retrieval Data Report for Single-Shell Tank 241-C-103*).

Figure 5-9. Tank 241-C-103 Waste on Walls and Stiffener Rings.

5.2.1.6 Summary of Tank Residual Volume Estimates for Tanks Retrieved. Table 5-2 summarizes the estimates for the volume of waste left after retrieval. These estimates are based on video observation and CCMS calculations. Dish bottom volumes were determined separately for visible solids and liquid pools. The fraction of solids beneath the pools is unknown and separate liquid samples were not obtained for most tanks. As a result, except for tanks C-106 and C-103, from which supernate samples were obtained, dish bottom pool inventories were calculated using saturated solids sample results and pool volumes were included with sludge volume estimates (Table 4-4).

5.3 ANCILLARY EQUIPMENT RESIDUAL INVENTORIES

The ancillary equipment includes the C-301 catch tank, the tanks in the CR-Vault, pits, diversion boxes, and pipelines. Ancillary equipment residual waste volume estimates prior to retrieval are discussed in Chapter 4 and summarized in Tables 4-6 to 4-8.

Table 5-2. 2019 241-C Tank Farm Post-Retrieval Waste Volume Estimates (cubic feet).

Tank	Component				
	In Dish Bottom*		In Tank Equipment	On Stiffener Rings and Walls	Total
	Solids	Pool			
241-C-101[a]	462	113	0	156	731
241-C-102[b]	1,470	346	0	253.9	2,070
241-C-103[c]	233	33	3.6	68.4	338
241-C-104[d]	58	170	0	26.6	255
241-C-105[e]	65.6	23.7	6.1	100.1	196
241-C-106[f]	336.9	11.3	4.84	17.3	370.3
241-C-107[g]	221	708	0	439	1,368
241-C-108[h]	334	31	0	91.9	457
241-C-109[i]	111	119	1.9	35.7	268
241-C-110[j]	96	172	0	13.4	281
241-C-111[k]	484	119	0	50.9	654
241-C-112[l]	831	450	0	41.6	1,323
241-C-201[m]	10.5	0.2	3.4	5.1	19.2
241-C-202[n]	8.2	0.3	6.1	5.1	19.7
241-C-203[o]	11.7	1.7	0	5.1	18.5
241-C-204[p]	9.3	0.4	3.4	5.3	18.4

*Except for 241-C-106, 241-C-103 and C-200 SSTs, dish bottom estimates are camera/computer-aided design modeling system values multiplied by the applicable regression equation (see Section 6.1). The fraction of solids in dish bottom pools is unknown, therefore except for C-103 and C-106, pool volumes were included with sludge volume estimates (Table 4-4).

[a] RPP-CALC-56434, *Post-Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-101*.

[b] RPP-RPT-59004, *Post-Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-102*.

[c] RPP-RPT-33060, *Retrieval Data Report for Single-Shell Tank 241-C-103*.

[d] RPP-CALC-54284, *Post-Hard Heel Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-104*.

[e] RPP-RPT-60731, *Post-Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-105*.

[f] RPP-20577, *Stage II Retrieval Data Report for Single-Shell Tank 241-C-106*, and RPP-19866, *Calculation for the Post-Retrieval Waste Volume Determination for Tank 241-C-106*.

[g] RPP-CALC-59985, *Post-Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-107*

[h] RPP-CALC-54266, *Post-Hard Heel Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-108.*

[i] RPP-CALC-54759, *Post-Hard Heel Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-109.*

[j] RPP-CALC-56399, *Post-Hard Heel Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-110*.

[k] RPP-CALC-59377, *Post-Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-111*.

[l] RPP-RPT-58383, *Post Hard Heel Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-112*.

[m] RPP-RPT-30181, *Retrieval Data Report for Single-Shell Tank 241-C-201*.

[n] RPP-RPT-29095, *Retrieval Data Report for Single-Shell Tank 241-C-202*.

[o] RPP-RPT-26475, *Retrieval Data Report for Single-Shell Tank 241-C-203*.

[p] RPP-RPT-34062, *Retrieval Data Report for Single-Shell Tank 241-C-204.*

For the 2002 estimates based on ancillary equipment volumes in the EIS inventory data package (DOE/ORP-2003-02), inventories were estimated assuming 99% retrieval of the waste in C-301 and CR-Vault catch tanks. Residual waste concentrations were assumed to be the same as pre-retrieval concentrations. The 2002 estimates assumed that waste will not be removed from pits, diversion boxes or transfer pipelines during or after retrieval and waste volume and inventory for these system components will remain unchanged. These inventory estimates are presented in Appendix C.2.

For updated residual inventory estimates, it was also assumed that waste will not be removed from pits/diversion boxes or transfer pipelines during or after retrieval and waste volume and inventory for these system components will remain unchanged. However, waste will likely be retrieved from catch tanks and IMUSTs as determined during the closure process. No decision or direction has been given to date regarding removal of waste from ancillary equipment. Therefore, it was assumed (somewhat arbitrarily) that 90% of the waste in catch tanks and IMUSTs will be retrieved. No sample data is available for the waste composition in pits/diversion boxes or pipelines, and little data is available for C-301 catch tank or CR-Vault tanks. As a result, residual waste concentrations in ancillary equipment are assumed to be represented by the average January 1, 2019 residual concentrations for retrieved and sampled C-Farm tanks. The basis for this assumption was discussed in Section 4.4.2.5. These post-retrieval ancillary equipment residual waste estimates at closure are provided in Appendix C.2. The inventory for constituents in CR-001 in CR-Vault is adjusted for water intrusions assumed to account for the change from 930 gal to 4,340 gal between 1994 and 2018 (see Appendix A.1).

6. INVENTORY UNCERTAINTY

This section summarizes the uncertainty of BBI and residual inventory estimates.

The relative standard deviations (RSDs) for detected sample-based residual waste concentrations vary from 0.01 to 0.81, with an average of 0.17. The RSD for less-than-detect values is assumed to be 1.0. Uncertainty estimates for specific tank inventories and constituents are presented in Appendix D. The basis for these uncertainty estimates is presented in the following sections.

6.1 BEST-BASIS INVENTORY UNCERTAINTY

The following description of BBI uncertainty is from Appendix B of RPP-7625.

Inventory uncertainties were divided into three phases: sludge, saltcake, and supernate. For each phase, the equation for the inventory of a constituent is

$$I = C \times D \times V$$

Where:

- I = Inventory
- C = Concentration
- D = Density
- V = Volume.

The term “density” is used to denote “Bulk Density” or “Specific Gravity” depending on the waste phase, solid or liquid. In this equation, C denotes constituent concentration, D the density of the waste, and V the volume of the waste in the phase.

The uncertainty in the inventory is calculated in terms of standard deviations (SDs). The RSD is the SD divided by the mean; i.e., it is the SD expressed as a percent of the mean. If it is assumed that the three variables C, D, and V are independent of each other, then the RSD^2 of the product is, approximately,

$$RSD^2(I) \cong RSD^2(C) + RSD^2(D) + RSD^2(V)$$

Therefore, the uncertainty of the inventory is a function of the uncertainty (RSD) of each of its components; concentration (C), density (D), and volume (V). For liquids, the RSD associated with density (specific gravity) is omitted from the equation because the concentrations are reported on a volumetric basis (µg/mL or µCi/mL) and the density is not used in calculating the inventory. The statistical techniques used to combine the inventory estimates for the waste phases and used to combine the RSDs are given in detail in RPP-6924, *Statistical Methods for Estimating the Uncertainty in the Best Basis Inventories*. Sample-based and template-based inventory RSD results are presented in the calculation detail report in the Tank Waste Information Network System (see Appendix D).

RPP-6924 also gives equations for confidence intervals for constituent inventories. Standard practice for an estimated 95% confidence interval is to multiply the SD of the mean by 2 and add that value to the mean. The SD of the mean can be calculated from the RSDs by multiplying each RSD by its associated inventory. The confidence interval is then calculated as shown in the following:

$$\text{Upper confidence interval on an inventory} = \text{Inventory} + 2 \times \text{RSD} \times \text{Inventory}$$
$$\text{Lower confidence interval on an inventory} = \text{Inventory} - 2 \times \text{RSD} \times \text{Inventory}$$

The mean values for BBI constituents and other constituents analyzed and the 95% upper confidence limit (UCL) for these constituents are provided in RDRs and are included in Appendix D.1 and D.2. The basis for concentration, density and volume uncertainties is described in the following sections.

6.1.1 Concentration Uncertainty

6.1.1.1 Sample Uncertainty. Residual concentration uncertainties for tanks retrieved are uncertainties in residual waste analytical results. As discussed in Chapter 5, samples were collected in accordance with the SST Component Closure DQO (RPP-23403). Samples were collected at multiple locations in the residual waste in an attempt to provide a representative sample. The variation in sample results obtained at different locations was factored into analytical uncertainty estimates in the BBI. In addition, sample uncertainty includes variability between primary and duplicate samples and other quality controls specified in the DQO and sampling and analysis plan.

Most analytical RSDs shown in Appendix D.1 for tanks retrieved are between 0.01 and 0.2. However, values range to as high as 0.8 for a few constituents and the BBI assigns an RSD of 1.0 for estimated values below detection limits.

Radionuclides and chemical constituents with low concentrations tend to have higher RSDs than those with high concentrations.

6.1.1.2 Waste Type Template Uncertainty. Waste type template values were used for BBI estimates when analytical sample data were not available for a constituent (see Section 4.1.2). Although sample-based RSDs mostly fall between 0.01 and 0.20, template RSDs can be much larger (as large as 17.0 for uranium; most values are 2.0 or lower). These results have large uncertainties because some are based on tank averages which have large variability with few data points. Waste type templates and uncertainties are described in RPP-8847 and included in Appendix D.3.

In the templates, the RSDs for sample-based composition data were calculated based on groups of solid waste types that were expected to have similar characteristics and variability. The solid waste type groups used for C-Farm waste are listed in Table 6-1. These groupings are based on knowledge of both separation plant and tank farm processes. Sample-based templates were not developed for other waste types including PUREX/REDOX zirconium cladding waste (1968-1972) (CWZr1), Hot Semiworks waste (1961-1968) (HS), and $BiPO_4$ metal waste

(1944-1949) (MW1) (see Table 4-3) because smaller amounts of these waste types were added to the tanks and a representative sample layer with only these waste types could not be obtained.

Table 6-1. Sample-Based Templates Used to Calculate Relative Standard Deviations for 241-C Tank Farm Solid Waste Types.

Waste Type Group*	Common Factors to Group
1C, 2C, 1CFeCN	Bismuth phosphate bearing waste generated by decontamination of the $BiPO_4$ process plutonium product.
CWP1, CWP2, CWR1	Wastes generated by the decladding of aluminum clad reactor fuel.
TBP, PFeCN, TFeCN	Wastes resulting from the retrieval of metal waste for uranium recovery (typically high fission product waste).

*Bold waste types are included in 241-C Tank Farm residual inventory calculations.

1C = First cycle $BiPO_4$ coating waste (1944-1956)
1CFeCN = Ferrocyanide sludge from in-plant scavenging of T-Plant 1C waste (without coating waste)
2C = Second cycle $BiPO_4$ decontamination waste
CWP1 = PUREX aluminum cladding waste (1956-1960)
CWP2 = PUREX aluminum cladding waste (1961-1972)
CWR1 = Reduction-Oxidation (S Plant) aluminum cladding waste
PFeCN = Ferrocyanide sludge from tributyl phosphate (TBP) in-plant scavenged supernate and co-disposed TBP sludge
TFeCN = Ferrocyanide sludge (1955-1958)

For the sample-based templates, RSDs were calculated in the following manner. For each constituent in a waste phase, a variance σ^2 is calculated using the mean square error from an analysis of variance. The analysis of variance is fit to the group results using waste type as the factor. The mean square error is a "pooled" variance based on differences in tank-to-tank average concentrations. Because the sample-based concentrations cover a wide range of values, a log transformation was applied. This requires that variances, calculated on the log scale, be converted back to the original units. The conversion assumes a "lognormal" distribution for differences within waste types.

A variable "*X*" is lognormally distributed if *Y = ln(X)* has a normal (Gaussian) distribution. Estimates of the parameters for *Y*, on the log scale, can be expressed as parameters for *X*. The transformation, however, is not simply *X = exp(Y)*, which relates the median of *Y* to the median of *X*. When *Y* has mean, μ, and variance, σ^2, the mean of *X* is *exp*($\mu + 0.5 * \sigma$^2), the variance is $(exp(\sigma\text{^}2)-1) * exp(2\mu + \sigma\text{^}2)$, and the estimated RSD is $sqrt(exp(\sigma\text{^}2)-1)$.

In situations where only concentration detection limits are available, the detection limits are used to calculate the mean concentrations. A default RSD of 1.00 was assumed when more than 50% of concentrations used in a template calculation for a given constituent are below detection limits or when concentration data were limited to a single detected value that was determined to be reasonable based on comparison to other detection limits and/or the HDW model.

6.1.2 Density Uncertainty

The density or specific gravity of the waste is also estimated from tank sample data. The technique for estimating the RSDs for density is reported in RPP-6924. The RSDs are given in Table 6-2.

Table 6-2. Relative Standard Deviations for Bulk Density and Specific Gravity by Type of Tank and Waste Phase.

Tank and Phase	Method	Relative Standard Deviation (%)
Single-shell tank, liquid	Specific gravity	5.90%
Single-shell tank, solid	Bulk density	7.55%

6.1.3 Volume Uncertainty

Volume estimates for retrieved tanks are based on CCMS measurements, described in Section 5.2. Initially, volume uncertainty equations for CCMS estimates were determined based on preliminary tests and a tank C-106 volume estimate (RPP-RPT-22891, *Revised Methodology to Calculating Residual Waste Volume at 95% Confidence Interval*).

The test was performed in a clean tank outside of the tank farms (the Cold Test Facility). Videos were obtained of 18 sand piles with measured volumes. Each was set up with different waste configurations to represent waste remaining in 100-series and 200-series post-retrieval tank farm waste tanks. Each videotape contained three sets of sand piles. Modelers looked at the video tapes and estimated the volume of each of the sand piles using the CCMS method. The volumes of the 18 Cold Test Facility points ranged from ~2 to ~50 ft^3, while the SST C-106 points are 348.19 ft^3 and 364 ft^3.

Another data point was obtained from a CCMS estimate of the residual waste volume in SST C-106 (~350 ft^3) compared to an estimate of residual waste volume using the Enraf®[1] displacement/submergence method. The Enraf® displacement measurement was calculated as the difference between Enraf® measurements of the volume of residual waste in tank C-106 after retrieval but before liquids were pumped from the tank, and the volume of liquids pumped from the tank (as measured by a flow totalizer and the change in liquid surface level measurements in a receiver tank). This was thought to be a more accurate measurement of the remaining residuals and provided an additional data point.

A regression line was calculated to estimate a 95% confidence interval for CCMS estimates of waste in the bottom of the tank. This approach to estimate CCMS uncertainty for waste on the tank bottom was approved through the DQO process and documented in the SST Component Closure DQO (RPP-23403, Rev 3).

[1] Honeywell Enraf® is a registered trademark of Honeywell International Inc., Corporation Delaware, 101 Columbia Road Morristown, New Jersey.

The following uncertainty equation was developed and applied for CCMS estimates for tanks retrieved through January 1, 2009:

$$\text{Actual Waste Volume @95\%UCL (ft)}^3 = 1.043 \times \text{CCMS In-Tank Volume Est.ft}^3 + 0.852$$

The CCMS volumes for tanks retrieved through January 1, 2009 were all determined by the same qualified operator on which the uncertainty equation was developed.

The volume of residual waste on the stiffener rings and walls was also determined based on the review of videos by estimating the thickness of waste on the ring and how much of the ring had waste. Equipment in the tank was also evaluated to determine the existence of void spaces that could contain waste. Any void spaces were conservatively assumed to be filled with waste. The assumptions concerning residual waste on the stiffener rings, in the void space of equipment, and on the tank walls are best-estimate values and do not require the determination of a confidence interval.

Table 6-3 shows 95% UCL residual waste volume estimates for tanks retrieved through January 1, 2009.

Table 6-3. 95% Upper Confidence Limit Post-Retrieval Waste Volume Estimates (cubic feet) for 241-C Farm Tanks Retrieved before 2009.

Component	C-103[a]	C-106[b]	C-201[c]	C-202[d]	C-203[e]	C-204[f]
In dish bottom	279	442	12.0	9.7	14.8	10.9
In tank equipment	3.6	4.8	3.4	6.1	0	3.4
On stiffener rings and walls	68.4	17	5.1	5.1	5.1	5.3
Total	351[g]	466[h]	20.5	20.9	19.9	19.6

[a] RPP-RPT-33060, *Retrieval Data Report for Single-Shell Tank 241-C-103*.

[b] RPP-20577, *Stage II Retrieval Data Report for Single-Shell Tank 241-C-106*, and RPP-19866, *Calculation for the Post-Retrieval Waste Volume Determination for Tank 241-C-106*.

[c] RPP-RPT-30181, *Retrieval Data Report for Single-Shell Tank 241-C-201*.

[d] RPP-RPT-29095, *Retrieval Data Report for Single-Shell Tank 241-C-202*.

[e] RPP-RPT-26475, *Retrieval Data Report for Single-Shell Tank 241-C-203*.

[f] RPP-RPT-34062, *Retrieval Data Report for Single-Shell Tank 241-C-204.*

[g] In accordance with RPP-23403, *Single-Shell Tank Component Closure Data Quality Objectives*, Rev. 3, 1.043 × dish bottom volume + 0.85 + Equip + Rings + Wall.

[h] In accordance with RPP-13889, *Tank 241-C-106 Component Closure Action Data Quality Objectives.*

The CCMS uncertainty equation was revised for tanks retrieved after January 1, 2009 based on additional CCMS testing (RPP-23403, Rev. 4). The new testing was conducted to develop qualification videos for additional CCMS operators because the video results from Test #1 were used to train others on the CCMS process and it was determined that the tank C-106 CCMS estimate should not be used and larger piles were needed as part of the qualification video to establish a statistical correlation. Like the initial tests at the Cold Test Facility, sand piles with

known volumes were placed in configurations attempting to simulate tank waste and videos of the piles were obtained. Two operators provided CCMS estimates for each sand pile. Sand piles ranged from 5 to ~250 ft^3 in size.

The new equation developed to be applied to future retrievals was:

$$\text{Residual volume } (ft^3) = 1.195 \times \text{CCMS estimate} + 0.27\ ft^3$$

This equation provides a greater uncertainty, but is based on a larger data set and is more defensible. This equation was applied to CCMS estimates in Table 5-3 for tanks C-104, C-108, C-109 and C-110 and was used as both an "actual" and upper bound (95%) estimate.

In 2015 the equation was again revised based on an additional set of CCMS video estimates. Both an average calculation and a 95% upper bound calculation were developed (RPP-23403, Rev. 6). The equations developed to be applied to future retrievals were:

$$\text{Average Residual volume } (ft^3) = 1.125 \times \text{CCMS estimate} + 0.53\ ft^3$$
$$\text{95\% UCL Residual volume } (ft^3) = 1.132 \times \text{CCMS estimate} + 17.09\ ft^3$$

These equations were applied to CCMS estimates in Table 5-3 for tanks C-101, C-107, C-112, C-102, C-111 and C-105.

Table 6-4 shows 95% UCL residual waste volume estimates calculated using the applicable equations for C-Farm tanks retrieved after 2009.

Table 6-4. 95% Upper Confidence Limit Post-Retrieval Waste Volume Estimates (cubic feet) for 241-C Farm Tanks Retrieved after 2009.

Component	C-101[a]	C-102[b]	C-104[c]	C-105[d]	C-107[e]	C-108[f]	C-109[g]	C-110[h]	C-111[i]	C-112[j]
In dish bottom	596	1,844	228	106	951	365	230	268	623	1,306
In tank equipment	0	0	0	6.1	0	0	1.9	0	0	0
On stiffener rings and walls	156	254	26.6	100	439	92	36	13.4	51	41.6
Total Residual Volume	752	2,098	255	213	1,390	457	268	281	674	1,348

[a] RPP-RPT-58803, *Tank 241-C-101 Residual Waste Inventory Estimates for Component Closure Risk Assessment.*
[b] RPP-RPT-59129, *Tank 241-C-102 Residual Waste Inventory Estimates for Component Closure Risk Assessment.*
[c] RPP-RPT-55307, *Tank 241-C-104 Residual Waste Inventory Estimates for Component Closure Risk Assessment*.
[d] RPP-RPT-61102, *Tank 241-C-105 Residual Waste Inventory Estimates for Component Closure Risk Assessment.*
[e] RPP-RPT-58514, *Tank 241-C-107 Residual Waste Inventory Estimates for Component Closure Risk Assessment.*
[f] RPP-RPT-54757, *Tank 241-C-108 Residual Waste Inventory Estimates for Component Closure Risk Assessment*.
[g] RPP-RPT-55803, *Tank 241-C-109 Residual Waste Inventory Estimates for Component Closure Risk Assessment*.
[h] RPP-RPT-56703, *Tank 241-C-110 Residual Waste Inventory Estimates for Component Closure Risk Assessment*.
[i] RPP-RPT-59714, *Tank 241-C-111 Residual Waste Inventory Estimates for Component Closure Risk Assessment.*
[j] RPP-RPT-58692, *Tank 241-C-112 Residual Waste Inventory Estimates for Component Closure Risk Assessment.*

This page intentionally left blank.

7. REFERENCES

0075083, 2008, "Department of Ecology Letter of Completion for Retrieval Data Reports (RDR) for Single-Shell Tanks (SST) 241-C-103, 241-C-201, 241-C-202, 241-C-203, and 241-C-204," (letter from J. L. Lyon to S. J. Olinger, Office of River Protection, U.S. Department of Energy, January 7), Nuclear Waste Program, State of Washington Department of Ecology, Richland Washington.

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," Subpart D—Technical Requirements for Land Disposal Facilities, § 61.55, Waste Classification, *Code of Federal Regulations*, as amended.

7G400-03-SMM-003, 2003, "Shipments of Cesium-137 and Strontium-90 from the Hanford Site (1961 through 1977)" (Interoffice memo from M. E. Johnson to B. A. Higley, April 22), CH2M HILL Hanford Group, Inc., Richland, Washington.

ARH-CD-691, 1976, *Strontium Recovery from PUREX Acidified Sludge*, Atlantic Richfield Hanford Company, Richland, Washington.

ATL-MP-1011, 2014, *ATL Quality Assurance Project Plan for 222-S Laboratory*, Rev. 12-3, Advanced Technologies and Laboratories International, Inc., Richland, Washington.

CH2M HILL, 2003, *Hanford Facility Dangerous Waste Part A Permit Application, Form 3, Revision 8, for the Single-Shell Tank System*, CH2M HILL Hanford Group Inc., Richland, Washington.

Consent Decree, *State of Washington v. Department of Energy*, Case No. CT-99-5076-EFS, United States District Court, Eastern District of Washington (September 9, 2003).

Consent Decree Case No. CV-08-5085-FVS, United States District Court Eastern District of Washington, October 25, 2010, as amended by the Amended Consent Decree, Case No. CV-08-5085-RMP (March 11, 2016), and the Second Amended Consent Decree, Case No. CV-08-5085-RMP (April 12, 2016).

DOE/EIS-0391, 2012, *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*, Rev. 0, U.S. Department of Energy, Office of River Protection, Richland, Washington.

DOE O 435.1, 2001, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C.

DOE/ORP-2003-02, 2003, *Environmental Impact Statement for Retrieval, Treatment, and Disposal of Tank Waste and Closure of Single-Shell Tanks at the Hanford Site, Richland, WA Inventory and Source Term Data Package*, Rev. 0, U.S. Department of Energy, Office of River Protection, Richland, Washington.

DOE/RL-88-30, 2019, *Hanford Site Waste Management Units Report*, Rev. 28, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-92-18, 1993, *Semiworks Source Aggregate Area Management Study Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2003-11, 2004, *Remedial Investigation Report for the 200-CW-5 U Pond/Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-SC-1 Steam Condensate Group Operable Units*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order – Tri-Party Agreement*, 2 vols., as amended, State of Washington Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

EPA/240/B-01/003, 2001, *EPA Requirements for Quality Assurance Project Plans EPA QA/R-5*, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

EPA/600/R-96/055, 2000, *Guidance for the Data Quality Objectives Process EPA QA/G-4*, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

H-2-432, 1969, *Piping Between 241B and 241C*, Rev. 6, Hanford Engineer Works, Richland, Washington.

H-2-4554, 1963, *Vent Filter VF-E1 Strontium Storage and Loadout Facility*, Sheet 1, Rev. 1, Atomic Energy Commission, Richland Operations Office, Richland, Washington.

H-2-4573, 1966, *Engineering Flow Diagram, C-Farm Cesium Loadout Facility*, Sheet 1, Rev. 2, Bovay Engineers, Richland, Washington.

HAN-95105-DEL, 1966, *Monthly Status and Progress Report June, 1966*, U.S. Atomic Energy Commission, Richland Operations Office, Richland, Washington.

HAN-96805-DEL, 1967, *Monthly Status and Progress Report February 1967*, U.S. Atomic Energy Commission, Richland Operations Office, Richland, Washington.

HNF-EP-0182, 2009, *Waste Tank Summary Report for Month Ending December 31, 2008*, Rev. 249, Washington River Protection Solutions, LLC, Richland, Washington.

HNF-EP-0182, 2019, *Waste Tank Summary Report for Month Ending December 31, 2018*, Rev. 372, Washington River Protection Solutions, LLC, Richland, Washington.

HNF-SD-WM-DQO-001, 2018, *Data Quality Objectives for Tank Farms Waste Compatibility Program*, Rev. 24, Washington River Protection Solutions, LLC, Richland, Washington.

HNF-SD-WM-DQO-026, 1997, *Data Quality Objective to Support Resolution of the Organic Solvent Safety Issue*, Rev. 0, DE&S Hanford, Inc./Lockheed Martin Hanford Corporation/ARES Corporation, Richland, Washington.

HNF-SD-WM-SP-012, 2007, *Tank Farm Contractor Operation and Utilization Plan*, Rev. 6, CH2M HILL Hanford Group, Inc., Richland, Washington.

HW-7-1388-DEL, 1945, *Hanford Engineer Works Monthly Report February 1945*, E. I. du Pont de Nemours and Company, Richland, Washington.

HW-10475 C-DEL, 1944, *Hanford Technical Manual Section C*, General Electric Company, Richland, Washington.

HW-19140, 1951, *Uranium Recovery Technical Manual*, General Electric Company, Richland, Washington.

HW-34487, 1955, *Scavenging of Stored TBP Waste*, General Electric Company, Richland, Washington.

HW-38955-REV, 1955, *"In-Farm Scavenging" Operating Procedure and Control Data*, General Electric Company, Richland, Washington.

HW-66297, 1960, *Strontium-90 – Recovery and Lag Storage Interim Program*, General Electric Company, Richland, Washington.

HW-72666, 1963, *Hot Semiworks Strontium-90 Recovery Program*, General Electric Company, Richland, Washington.

HW-79377, 1963, *Hanford Laboratories Monthly Activities Report October, 1963*, General Electric Company, Richland, Washington.

HW-79480, 1963, *Chemical Processing Department Monthly Report for October, 1963*, General Electric Company, Richland, Washington.

HW-79768, 1963, *Chemical Processing Department Monthly Report for November, 1963*, General Electric Company, Richland, Washington.

HW-83876, 1964, *Chemical Processing Department Monthly Report for August, 1964*, General Electric Company, Richland, Washington.

HW-84354, 1964, *Chemical Processing Department Monthly Report September 1964*, General Electric Company, Richland, Washington.

INDC-356-VOL3, 1945, *Construction Hanford Engineer Works, U.S. Contract No. W-7412-ENG-1, du Pont Project 9536, History of the Project, Volume III*, E. I. du Pont de Nemours & Company, Inc., Wilmington, Delaware.

ISO-100, 1967, *Waste Management Technical Manual*, ISOCHEM, Inc., 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.

ORP-11242, 2011, *River Protection Project System Plan*, Rev. 6, U.S. Department of Energy, Office of River Protection, Richland, Washington.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq.

RPP-6924, 2010, *Statistical Methods for Estimating the Uncertainty in the Best Basis Inventories*, Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-7614, 2002, *Data Quality Objectives to Support PCB Management in the Double-Shell Tank System*, Rev. 3, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-7625, 2019, *Guidelines for Updating Best-Basis Inventory*, Rev. 14, 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-10466, 2002, *Status of Facilities and Waste Transfer Lines Within Single Shell Tank Farms*, Rev. 2A, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-13489, 2002, *Activity of Fuel Batches Processed Through Hanford Separations Plants, 1944 Through 1989*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-13774, 2004, *Single-Shell Tank System Closure Plan*, Rev. 2, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-13889, 2004, *Tank 241-C-106 Component Closure Action Data Quality Objectives*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-15043, 2003, *Single-Shell Tank System Description*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-16015, 2003, *Origin of Wastes in Single-Shell Tanks 241-B-110 and 241-B-111*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-19822, 2005, *Hanford Defined Waste Model – Revision 5.0*, Rev. 0-A, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-19866, 2004, *Calculation for the Post-Retrieval Waste Volume Determination for Tank 241-C-106*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-20226, 2004, *Analytical Results for Liquid Grab Sampling and Analysis Plan for Tank 241-C-106 Component Closure Action*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-20264, 2006, *Analytical Results for Tank 241-C-106 Solid Clam Shell Samples Supporting Closure Action*, Rev. 0A, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-20577, 2007, *Stage II Retrieval Data Report for Single-Shell Tank 241-C-106*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-20658, 2008, *Basis for Exception to the Hanford Federal Facility Agreement and Consent Order Waste Retrieval Criteria for Single-Shell Tank 241-C-106*, Rev. 3, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-21084, 2006, *Final Report for Tanks 241-C-201, 241-C-202, 241-C-203, and 241-C-204 Solid Grab Samples*, Rev. 0A, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-23403, 2006, *Single-Shell Tank Component Closure Data Quality Objectives*, Rev. 3, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-23403, 2009, *Single-Shell Tank Component Closure Data Quality Objectives*, Rev. 4, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-23403, 2016, *Single-Shell Tank Component Closure Data Quality Objectives*, Rev. 6, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-25113, 2006, *Residual Waste Inventories in the Plugged and Abandoned Pipelines at the Hanford Site*, Rev. 0-A, Meier Enterprises, Inc., Richland, Washington.

RPP-31159, 2006, *Post-Retrieval Waste Volume Determination for Single-Shell Tank 241-C-103*, Rev. 0, Freestone Environmental Services, Inc./CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-52290, 2012, *Practicability Evaluation Request to Forego a Third Retrieval Technology for Tank 241-C-108*, Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-53823, 2013, *Retrieval Completion Certification for Tank 241-C-104*, Rev. 2A, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-53824, 2013, *Retrieval Completion Certification Report for Tank 241-C-109*, Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-53869, 2013, *Retrieval Completion Certification Report for Tank 241-C-108*, Rev. 2, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-55849, 2014, *Practicability Evaluation Request to Forego a Third Retrieval Technology for Tank 241-C-101*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-56214, 2014, *Retrieval Completion Certification Report for Tank 241-C-110*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-56935, 2014, *Practicability Evaluation Request to Forego a Third Retrieval Technology for Tank 241-C-112*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-57570, 2014, *Retrieval Completion Certification Report for Tank 241-C-101*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-CALC-54266, 2013, *Post-Hard Heel Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-108*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-CALC-54284, 2013, *Post-Hard Heel Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-104*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-CALC-54759, 2013, *Post-Hard Heel Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-109*, Rev. 0, Washington River Protection Solutions, LLC/Weirich Consulting Services Inc., Richland, Washington.

RPP-CALC-56399, 2013, *Post-Hard Heel Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-110*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-CALC-56434, 2013, *Post-Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-101*, Rev. 0, Washington River Protection Solutions, LLC/Weirich Consulting Services Inc., Richland, Washington.

RPP-CALC-56856, 2014, *Estimated Waste Volume Remaining in Single Shell Tank 241-C-112 after Hard Heel Retrieval*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-CALC-59985, 2015, *Post-Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-107*, Rev. 0, Washington River Protection Solutions, LLC/Weirich Consulting Services Inc., Richland, Washington.

RPP-ENV-58782, 2016, *Performance Assessment of Waste Management Area C, Hanford Site, Washington*, Rev. 0, INTERA, Inc./CH2M HILL Plateau Remediation Company/ Ramboll Environ, Inc./Washington River Protection Solutions, LLC/TecGeo, Inc., Richland, Washington.

RPP-PLAN-47559, 2012, *Single-Shell Tank Waste Management Area C Pipeline Feasibility Evaluation*, Rev. 1, Washington River Protection Solutions, LLC/Cenibark International, Inc., Richland, Washington.

RPP-RPT-22891, 2004, *Revised Methodology to Calculating Residual Waste Volume at 95% Confidence Interval*, Rev. 0, CH2M HILL Hanford Group, Inc./Cenibark International, Inc./Washington State University Tri-Cities, Richland, Washington.

RPP-RPT-24257, 2005, *244-CR Vault Liquid Level Assessment and Video Inspection Completion Report*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-26475, 2007, *Retrieval Data Report for Single-Shell Tank 241-C-203*, Rev. 1-A, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-26925, 2007, *Final Report for Tank 241-C-203 Post Retrieval Solid Finger Trap Grab Samples*, Rev. 0A, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-28734, 2006, *Final Report for Tank 241-C-202 Post Retrieval Solid Finger Trap Grab Samples*, Rev. 0A, ATL International, Inc., Richland, Washington.

RPP-RPT-29095, 2006, *Retrieval Data Report for Single-Shell Tank 241-C-202*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-29191, 2006, *Supplemental Information Hanford Tank Waste Leaks*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-29889, 2006, *Tank 241-C-201 Residual Waste Inventory Estimates for Component Closure Risk Assessment*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-30181, 2006, *Retrieval Data Report for Single-Shell Tank 241-C-201*, Rev. 0-B, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-31239, 2007, *Final Report for Tank 241-C-103 Liquid Grab Samples in Support of the Single Shell Tank Component Closure Program*, Rev. 0A, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-31949, 2007, *Final Report for Tank 241-C-103 Solid Samples in Support of the Single-Shell Tank Component Closure Program*, Rev. 0C, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-33060, 2007, *Retrieval Data Report for Single-Shell Tank 241-C-103*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-34062, 2007, *Retrieval Data Report for Single-Shell Tank 241-C-204*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-42294, 2016, *Hanford Waste Management Area C Soil Contamination Inventory Estimates*, Rev. 2, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-49701, 2011, *Waste Management Area C Closure – Conceptual Design Report*, Rev. 0, Columbia Energy and Environmental Services, Inc., Richland, Washington.

RPP-RPT-54757, 2014, *Tank 241-C-108 Residual Waste Inventory Estimates for Component Closure Risk Assessment,* Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-55307, 2014, *Tank 241-C-104 Residual Waste Inventory Estimates for Component Closure Risk Assessment,* Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-55803, 2014, *Tank 241-C-109 Residual Waste Inventory Estimates for Component Closure Risk Assessment,* Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-56703, 2014, *Tank 241-C-110 Residual Waste Inventory Estimates for Component Closure Risk Assessment,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-58150, 2014, *Retrieval Completion Certification Report for Tank 241-C-107*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-58383, 2015, *Post Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-112*, Rev. 0, Washington River Protection Solutions, LLC/Weirich Consulting Services Inc., Richland, Washington.

RPP-RPT-58514, 2015, *Tank 241-C-107 Residual Waste Inventory Estimates for Component Closure Risk Assessment*, Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-58676, 2015, *Practicability Evaluation Request to Forego a Third Retrieval Technology for Tank 241-C-102*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-58692, 2015, *Tank 241-C-112 Residual Waste Inventory Estimates for Component Closure Risk Assessment*, Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-58803, 2015, *Tank 241-C-101 Residual Waste Inventory Estimates for Component Closure Risk Assessment,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-59004, 2015, *Post-Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-102*, Rev. 0, Washington River Protection Solutions, LLC/Weirich Consulting Services Inc., Richland, Washington.

RPP-RPT-59129, 2016, *Tank 241-C-102 Residual Waste Inventory Estimates for Component Closure Risk Assessment,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-59377, 2016, *Post-Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-111*, Rev. 0, Washington River Protection Solutions, LLC/Weirich Consulting Services Inc., Richland, Washington.

RPP-RPT-59714, 2017, *Tank 241-C-111 Residual Waste Inventory Estimates for Component Closure Risk Assessment,* Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-60731, 2018, *Post-Retrieval Camera/CAD Modeling System Waste Volume Estimate for Tank 241-C-105*, Rev. 0, Washington River Protection Solutions, LLC/Weirich Consulting Services Inc., Richland, Washington.

RPP-RPT-61102, 2019, *Tank 241-C-105 Residual Waste Inventory Estimates for Component Closure Risk Assessment,* Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-SPEC-25386, 2015, *Criticality Data Quality Objectives for Tank Core Samples*, Rev. 1, Washington River Protection Solutions, LLC, Richland, Washington.

SD-WM-TI-302, 1987, *Hanford Waste Tank Sluicing History*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WAC 173-303-9905, "Dangerous Waste Constituents List," *Washington Administrative Code*, as amended.

WHC-EP-0723, 1994, *Tank 241-C-106 Sampling Data Requirements Developed Through the Data Quality Objectives (DQO) Process*, Westinghouse Hanford Company/Pacific Northwest Laboratory, Richland, Washington.

WHC-MR-0132, 1990, *A History of the 200 Area Tank Farms*, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-DQO-006, 1995, *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue*, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-DQO-018, 1997, *Historical Model Evaluation Data Requirements*, Rev. 2, Lockheed Martin Hanford Corporation, Richland, Washington.

WHC-SD-WM-DQO-022, 1995, *Data Needs and Attendant Data Quality Objectives for Tank Waste Pretreatment and Disposal*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-ES-259, 1993, *Single-Shell Tank Saltwell Transfer Piping Evaluation*, Rev. 0, Westinghouse Hanford Company, Richland Washington.

WHC-SD-WM-SP-004, 1995, *Tank Safety Screening Data Quality Objective*, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-TI-731, 1996, *Predominant Radionuclides in Hanford Site Waste Tanks*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

This page intentionally left blank.

APPENDIX A

ANCILLARY FACILITIES INVENTORY ESTIMATES

This page intentionally left blank.

APPENDIX A. ANCILLARY FACILITIES INVENTORY ESTIMATES

A1. DESCRIPTION AND WASTE VOLUME ESTIMATES

Waste volume estimates for 241-C Tank Farm (C-Farm) ancillary facilities including inactive miscellaneous underground storage tanks (IMUSTs), vault tanks and cells, diversion boxes, pits, and transfer lines are provided in Table A-1. The 2002 waste volume information was taken from RPP-15043, *Single-Shell Tank System Description*.

Table A-1. Ancillary Equipment Waste Volume Estimates.

Structure	Capacity kL (kgal)	1/2019 [2]			2002 Estimate[1] RPP-15043
		Liquid L (gal)	Solid L (gal)	Total kL (kgal)	Total kL (kgal)
Vaults					
244-CR Cell 1	NA	290 (77)	0	0.29 (0.08)	3.8 (1)
244-CR Cell 2	NA	380 (100)	3.8 (1)	0.38 (0.1)	3.8 (1)
244-CR Cell 3	NA	344 (91)	34 (9)	0.38(0.1)	1.5 (4)
244-CR Cell 11	NA	0 (0)	20 (4)	0.02 (0.004)	3.8 (1)
244-CR-001	150 (40)	18,000 (4,760)[3]	1,680 (443)	5.2 (1.4)	7.6 (2)
244-CR-002	57 (15)	1,000 (270)	1,830 (483)	2.8 (0.74)	5.7 (1.5)
244-CR-003	57 (15)	6,400 (1,690)	2,700 (714)	9.1 (2.4)	15 (4.0)
244-CR-011	150 (40)	38 (10)	15,100 (3,990)	15.1 (4)	140 (36)
Inactive Miscellaneous Underground Storage Tans					
241-C-301	140 (36)	43,100 (11,400)	6,100 (1,600)	49 (13)	40 (10.5)
Pits and Diversion boxes	Not estimated			0.36 (0.1)	0.1 (0.3)
Transfer lines	Not estimated			6.0 (1.6)	0.45 (0.12)

[1] Reference: RPP-15043, *Single-Shell Tank System Description*.

[2] HNF-EP-0182, Rev. 372, *Waste Tank Summary Report for Month Ending December31, 2018*; RPP-RPT-24257, *244-CR Vault Liquid Level Assessment and Video Inspection Completion Report*.

[3] The increase in liquid volume from 932 gal in 1994 to 4,760 gal in 2019 is attributed to water intrusions. Inventory estimates for 244-CR-001 based on 932 gal liquid (Interoffice Memorandum WRPS-1803745, "FY18 Visual Inspection of Tank 241-C-301") plus solids = 5.2 kL (1.4 kgal).

NA = not applicable

Section A2 describes the 241-C-301 IMUST. Updated waste volumes are from RPP-RPT-58156, *Basis for Miscellaneous Underground Storage Tanks and Special Surveillance Facilities Waste Volumes Published in HNF-EP-0182 Revision 320 "Waste Tank Summary Report for Month Ending August 31, 2014"*.

The CR Vaults are described in Section A3. The liquid volume in 244-CR-001 increased from 932 gal in 1994 (WHC-SD-EN-ES-040, *Engineering Study of 50 Miscellaneous Inactive Underground Radioactive Waste Tanks Located at the Hanford Site, Washington*) to 3,200 gal in 2005. The increase is attributed to intrusion. From 2005 video observations: "The top of the exterior of the tank below the riser pit appears to be wet which may indicate the riser pit is a water intrusion path. These areas of wetness trail down the side of the tank below the riser pit." (RPP-RPT-24257, *244-CR Vault Liquid Level Assessment and Video Inspection Completion Report*). Quarterly manual tape measurements have been obtained since September 2013. The current tank waste volume estimate is 4,760 gal, based on a January 18, 2017 measurement. The increased liquid volume since 1994 is assumed to be due to water intrusions.

Table A-2 provides a list of ancillary equipment in C-Farm.

A2. TANK 241-C-301

Tank 241-C-301 is an underground tank classified as an IMUST. The tank is located northwest of tank 241-C-112 (see Figure A-1). The tank receives waste from the 241-C-151, 241-C-152, 241-C-153, and 241-C-252 diversion boxes (H-2-44501, "Area Map-200 East "A" Plant Facilities," sheets 92 and 103).

Figure A-1. Location of 241-C-301.
(H-2-44501 sheet 92)

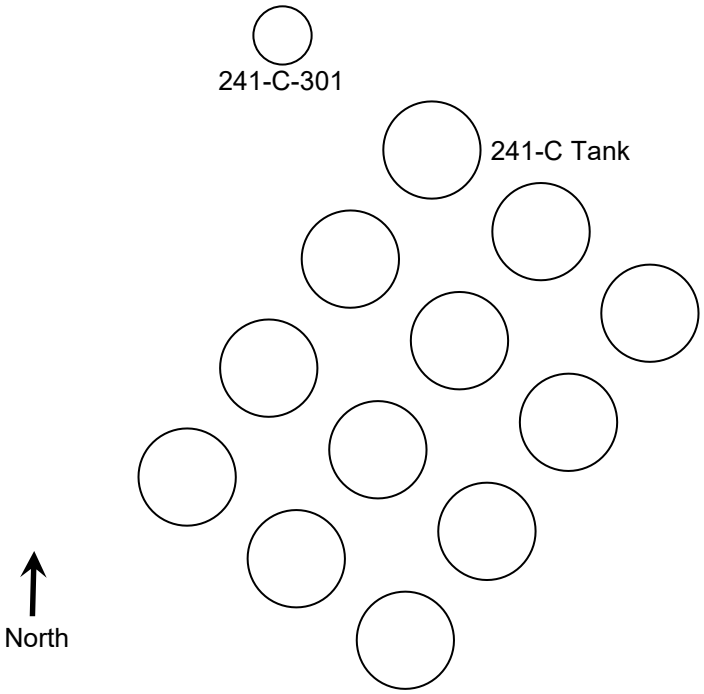


Table A-2. 241-C Tank Farm Pits, Diversion Boxes, and Pipelines (RPP-15043).

Pits	Diversion Boxes	Pipelines	Pipelines	Pipelines	Pipelines	Pipelines
241-C-04D	241-C-151	241-C-151 unmarked	8202	8625	C-104 unmarked green	C-204 unmarked red
241-C-07	241-C-152	241-C-152 unmarked	8206	8630	C-104 unmarked red	DR-302
241-C-08	241-C-153	241-C-153 unmarked	8210	8631	C-105 unmarked green	SL-100-C
241-C-09	241-C-252	241-C-154 unmarked red	8212	8636	C-105 unmarked red	SN-200-C
241-C-110-P	241-CR-151	241-C-252 unmarked	8214	8648	C-106 unmarked red	SN-275-C
241-C-111-P	241-CR-152	241-CR-151 unmarked	8217	8900	C-107 unmarked black	V050
24-C-112-P	241-CR-153	8002	8220	C-101 unmarked black	C-107 unmarked red	V051
241-C-01B		8006	8225	C-101 unmarked green	C-108 unmarked green	V100
241-C-02B		8010	8231	C-101 unmarked red	C-109 side unmarked	V1000
241-C-03B		8012	8232	C-102 unmarked black	C-109 unmarked green	V1001
241-C-04B		8014	8235	C-102 unmarked red	C-110 unmarked purple	V1002
241-C-05b		8017	8237	C-103 side 1 unmarked	C-110 unmarked red	V101
241-C-06B		8020	8238	C-103 side 1 unmarked	C-111 unmarked purple	V-101
241-C-01A		8025-C	8241	C-103 side 1 unmarked	C-111 unmarked red	V102
241-C-02A		8031	8244	C-103 side 1 unmarked	C-112 unmarked green	V103
241-C-03A		8032-C	8247	C-103 side 2 unmarked	C-112 unmarked purple	V104
241-C-04A		8035	8552	C-103 side 2 unmarked	C-201 unmarked black	V107
241-C-05A		8037	8555	C-103 side 2 unmarked	C-201 unmarked red	V108
241-C-06A		8038	8601	C-103 side 1 unmarked	C-202 unmarked black	V109
241-C-01C		8041-C	8616	C-103 unmarked purple	C-202 unmarked red	V110
241-C-02C		8044-C	8618	C-103 unmarked red	C-203 unmarked black	V115
241-C-03C		8047	8622	C-104 side unmarked	C-203 unmarked red	V118
241-C-05C		8107	8624	C-104 unmarked black	C-204 unmarked black	V119
		V120	V139	V145	V157	V163
		V121	V140	V147	V158	V172
		V122	V141	V148	V159	V175
		V136	V142	V149	V160	V228
		V137	V143	V150	V161	V839
		V138	V144	V156	V162	V843

Reference: RPP-15043, *Single-Shell Tank System Description*.

The tank is a vertically-aligned cylinder tank with an outside diameter of 6.4 m (20 ft 10 in.). It is constructed of reinforced concrete with 13-cm (5-in.)-thick walls. The inside diameter is 6.0 m (20 ft) and the height, not including the domed top, is 5.0 m (16 ft 6 in.). The domed top is ~0.8 m (2 ft 6 in.) high. The liquid level should only reach ~4.6 m (15 ft) inside the tank before hitting the side inlet pipes (W-72903, "Hanford Engineer Works ~ Bl'd. #241-TUB 20'0" Dia. Catch Tank Arrangement and Concrete," and H-2-1750, "Tanks 241-301 & 361 Riser & Nozzle Elevs.").

The tank was stabilized as part of Project B-231 on May 21, 1985. RPP-RPT-58156 shows current waste volume estimates for this tank.

A3. 244-CR-VAULT TANKS AND CELLS

The 244-CR Vault is located south of C-Farm (see Figure A-2). The vault received waste from the tank farms in the area, through transfer lines (H-2-44501, sheet 92). The CR-003 tank was last used to transfer supernates from interim stabilization of C-Farm tanks. The 244-CR Vault is a concrete structure that is mostly underground, ~0.3 m (1 ft) exposed. The vault is 31 m (102 ft) long and is 7.9 m (26 ft) at its widest point. The vault has four tanks; tanks 001 and 011 are 190 kL (50 kgal), and tanks 002 and 003 are 57 kL (15 kgal). Each tank has a 170 L (45 gal) sump that is associated with it (see Figure A-3) (H-2-40388, "Piping—Equipment Arrangement—Processing Area—Plan & Sections—Waste Metal Removal—Phase 2"). The vault is currently out of service and the valves and seals are checked to be sure they are satisfactory (Tank Farm Operator Rounds: Single Shell Tank Farms). Waste was transferred from 244-CR Vault sumps during February and March 2010. RPP-RPT-58156 shows current waste volume estimates for the 244-CR Vault tanks and sumps based on Surveillance Analysis Computer System surface level measurements and RPP-RPT-24257.

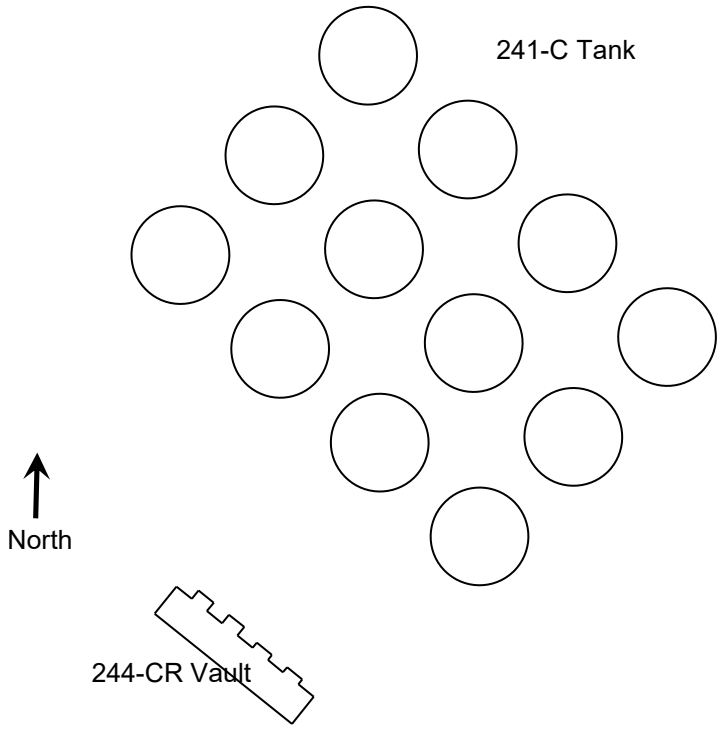
A3.1 Tank 011

The first tank starting on the east side is tank 011. The tank is inside a concrete cell that has 0.6 m (2 ft)-thick walls. The cell is 6.7 m (22 ft) wide and 7.9 m (26 ft) long and contains a 170-L (45-gal) sump located along the north wall. The sump is 37 cm (14.5 in.) deep and is 0.9 m by 0.6 m (3 ft by 2 ft). The floor of the cell is sloped slightly to help drain waste to the sump. The tank is a stainless-steel horizontal cylinder with two dished heads. The length between the dished heads is 5.8 m (19 ft 2 in.) and the dished heads are each 0.99 m (3 ft 3 in.), making the tank a total height of 7.8 m (25 ft 8 in.). The outside diameter of the tank is 6.1 m (20 ft) and the wall thickness is a minimum of 0.8 cm (0.3125 in.). The tank has a support ring that goes around the bottom of the tank (H-2-41088, "Vessel Assembly & Details 20'-0" x 19'-2" Tank TK-CR-001, TK-BXR-001, TK-TXR-001").

A3.2 Tank 001

The second tank in the vault is tank 001. This tank is inside a concrete cell the same size and shape as the cell for tank 011; tank 001 is the same as tank 011 except it has leg supports instead of a tank skirt and the tank is constructed with carbon steel instead of stainless steel (H-2-41088, H-2-40388).

Figure A-2. Location of 244-CR Vault
(H-2-44501 sheet 92)



A3.3 Tank 002

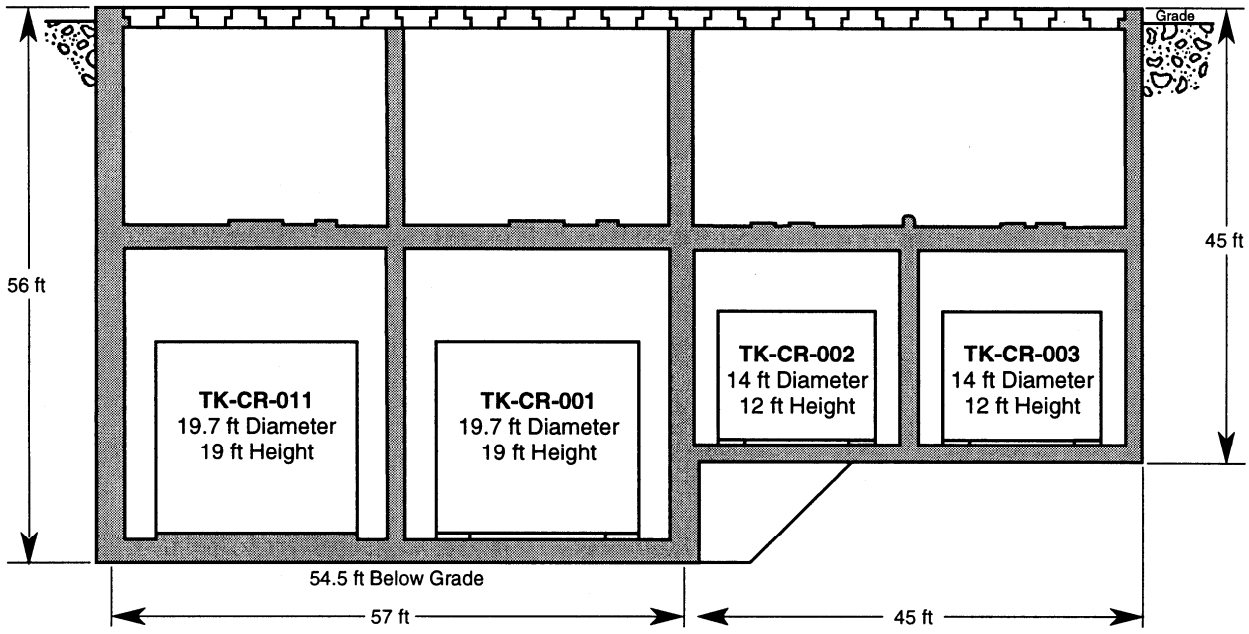
Tank 002 is a smaller tank than the first two and therefore has a smaller concrete cell. The cell has 0.6-m (2-ft)-thick walls, but has dimensions of 4.9-m (16-ft) width and 6-m (20-ft) length. The sump is 0.6 m (2 ft) wide, 0.9 m (3 ft) long, and 34.9 cm (13.75 in.) deep. The sump is located along the north wall in the cell. The floor of the cell is sloped so that all the waste will drain to the sump (H-2-40388). The tank is centered in the cell and is a stainless steel tank. The tank is a horizontal cylinder with two dished heads. The length between the dished heads is 3.7 m (12 ft) and the dished heads are each 0.74 m (2 ft 5 in.), for a total tank height of 5.1 m (16 ft 10 in). The outside diameter of the tank is 4.3 m (14 ft) and the wall thickness is a minimum of 0.8 cm (0.3125 in.). The tank is supported by four leg supports that hold the tank up from the bottom of the cell ~15 cm (6 in.) (H-2-41089, "Vessel Assembly & Details—140'-0" x 12'-0" Tank—TK-CR-002, TK-CR-003, TK-BXR-002, TK-BXR-003, TK-TXR-002, TK-TXR-003").

A3.4 Tank 003

Tank 003 is inside of a concrete cell that has 0.6 m (2 ft)-thick walls, but has dimensions of 4.9 m (16 ft) width and 6 m (20 ft) length. The sump is 0.6 m (2 ft) wide, 0.9 m (3 ft) long and 34.9 cm (13.75 in.) deep. The sump is located 0.84 m (2 feet 9 in.) west of the east wall, along the north wall in the cell. The floor of the cell is sloped so that all the waste will drain to the sump (H-2-41496, "Piping Arrangement – Plan Process Tank Vault – Sheet No. 1"; H-2-41499,

"Piping Arrangement – Sections & Elevations Process Tank Vault – Sh. #2"). The tank is centered in the cell and is a stainless steel tank. The tank is a horizontal cylinder with two dished heads. The length between the dished heads is 3.7 m (12 ft) and the dished heads are each 0.74 m (2 ft 5 in.), for a total tank height of 5.1 m (16 ft 10 in.). The outside diameter of the tank is 4.3 m (14 ft) and the wall thickness is a minimum of 0.8 cm (0.3125 in.). Four leg supports hold the tank ~15 cm (6 in.) above the floor of the cell (H-2-41089). The tank is monitored periodically using the Surveillance Analysis Computer System.

Figure A-3. 244-CR Vault
(See H-2-40388)



A4. OTHER ANCILLARY EQUIPMENT

Table A-2 shows pits, diversion boxes and pipelines in C-Farm.

A5. REFERENCES

H-2-1750, 1949, "Tanks 241-301 & 361 Riser & Nozzle Elevs.," Sheet 1, Rev. 0, General Electric Company Hanford Works, Richland, Washington.

H-2-40388, 1953, "Piping—Equipment Arrangement—Processing Area—Plan & Sections—Waste Metal Removal—Phase 2," Rev. 1, General Electric Company Hanford Works, Richland, Washington.

H-2-41088, 1953, “Vessel Assembly & Details 20'-0" x 19'-2" Tank TK-CR-001, TK-BXR-001, TK-TXR-001,” Sheet 1, Rev. 3, General Electric Company Hanford Works, Richland, Washington.

H-2-41089, 1953, “Vessel Assembly & Details—140'-0" x 12'-0" Tank—TK-CR-002, TK-CR-003, TK-BXR-002, TK-BXR-003, TK-TXR-002, TK-TXR-003,” Sheet 1, Rev. 2, General Electric Company Hanford Works, Richland, Washington.

H-2-41496, 1964, “Piping Arrangement – Plan Process Tank Vault – Sheet No. 1,” Rev. 5, The Kellex Corporation, Richland, Washington.

H-2-41499, 1961, “Piping Arrangement – Sections & Elevations Process Tank Vault – Sh. #2,” Rev. 4, The Kellex Corporation, Richland, Washington.

H-2-44501, 1983, “Area Map 200 East "A" Plant Facilities,” Sheet 92, Rev. 14, Atlantic Richfield Hanford Company, Richland, Washington.

H-2-44501, 1983, “Area Map-200 East "A" Plant Facilities,” Sheet 103, Rev. 4, Rockwell Hanford Operations, Richland, Washington.

HNF-EP-0182, 2019, *Waste Tank Summary Report for Month Ending December 31, 2018*, Rev. 372, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-15043, 2003, *Single-Shell Tank System Description*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-24257, 2005, *244-CR Vault Liquid Level Assessment and Video Inspection Completion Report*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-58156, 2014, *Basis for Miscellaneous Underground Storage Tanks and Special Surveillance Facilities Waste Volumes Published in HNF-EP-0182 Revision 320 "Waste Tank Summary Report for Month Ending August 31, 2014"*, Rev. 0, Washington River Protection Solutions, LLC/AEM Consulting, LLC, Richland, Washington.

W-72903, 1944, “Hanford Engineer Works ~ Bl'd. #241-TUB 20'0" Dia. Catch Tank Arrangement and Concrete,” Rev. 8, E. I. Du Pont De Nemours Company, Richland, Washington.

WHC-SD-EN-ES-040, 1994, *Engineering Study of 50 Miscellaneous Inactive Underground Radioactive Waste Tanks Located at the Hanford Site, Washington*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WRPS-1803745, 2018, “FY18 Visual Inspection of Tank 241-C-301” (Interoffice Memorandum from J. S. Schofield to R. E. Mendoza, September 10), Washington River Protection Solutions, LLC, Richland, Washington.

This page intentionally left blank.

APPENDIX B

C-FARM BEST BASIS INVENTORY TANK WASTE INVENTORY ESTIMATES

This page intentionally left blank.

APPENDIX B

C-FARM BEST BASIS INVENTORY TANK WASTE INVENTORY ESTIMATES

B.1 2002 BBI Inventory for SSTs (Excel®1 file)

B.2 2014 BBI Inventory for SSTs (Excel® file)

This page intentionally left blank.

RPP-RPT-42323 Rev. 4, Appendix B.1

2002 BBI Inventory for SSTs

Spreadsheet Documentation

Spreadsheet Name	B_1 2002 Inventory for SSTs.xlsx
Related Documents	RPP-RPT-42323, Rev. 4, Hanford C-Farm Tank and Ancillary Equipment Residual Waste Inventory Estimates
Purpose	This spreadsheet was developed to estimate C-Farm tank waste inventories for DOE/EIS-0391, Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland Washington and as Appendix B-1 of RPP-RPT-42323.
Overview	Data for this worksheet was taken from the 12-1-2002 Best Basis Inventory (BBI). Radionuclides from the 12-1-2002 BBI were decayed to 1/1/2020 for RPP-42323. The spreadsheet also calculates waste concentrations and average C-farm tank waste concentrations for the BBI constituents.
Worksheet Descriptions	Inventory worksheet: This worksheet presents the 12-1-2002 BBI standard chemical and radionuclide inventory estimates (rows 2-76). The 2001 inventory estimates are then decayed to 1-1-2020 (rows 79-124) by multiplying the 12-1-2002 BBI values by decay values from the "concentration" work sheet for each radionuclide as applicable. Rows 128-173 preset are identical values as those in rows 79-124, but each cell is a number rather than a formula to facilitate development of an inverted table (pivot table) for Appendix C-3 of RPP-RPT-42323.
	Concentration Worksheet: This worksheet calculates standard BBI chemical and radionuclide concentrations by dividing the inventory values from the "inventory" worksheet by BBI tank waste volume estimates (rows 2-75). The radionuclide concentrations are then decayed to 1-1-2020 values (Rows 78-123, columns C-S) by mutiplying by decay values for corresponding rows in column Y. The decay values in column Y are calculated based on the 1/2 life of radionuclides and formulas in SVF-2545, Spreadsheet for Data Entry and Decay Calculation (Rows 69-123, Columns U-Y). Start and end decay dates are inputs in cells Y71 and Y72 respectively. SVF-2545 is based on 1/2 life values taken from the 16th edition of chart of the nuclides. Column S shows average concentrations for all of the C-Farm tanks for each applicable constituent. These average values are used in Appendix C-3 of RPP-42323 to estimate the inventory of waste in ancillary equipment.
	RPP-RPT-42323 Worksheet: This is a title page for this spreadsheet.
Macros and Add-in software	None
Key Assumptions	None
Units	Inventory units are shown (kg or Ci). Concentration units g/L or Ci/L as shown. Waste volumes are shown as kL and ft3. Conversions: 1 gal = 3.785 L, 1 ft3 = 7.481 gal.
Input Data	BBI inventory values, SVF-2545 spreadsheet, and Start and end dates for decay values, "concentration" worksheet cells Y71 and Y72.
Verification	By: Kristin Singleton Date: Approval date for RPP-RPT-42323 report Summary: Checked and verified worksheet inputs and formulas

12-1-2002 BBI C-Farm tank Inventory by constituent																		
Analyte	**Units**	**C-101**	**C-102**	**C-103**	**C-104**	**C-105**	**C-106**	**C-107**	**C-108**	**C-109**	**C-110**	**C-111**	**C-112**	**C-201**	**C-202**	**C-203**	**C-204**	**Total Tanks**
Tank Volume	kL	333	1196	764	980	500	138	940	250	240	674	217	393	4	4	10	10	6653
Tank Volume	ft3	1.18E+04	4.22E+04	2.70E+04	3.46E+04	1.77E+04	4.87E+03	3.32E+04	8.83E+03	8.48E+03	2.38E+04	7.66E+03	1.39E+04	1.41E+02	1.41E+02	3.53E+02	3.53E+02	2.35E+05
Al	kg	6.53E+04	8.25E+04	1.36E+05	9.01E+04	1.72E+05	2.06E+03	5.86E+04	1.89E+04	2.34E+04	1.31E+04	2.86E+04	1.24E+04	2.74E+01	2.86E+01	5.46E+01	3.53E+01	7.03E+05
Bi	kg	6.24E+02	2.63E+03	3.63E+02	4.80E+01	3.72E+02	7.79E-01	1.04E+04	4.41E+03	1.14E+03	1.48E+04	1.69E+03	2.04E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.85E+04
Ca	kg	3.71E+03	6.82E+03	2.60E+03	2.99E+03	1.97E+03	8.23E+01	1.24E+03	4.59E+03	5.65E+03	1.05E+03	4.00E+03	1.17E+04	1.24E+02	1.30E+02	2.48E+02	1.60E+02	4.71E+04
Cl	kg	5.37E+02	1.85E+03	6.09E+02	8.00E+02	3.73E+02	3.21E+01	8.70E+02	2.64E+02	2.78E+02	9.91E+02	2.70E+02	5.32E+02	3.49E+00	9.91E+00	1.29E+01	8.34E+00	7.44E+03
Cr	kg	2.99E+02	7.35E+02	6.90E+02	1.46E+03	4.13E+02	6.18E+01	9.30E+02	2.32E+02	1.18E+02	4.20E+02	8.52E+01	1.39E+02	2.29E+00	2.39E+00	4.57E+00	2.95E+00	5.60E+03
F	kg	4.76E+02	4.10E+03	1.19E+03	3.46E+04	8.70E+02	1.67E+01	6.39E+03	1.54E+03	6.46E+02	6.75E+03	8.63E+02	4.26E+02	1.25E+01	2.30E+01	3.44E+01	2.22E+01	5.80E+04
Fe	kg	1.60E+04	2.02E+04	1.11E+04	2.76E+04	2.82E+03	3.06E+03	1.03E+05	2.60E+03	6.53E+03	9.84E+03	1.33E+04	1.37E+04	1.06E+03	1.11E+03	2.12E+03	1.37E+03	2.35E+05
Hg	kg	4.12E+01	1.23E+01	1.61E+02	6.73E+01	1.39E+01	4.46E+00	6.70E+01	2.06E+01	2.15E+00	3.98E-01	0.00E+00	2.77E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.93E+02
K	kg	5.71E+02	1.43E+03	5.73E+02	1.33E+03	8.60E+02	1.08E+02	4.47E+02	1.37E+02	1.76E+02	5.11E+02	2.88E+02	3.00E+02	6.85E+00	7.15E+00	1.36E+01	8.82E+00	6.77E+03
La	kg	1.99E+02	1.99E+02	1.44E+02	4.87E+01	3.65E+02	1.23E+01	2.70E+02	4.41E+00	2.52E+00	1.28E+00	1.05E+02	4.51E+01	1.20E+01	1.25E+01	2.39E+01	1.54E+01	1.46E+03
Mn	kg	4.57E+02	1.63E+03	3.38E+02	7.01E+03	1.90E+03	7.59E+02	5.02E+03	5.70E+01	7.21E+01	4.76E+01	8.01E+01	1.23E+02	1.71E-01	1.79E-01	3.41E-01	2.20E-01	1.75E+04
Na	kg	5.70E+04	1.06E+05	2.95E+04	1.78E+05	3.29E+04	1.20E+04	9.52E+04	3.41E+04	3.48E+04	7.53E+04	1.27E+04	5.01E+04	4.62E+02	4.82E+02	9.21E+02	5.95E+02	7.20E+05
Ni	kg	8.53E+02	6.73E+03	3.42E+03	2.63E+03	1.66E+03	1.06E+02	3.09E+03	3.05E+03	4.57E+03	2.17E+01	4.89E+03	7.78E+03	1.37E+02	1.43E+02	2.73E+02	1.76E+02	3.95E+04
NO2	kg	9.18E+03	1.69E+04	1.63E+04	3.65E+04	8.42E+03	1.53E+03	3.53E+04	8.74E+03	1.22E+04	6.53E+03	9.49E+03	2.78E+04	4.18E+01	2.14E+02	2.45E+02	1.58E+02	1.90E+05
NO3	kg	6.14E+04	7.32E+04	1.38E+03	1.96E+04	8.14E+03	7.69E+01	4.78E+04	1.57E+04	1.80E+04	9.80E+04	1.73E+04	3.72E+04	2.27E+02	6.39E+02	8.38E+02	5.41E+02	4.00E+05
Pb	kg	7.77E+02	1.11E+03	4.46E+02	8.37E+02	3.59E+02	1.61E+02	1.01E+04	3.12E+02	8.27E+02	2.20E+02	1.40E+03	1.48E+03	9.71E+02	1.01E+03	1.93E+03	1.25E+03	2.32E+04
PO4	kg	3.37E+04	1.41E+04	3.67E+03	3.21E+03	6.01E+03	9.39E+02	5.88E+04	2.97E+04	2.51E+04	5.68E+04	1.81E+04	3.90E+04	1.00E+01	1.10E+01	2.04E+01	1.32E+01	2.89E+05
Si	kg	8.02E+03	3.67E+04	2.75E+04	1.02E+04	3.09E+04	6.78E+01	1.87E+03	2.04E+03	2.14E+03	6.33E+03	2.31E+03	1.55E+03	6.56E+01	6.85E+01	1.31E+02	8.45E+01	1.30E+05
SO4	kg	6.38E+03	5.75E+03	2.82E+03	3.42E+03	3.54E+03	4.82E+02	8.43E+03	2.43E+03	2.94E+03	1.11E+04	1.49E+03	7.01E+03	1.14E+01	3.02E+01	4.02E+01	2.59E+01	5.59E+04
Sr	kg	2.75E+02	1.58E+02	4.40E+01	8.74E+01	1.43E+02	6.50E+00	2.57E+02	1.49E+02	1.24E+02	1.12E+02	5.74E+01	1.93E+02	2.79E+01	2.91E+01	5.56E+01	3.59E+01	1.75E+03
TIC as CO3	kg	1.16E+04	7.60E+04	2.84E+04	4.85E+04	1.65E+04	1.32E+04	1.14E+04	3.79E+03	9.25E+03	9.42E+03	6.75E+03	1.46E+04	6.52E+02	6.66E+02	1.30E+03	8.51E+02	2.53E+05
TOC	kg	1.19E+03	1.57E+03	7.74E+03	1.42E+04	4.74E+03	5.25E+02	7.36E+02	3.43E+02	7.60E+02	5.22E+02	2.44E+02	2.42E+03	2.50E+02	2.15E+02	4.54E+02	2.93E+02	3.62E+04
UTOTAL	kg	9.61E+03	8.15E+03	5.96E+03	3.53E+04	9.84E+03	1.32E+02	9.29E+03	1.53E+02	4.06E+03	1.97E+03	4.25E+03	2.41E+04	1.14E+00	1.19E+00	2.26E+00	1.46E+00	1.13E+05
Zr	kg	1.99E+02	5.15E+03	8.20E+03	6.49E+04	1.80E+02	2.66E+00	7.39E+01	3.11E+01	1.02E+01	1.50E+02	5.31E+01	9.65E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.90E+04

12-1-2002 BBI Radionuclide values, decayed to 1/1/2001 for EIS data package

Analyte	Units	C-101	C-102	C-103	C-104	C-105	C-106	C-107	C-108	C-109	C-110	C-111	C-112	C-201	C-202	C-203	C-204	Total Tanks
106Ru	Ci	4.08E-09	6.27E-06	4.15E-05	1.81E-04	7.41E-09	1.69E-05	1.13E-02	7.62E-11	5.98E-07	5.88E-11	4.66E-07	9.51E-10	1.36E-07	1.42E-07	2.71E-07	1.75E-07	1.15E-02
113mCd	Ci	2.27E-01	5.90E-01	4.23E+01	1.93E+01	3.13E-01	1.77E+01	1.19E+03	1.76E-01	5.81E-01	1.46E-01	5.14E-01	5.81E-01	7.20E-02	7.50E-02	1.44E-01	9.24E-02	1.27E+03
125Sb	Ci	1.49E-02	2.21E-01	9.70E+00	1.77E+02	2.51E-02	2.83E+00	7.42E+00	3.65E-03	1.46E-02	2.90E-03	1.25E-02	3.89E-01	1.41E-03	1.47E-03	2.81E-03	1.81E-03	1.98E+02
126Sn	Ci	1.30E-02	2.63E-02	1.15E+01	1.72E+00	1.63E-02	2.14E+00	6.37E+01	1.28E-02	4.29E-02	1.07E-02	3.79E-02	4.15E-02	5.61E-03	5.85E-03	1.12E-02	7.21E-03	7.93E+01
129I	Ci	1.34E-03	2.74E-03	6.62E-02	7.54E-01	9.30E-02	1.70E-02	4.83E-02	1.32E-03	2.00E-03	1.10E-03	2.01E-03	4.26E-03	2.74E-05	2.85E-05	5.46E-05	3.52E-05	9.93E-01
134Cs	Ci	2.03E-04	1.07E-02	2.06E-01	4.50E-02	3.56E-04	7.07E-02	4.90E-01	6.61E-04	1.39E-03	6.43E-05	1.45E-03	2.65E-01	7.46E-07	7.78E-07	1.49E-06	9.59E-07	1.09E+00
137Cs	Ci	3.64E+04	2.98E+04	9.61E+04	9.55E+04	8.18E+04	1.75E+04	6.35E+04	8.15E+04	1.71E+05	1.44E+04	1.96E+04	2.85E+05	7.87E+01	8.22E+01	1.57E+02	1.01E+02	9.93E+05
137mBa	Ci	3.44E+04	2.82E+04	9.09E+04	9.03E+04	7.74E+04	1.66E+04	6.01E+04	7.71E+04	1.62E+05	1.37E+04	1.85E+04	2.69E+05	7.45E+01	7.77E+01	1.48E+02	9.59E+01	9.39E+05
14C	Ci	1.00E-01	2.83E-01	4.89E+00	1.85E+00	5.07E-01	5.73E-02	3.80E+00	1.31E-01	1.63E-02	3.33E-01	1.62E-01	3.61E+00	2.01E-03	2.09E-03	4.00E-03	2.58E-03	1.58E+01
151Sm	Ci	7.29E+01	1.32E+02	6.40E+04	9.40E+03	8.99E+01	1.19E+04	6.36E+05	7.51E+01	2.43E+02	6.29E+01	2.16E+02	2.42E+02	3.12E+01	3.25E+01	6.22E+01	4.01E+01	7.23E+05
152Eu	Ci	1.29E-01	7.72E-01	1.86E+01	2.43E+00	1.42E-01	3.28E+00	1.17E+02	1.31E-01	1.99E+00	1.63E-02	1.61E+00	5.12E-01	4.05E-01	4.22E-01	8.08E-01	5.20E-01	1.49E+02
154Eu	Ci	5.70E-01	3.30E+01	5.49E+03	1.10E+03	9.06E-01	2.67E+02	1.60E+03	5.78E-01	1.34E+00	1.43E+00	1.17E+00	2.21E+02	1.91E-01	1.99E-01	3.80E-01	2.45E-01	8.72E+03
155Eu	Ci	4.41E+00	2.61E+01	3.29E+03	8.05E+02	4.28E+00	1.89E+02	1.04E+03	2.84E+00	1.90E+01	1.08E+00	5.73E+01	1.53E+02	1.42E+01	1.48E+01	2.83E+01	1.82E+01	5.67E+03
226Ra	Ci	3.38E-06	7.47E-04	2.47E-03	6.27E-03	2.82E-06	4.10E-04	2.16E-02	5.86E-06	2.94E-04	5.13E-06	2.31E-04	1.83E-05	6.52E-05	6.79E-05	1.30E-04	8.37E-05	3.24E-02
227Ac	Ci	2.19E-05	2.01E+01	1.39E-02	1.09E+02	1.89E-05	2.31E-03	1.41E-01	3.70E-05	1.17E-03	3.22E-05	9.25E-04	1.16E-04	2.56E-04	2.66E-04	5.10E-04	3.28E-04	1.29E+02
228Ra	Ci	2.18E-10	2.63E+00	1.54E-04	2.26E+01	1.41E-10	3.15E-05	4.85E-02	3.62E-10	1.33E-09	5.99E-11	1.19E-09	1.38E-09	1.78E-10	1.85E-10	3.54E-10	2.28E-10	2.53E+01
229Th	Ci	8.22E-08	1.62E-01	1.32E-04	9.41E-01	5.11E-08	2.43E-05	2.43E-03	1.39E-07	5.05E-07	1.90E-08	4.51E-07	5.32E-07	6.63E-08	6.91E-08	1.32E-07	8.52E-08	1.11E+00
231Pa	Ci	3.98E-05	2.96E+01	1.79E-02	2.39E+02	3.55E-05	3.37E-03	1.92E-01	6.50E-05	1.23E-04	5.66E-05	1.18E-04	2.04E-04	8.65E-06	9.01E-06	1.73E-05	1.11E-05	2.69E+02
232Th	Ci	2.50E-11	3.24E-02	3.07E-05	5.58E+00	2.91E-11	2.54E-03	7.28E-02	2.88E-11	4.19E-11	2.43E-11	4.28E-11	9.24E-11	4.78E-13	4.98E-13	9.54E-13	6.14E-13	5.69E+00
232U	Ci	1.19E-04	2.28E-01	5.35E-02	1.93E+01	1.58E-04	5.30E-04	5.45E-03	5.59E-07	5.64E-05	7.21E-06	4.71E-05	1.44E-01	4.15E-09	2.60E-08	8.27E-09	5.35E-09	1.97E+01
233U	Ci	4.62E-06	9.58E-01	2.20E-01	4.13E+02	5.65E-06	2.18E-03	2.26E-02	3.58E-08	2.52E-06	4.62E-07	1.84E-06	5.99E-01	2.66E-10	7.31E-10	5.30E-10	3.42E-10	4.15E+02
234U	Ci	3.14E+00	2.72E+00	1.95E+00	2.08E+01	3.21E+00	4.31E-02	5.63E-01	5.03E-02	1.44E+00	6.51E-01	1.40E+00	7.98E+00	3.75E-04	3.99E-04	7.47E-04	4.82E-04	4.39E+01
235U	Ci	1.36E-01	1.17E-01	8.32E-02	6.03E-01	1.37E-01	1.84E-03	1.37E-01	2.26E-03	5.75E-02	2.93E-02	6.10E-02	3.50E-01	1.69E-05	1.68E-05	3.36E-05	2.17E-05	1.72E+00
236U	Ci	4.48E-02	4.45E-02	3.48E-02	6.84E-01	5.56E-02	7.66E-04	8.92E-02	3.22E-04	2.09E-02	4.16E-03	1.85E-02	9.88E-02	2.39E-06	9.28E-06	4.77E-06	3.08E-06	1.10E+00
237Np	Ci	4.44E-03	9.38E-03	1.08E-01	4.39E+00	5.61E-03	2.62E-01	8.07E-02	4.32E-03	9.78E-02	3.61E-03	6.46E-03	7.51E-01	4.28E-05	4.46E-05	8.53E-05	5.49E-05	5.72E+00
238Pu	Ci	1.04E+01	9.19E+01	6.79E+01	2.27E+02	3.05E+01	3.50E+00	6.81E+01	1.18E-02	1.55E+00	2.05E-01	1.38E+00	8.03E+00	1.45E+00	7.62E-01	3.81E-01	7.76E-03	5.13E+02
238U	Ci	3.21E+00	2.72E+00	1.99E+00	1.17E+01	3.29E+00	4.40E-02	3.10E+00	5.09E-02	1.36E+00	6.59E-01	1.42E+00	8.06E+00	3.80E-04	3.96E-04	7.56E-04	4.89E-04	3.76E+01
239Pu	Ci	5.35E+02	3.38E+03	4.21E+03	5.47E+03	2.06E+03	7.56E+01	2.16E+03	3.19E+00	6.07E+01	6.78E+01	1.31E+02	8.19E+01	6.48E+01	3.39E+01	1.70E+01	3.47E-01	1.84E+04
240Pu	Ci	8.95E+01	6.20E+02	6.49E+02	1.08E+03	3.14E+02	1.54E+01	3.93E+02	2.06E-01	1.03E+01	4.00E+00	1.44E+01	1.30E+01	1.07E+01	5.57E+00	2.79E+00	5.69E-02	3.22E+03
241Am	Ci	8.30E+00	1.16E+03	3.13E+03	6.34E+03	1.19E+03	2.25E+02	6.75E+03	6.58E+00	4.66E+01	3.92E+01	2.13E+02	4.75E+02	2.27E+01	1.19E+01	5.95E+00	1.21E-01	1.96E+04
241Pu	Ci	6.11E+02	5.35E+03	3.61E+03	1.48E+04	1.68E+03	1.85E+02	3.73E+03	1.98E-01	6.07E+01	1.82E+00	6.16E+01	8.06E+01	7.92E+01	4.14E+01	2.07E+01	4.23E-01	3.03E+04
242Cm	Ci	3.58E-03	2.15E+00	3.93E+00	5.38E+00	3.81E-01	3.56E-01	5.37E+00	1.37E-01	8.10E-02	4.51E-02	3.08E+00	1.51E+00	3.41E-02	1.78E-02	8.93E-03	1.81E-04	2.25E+01
242Pu	Ci	2.66E-03	2.84E-02	2.02E-02	9.49E-02	8.94E-03	1.65E-03	2.74E-02	1.08E-06	9.05E-04	7.82E-06	3.95E-04	4.11E-04	5.46E-04	2.85E-04	1.43E-04	2.92E-06	1.87E-01
243Am	Ci	1.86E-06	3.65E-03	7.20E-02	3.12E-01	3.26E-04	2.20E-03	3.47E-01	4.56E-05	1.09E-03	1.16E-04	1.94E-03	1.20E-02	5.26E-04	2.75E-04	1.37E-04	2.80E-06	7.53E-01
243Cm	Ci	7.31E-05	6.79E-02	2.36E-01	4.31E-01	7.87E-03	2.81E-02	4.21E-01	2.45E-03	3.54E-03	5.84E-04	5.93E-02	5.01E-02	1.63E-03	8.52E-04	4.26E-04	8.70E-06	1.31E+00
244Cm	Ci	5.34E-05	6.65E-01	1.78E+00	1.50E+01	1.20E-02	6.03E-01	1.56E+01	8.21E-04	1.75E-03	1.36E-03	5.32E-02	2.13E-02	7.20E-04	3.76E-04	1.88E-04	3.84E-06	3.37E+01
3H	Ci	4.76E-01	1.04E+00	9.96E+00	5.61E+01	5.85E-01	1.55E+00	2.99E+01	3.87E-01	1.35E+00	6.75E-01	5.62E-01	7.22E+00	9.80E-04	1.02E-03	1.95E-03	1.26E-03	1.10E+02
59Ni	Ci	2.84E-02	4.52E-02	3.84E+01	4.58E+00	3.53E-02	6.53E+00	3.22E+02	1.09E+00	5.54E+00	2.40E-02	4.94E+00	8.36E+00	7.52E-01	7.84E-01	1.50E+00	9.66E-01	3.96E+02
60Co	Ci	1.81E-02	1.37E+02	7.24E+02	2.72E+02	8.63E+01	1.40E+00	2.47E+02	9.11E-03	1.93E-02	7.38E-03	1.81E-02	4.33E+00	8.42E-04	8.77E-04	1.68E-03	1.08E-03	1.47E+03
63Ni	Ci	2.52E+00	4.22E+00	3.58E+03	4.29E+02	3.18E+00	6.08E+02	3.01E+04	9.31E+01	4.99E+02	2.05E+00	4.41E+02	7.58E+02	7.00E+01	7.29E+01	1.40E+02	8.99E+01	3.69E+04
79Se	Ci	2.11E-03	4.70E-03	1.76E+00	6.41E+00	2.64E-03	2.88E-01	1.79E+01	2.12E-03	5.34E-03	2.02E-03	6.10E-03	5.56E-01	8.79E-04	9.16E-04	1.75E-03	1.13E-03	2.69E+01
90Sr	Ci	2.86E+05	5.94E+05	3.01E+06	4.84E+05	4.76E+05	2.82E+05	2.24E+06	8.44E+03	2.51E+05	3.72E+03	8.90E+05	6.48E+05	4.13E+02	4.31E+02	8.23E+02	5.32E+02	9.18E+06
90Y	Ci	2.86E+05	5.94E+05	3.01E+06	4.84E+05	4.76E+05	2.82E+05	2.24E+06	8.44E+03	2.51E+05	3.72E+03	8.90E+05	6.48E+05	4.13E+02	4.31E+02	8.23E+02	5.32E+02	9.18E+06
93mNb	Ci	8.67E-02	1.64E-01	6.89E+01	9.90E+00	1.06E-01	1.28E+01	6.98E+02	9.00E-02	2.78E-01	7.54E-02	2.48E-01	2.90E-01	3.45E-02	3.59E-02	6.88E-02	4.43E-02	7.91E+02
93Zr	Ci	9.98E-02	1.99E-01	7.42E+01	1.17E+01	1.24E-01	1.44E+01	7.75E+02	1.01E-01	3.13E-01	8.46E-02	2.79E-01	3.26E-01	3.88E-02	4.04E-02	7.73E-02	4.98E-02	8.77E+02
99Tc	Ci	6.97E-01	1.32E+00	3.42E+01	5.80E+01	8.14E+01	3.14E+00	3.79E+01	6.19E+00	3.23E+01	3.18E+01	2.70E+00	6.11E+01	1.41E-02	1.47E-02	2.82E-02	1.81E-02	3.51E+02

12-1-2002 BBI Radionuclide values, decayed to 1/1/2020 for closure data package

Analyte	Units	C-101	C-102	C-103	C-104	C-105	C-106	C-107	C-108	C-109	C-110	C-111	C-112	C-201	C-202	C-203	C-204	Total Tanks
106Ru	Ci	1.01E-14	1.55E-11	1.03E-10	4.48E-10	1.83E-14	4.18E-11	2.79E-08	1.88E-16	1.48E-12	1.45E-16	1.15E-12	2.35E-15	3.36E-13	3.51E-13	6.70E-13	4.33E-13	2.86E-08
113mCd	Ci	8.92E-02	2.32E-01	1.66E+01	7.59E+00	1.23E-01	6.96E+00	4.68E+02	6.92E-02	2.28E-01	5.74E-02	2.02E-01	2.28E-01	2.83E-02	2.95E-02	5.66E-02	3.63E-02	5.00E+02
125Sb	Ci	1.26E-04	1.87E-03	8.19E-02	1.49E+00	2.12E-04	2.39E-02	6.26E-02	3.08E-05	1.23E-04	2.45E-05	1.06E-04	3.28E-03	1.19E-05	1.24E-05	2.37E-05	1.53E-05	1.67E+00
126Sn	Ci	1.30E-02	2.63E-02	1.15E+01	1.72E+00	1.63E-02	2.14E+00	6.37E+01	1.28E-02	4.29E-02	1.07E-02	3.79E-02	4.15E-02	5.61E-03	5.85E-03	1.12E-02	7.21E-03	7.93E+01
129I	Ci	1.34E-03	2.74E-03	6.62E-02	7.54E-01	9.30E-02	1.70E-02	4.83E-02	1.32E-03	2.00E-03	1.10E-03	2.01E-03	4.26E-03	2.74E-05	2.85E-05	5.46E-05	3.52E-05	9.93E-01
134Cs	Ci	3.45E-07	1.82E-05	3.50E-04	7.65E-05	6.05E-07	1.20E-04	8.33E-04	1.12E-06	2.36E-06	1.09E-07	2.47E-06	4.51E-04	1.27E-09	1.32E-09	2.53E-09	1.63E-09	1.86E-03
137Cs	Ci	2.35E+04	1.92E+04	6.20E+04	6.16E+04	5.28E+04	1.13E+04	4.10E+04	5.26E+04	1.10E+05	9.29E+03	1.26E+04	1.84E+05	5.08E+01	5.30E+01	1.01E+02	6.52E+01	6.41E+05
137mBa	Ci	2.10E+04	1.72E+04	5.54E+04	5.50E+04	4.72E+04	1.01E+04	3.66E+04	4.70E+04	9.87E+04	8.35E+03	1.13E+04	1.64E+05	4.54E+01	4.73E+01	9.02E+01	5.84E+01	5.72E+05
14C	Ci	9.98E-02	2.82E-01	4.88E+00	1.85E+00	5.06E-01	5.72E-02	3.79E+00	1.31E-01	1.63E-02	3.32E-01	1.62E-01	3.60E+00	2.01E-03	2.09E-03	3.99E-03	2.57E-03	1.57E+01
151Sm	Ci	6.30E+01	1.14E+02	5.53E+04	8.12E+03	7.77E+01	1.03E+04	5.49E+05	6.49E+01	2.10E+02	5.43E+01	1.87E+02	2.09E+02	2.70E+01	2.81E+01	5.37E+01	3.46E+01	6.24E+05
152Eu	Ci	4.88E-02	2.92E-01	7.03E+00	9.19E-01	5.37E-02	1.24E+00	4.42E+01	4.95E-02	7.52E-01	6.16E-03	6.09E-01	1.94E-01	1.53E-01	1.60E-01	3.06E-01	1.97E-01	5.63E+01
154Eu	Ci	1.23E-01	7.13E+00	1.19E+03	2.38E+02	1.96E-01	5.77E+01	3.46E+02	1.25E-01	2.89E-01	3.09E-01	2.53E-01	4.77E+01	4.13E-02	4.30E-02	8.21E-02	5.29E-02	1.88E+03
155Eu	Ci	2.76E-01	1.63E+00	2.06E+02	5.03E+01	2.68E-01	1.18E+01	6.50E+01	1.78E-01	1.19E+00	6.75E-02	3.58E+00	9.57E+00	8.88E-01	9.25E-01	1.77E+00	1.14E+00	3.54E+02
226Ra	Ci	3.35E-06	7.41E-04	2.45E-03	6.22E-03	2.80E-06	4.07E-04	2.14E-02	5.81E-06	2.92E-04	5.09E-06	2.29E-04	1.81E-05	6.47E-05	6.73E-05	1.29E-04	8.30E-05	3.21E-02
227Ac	Ci	1.20E-05	1.10E+01	7.59E-03	5.95E+01	1.03E-05	1.26E-03	7.70E-02	2.02E-05	6.39E-04	1.76E-05	5.05E-04	6.34E-05	1.40E-04	1.45E-04	2.79E-04	1.79E-04	7.06E+01
228Ra	Ci	2.22E-11	2.67E-01	1.57E-05	2.30E+00	1.43E-11	3.20E-06	4.93E-03	3.68E-11	1.35E-10	6.09E-12	1.21E-10	1.40E-10	1.81E-11	1.88E-11	3.60E-11	2.32E-11	2.57E+00
229Th	Ci	8.21E-08	1.62E-01	1.32E-04	9.39E-01	5.10E-08	2.43E-05	2.43E-03	1.39E-07	5.04E-07	1.90E-08	4.50E-07	5.31E-07	6.62E-08	6.90E-08	1.32E-07	8.50E-08	1.10E+00
231Pa	Ci	3.98E-05	2.96E+01	1.79E-02	2.39E+02	3.55E-05	3.37E-03	1.92E-01	6.50E-05	1.23E-04	5.66E-05	1.18E-04	2.04E-04	8.65E-06	9.01E-06	1.73E-05	1.11E-05	2.69E+02
232Th	Ci	2.50E-11	3.24E-02	3.07E-05	5.58E+00	2.91E-11	2.54E-03	7.28E-02	2.88E-11	4.19E-11	2.43E-11	4.28E-11	9.24E-11	4.78E-13	4.98E-13	9.54E-13	6.14E-13	5.69E+00
232U	Ci	9.85E-05	1.89E-01	4.43E-02	1.60E+01	1.31E-04	4.39E-04	4.51E-03	4.63E-07	4.67E-05	5.97E-06	3.90E-05	1.19E-01	3.44E-09	2.15E-08	6.85E-09	4.43E-09	1.63E+01
233U	Ci	4.62E-06	9.58E-01	2.20E-01	4.13E+02	5.65E-06	2.18E-03	2.26E-02	3.58E-08	2.52E-06	4.62E-07	1.84E-06	5.99E-01	2.66E-10	7.31E-10	5.30E-10	3.42E-10	4.15E+02
234U	Ci	3.14E+00	2.72E+00	1.95E+00	2.08E+01	3.21E+00	4.31E-02	5.63E-01	5.03E-02	1.44E+00	6.51E-01	1.40E+00	7.98E+00	3.75E-04	3.99E-04	7.47E-04	4.82E-04	4.39E+01
235U	Ci	1.36E-01	1.17E-01	8.32E-02	6.03E-01	1.37E-01	1.84E-03	1.37E-01	2.26E-03	5.75E-02	2.93E-02	6.10E-02	3.50E-01	1.69E-05	1.68E-05	3.36E-05	2.17E-05	1.72E+00
236U	Ci	4.48E-02	4.45E-02	3.48E-02	6.84E-01	5.56E-02	7.66E-04	8.92E-02	3.22E-04	2.09E-02	4.16E-03	1.85E-02	9.88E-02	2.39E-06	9.28E-06	4.77E-06	3.08E-06	1.10E+00
237Np	Ci	4.44E-03	9.38E-03	1.08E-01	4.39E+00	5.61E-03	2.62E-01	8.07E-02	4.32E-03	9.78E-02	3.61E-03	6.46E-03	7.51E-01	4.28E-05	4.46E-05	8.53E-05	5.49E-05	5.72E+00
238Pu	Ci	8.95E+00	7.91E+01	5.84E+01	1.95E+02	2.62E+01	3.01E+00	5.86E+01	1.02E-02	1.33E+00	1.76E-01	1.19E+00	6.91E+00	1.25E+00	6.56E-01	3.28E-01	6.68E-03	4.42E+02
238U	Ci	3.21E+00	2.72E+00	1.99E+00	1.17E+01	3.29E+00	4.40E-02	3.10E+00	5.09E-02	1.36E+00	6.59E-01	1.42E+00	8.06E+00	3.80E-04	3.96E-04	7.56E-04	4.89E-04	3.76E+01
239Pu	Ci	5.35E+02	3.38E+03	4.21E+03	5.47E+03	2.06E+03	7.56E+01	2.16E+03	3.19E+00	6.07E+01	6.78E+01	1.31E+02	8.19E+01	6.48E+01	3.39E+01	1.70E+01	3.47E-01	1.83E+04
240Pu	Ci	8.93E+01	6.19E+02	6.48E+02	1.08E+03	3.13E+02	1.54E+01	3.92E+02	2.06E-01	1.03E+01	3.99E+00	1.44E+01	1.30E+01	1.07E+01	5.56E+00	2.78E+00	5.68E-02	3.22E+03
241Am	Ci	8.05E+00	1.13E+03	3.04E+03	6.15E+03	1.15E+03	2.18E+02	6.55E+03	6.38E+00	4.52E+01	3.80E+01	2.07E+02	4.61E+02	2.20E+01	1.15E+01	5.77E+00	1.17E-01	1.90E+04
241Pu	Ci	2.45E+02	2.14E+03	1.45E+03	5.93E+03	6.73E+02	7.41E+01	1.49E+03	7.93E-02	2.43E+01	7.29E-01	2.47E+01	3.23E+01	3.17E+01	1.66E+01	8.30E+00	1.70E-01	1.21E+04
242Cm	Ci	3.26E-03	1.96E+00	3.58E+00	4.90E+00	3.47E-01	3.24E-01	4.89E+00	1.25E-01	7.38E-02	4.11E-02	2.81E+00	1.38E+00	3.11E-02	1.62E-02	8.13E-03	1.65E-04	2.05E+01
242Pu	Ci	2.66E-03	2.84E-02	2.02E-02	9.49E-02	8.94E-03	1.65E-03	2.74E-02	1.08E-06	9.05E-04	7.82E-06	3.95E-04	4.11E-04	5.46E-04	2.85E-04	1.43E-04	2.92E-06	1.87E-01
243Am	Ci	1.86E-06	3.64E-03	7.19E-02	3.11E-01	3.25E-04	2.20E-03	3.46E-01	4.55E-05	1.09E-03	1.16E-04	1.94E-03	1.20E-02	5.25E-04	2.75E-04	1.37E-04	2.80E-06	7.52E-01
243Cm	Ci	4.65E-05	4.32E-02	1.50E-01	2.74E-01	5.01E-03	1.79E-02	2.68E-01	1.56E-03	2.25E-03	3.71E-04	3.77E-02	3.19E-02	1.04E-03	5.42E-04	2.71E-04	5.53E-06	8.34E-01
244Cm	Ci	2.58E-05	3.21E-01	8.60E-01	7.25E+00	5.80E-03	2.91E-01	7.54E+00	3.97E-04	8.45E-04	6.57E-04	2.57E-02	1.03E-02	3.48E-04	1.82E-04	9.08E-05	1.86E-06	1.63E+01
3H	Ci	1.63E-01	3.57E-01	3.42E+00	1.93E+01	2.01E-01	5.32E-01	1.03E+01	1.33E-01	4.64E-01	2.32E-01	1.93E-01	2.48E+00	3.37E-04	3.50E-04	6.70E-04	4.33E-04	3.77E+01
59Ni	Ci	2.84E-02	4.52E-02	3.84E+01	4.58E+00	3.53E-02	6.53E+00	3.22E+02	1.09E+00	5.54E+00	2.40E-02	4.94E+00	8.36E+00	7.52E-01	7.84E-01	1.50E+00	9.66E-01	3.96E+02
60Co	Ci	1.49E-03	1.13E+01	5.95E+01	2.24E+01	7.10E+00	1.15E-01	2.03E+01	7.49E-04	1.59E-03	6.07E-04	1.49E-03	3.56E-01	6.92E-05	7.21E-05	1.38E-04	8.88E-05	1.21E+02
63Ni	Ci	2.21E+00	3.70E+00	3.14E+03	3.77E+02	2.79E+00	5.34E+02	2.64E+04	8.17E+01	4.38E+02	1.80E+00	3.87E+02	6.65E+02	6.14E+01	6.40E+01	1.23E+02	7.89E+01	3.24E+04
79Se	Ci	2.11E-03	4.70E-03	1.76E+00	6.41E+00	2.64E-03	2.88E-01	1.79E+01	2.12E-03	5.34E-03	2.02E-03	6.10E-03	5.56E-01	8.79E-04	9.16E-04	1.75E-03	1.13E-03	2.69E+01
90Sr	Ci	1.81E+05	3.76E+05	1.90E+06	3.06E+05	3.01E+05	1.78E+05	1.42E+06	5.34E+03	1.59E+05	2.35E+03	5.63E+05	4.10E+05	2.61E+02	2.73E+02	5.21E+02	3.37E+02	5.81E+06
90Y	Ci	1.81E+05	3.76E+05	1.90E+06	3.06E+05	3.01E+05	1.78E+05	1.42E+06	5.34E+03	1.59E+05	2.35E+03	5.63E+05	4.10E+05	2.61E+02	2.73E+02	5.21E+02	3.37E+02	5.81E+06
93mNb	Ci	3.83E-02	7.24E-02	3.04E+01	4.37E+00	4.68E-02	5.65E+00	3.08E+02	3.97E-02	1.23E-01	3.33E-02	1.09E-01	1.28E-01	1.52E-02	1.58E-02	3.04E-02	1.96E-02	3.49E+02
93Zr	Ci	9.98E-02	1.99E-01	7.42E+01	1.17E+01	1.24E-01	1.44E+01	7.75E+02	1.01E-01	3.13E-01	8.46E-02	2.79E-01	3.26E-01	3.88E-02	4.04E-02	7.73E-02	4.98E-02	8.77E+02
99Tc	Ci	6.97E-01	1.32E+00	3.42E+01	5.80E+01	8.14E+01	3.14E+00	3.79E+01	6.19E+00	3.23E+01	3.18E+01	2.70E+00	6.11E+01	1.41E-02	1.47E-02	2.82E-02	1.81E-02	3.51E+02

12-1-2002 BBI C-Farm Tank Waste Concentrations and Average Concentrations by Constituent																	
Analyte	**Units**	**C-101**	**C-102**	**C-103**	**C-104**	**C-105**	**C-106**	**C-107**	**C-108**	**C-109**	**C-110**	**C-111**	**C-112**	**C-201**	**C-202**	**C-203**	**C-204**	**Average**
Tank Volume	kL	333	1196	764	980	500	138	940	250	240	674	217	393	4	4	10	10	Conc.
Al	g/L	1.96E+02	6.90E+01	1.78E+02	9.19E+01	3.44E+02	1.49E+01	6.23E+01	7.56E+01	9.75E+01	1.94E+01	1.32E+02	3.16E+01	6.85E+00	7.15E+00	5.46E+00	3.53E+00	8.34E+01
Bi	g/L	1.87E+00	2.20E+00	4.75E-01	4.90E-02	7.44E-01	5.64E-03	1.11E+01	1.76E+01	4.75E+00	2.20E+01	7.79E+00	5.19E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.61E+00
Ca	g/L	1.11E+01	5.70E+00	3.40E+00	3.05E+00	3.94E+00	5.96E-01	1.32E+00	1.84E+01	2.35E+01	1.56E+00	1.84E+01	2.98E+01	3.10E+01	3.25E+01	2.48E+01	1.60E+01	1.41E+01
Cl	g/L	1.61E+00	1.55E+00	7.97E-01	8.16E-01	7.46E-01	2.33E-01	9.26E-01	1.06E+00	1.16E+00	1.47E+00	1.24E+00	1.35E+00	8.73E-01	2.48E+00	1.29E+00	8.34E-01	1.15E+00
Cr	g/L	8.98E-01	6.15E-01	9.03E-01	1.49E+00	8.26E-01	4.48E-01	9.89E-01	9.28E-01	4.92E-01	6.23E-01	3.93E-01	3.54E-01	5.73E-01	5.98E-01	4.57E-01	2.95E-01	6.80E-01
F	g/L	1.43E+00	3.43E+00	1.56E+00	3.53E+01	1.74E+00	1.21E-01	6.80E+00	6.16E+00	2.69E+00	1.00E+01	3.98E+00	1.08E+00	3.13E+00	5.75E+00	3.44E+00	2.22E+00	5.55E+00
Fe	g/L	4.80E+01	1.69E+01	1.45E+01	2.82E+01	5.64E+00	2.22E+01	1.10E+02	1.04E+01	2.72E+01	1.46E+01	6.13E+01	3.49E+01	2.65E+02	2.78E+02	2.12E+02	1.37E+02	8.03E+01
Hg	g/L	1.24E-01	1.03E-02	2.11E-01	6.87E-02	2.78E-02	3.23E-02	7.13E-02	8.24E-02	8.96E-03	5.91E-04	0.00E+00	7.05E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.02E-02
K	g/L	1.71E+00	1.20E+00	7.50E-01	1.36E+00	1.72E+00	7.83E-01	4.76E-01	5.48E-01	7.33E-01	7.58E-01	1.33E+00	7.63E-01	1.71E+00	1.79E+00	1.36E+00	8.82E-01	1.12E+00
La	g/L	5.98E-01	1.66E-01	1.88E-01	4.97E-02	7.30E-01	8.91E-02	2.87E-01	1.76E-02	1.05E-02	1.90E-03	4.84E-01	1.15E-01	3.00E+00	3.13E+00	2.39E+00	1.54E+00	8.00E-01
Mn	g/L	1.37E+00	1.36E+00	4.42E-01	7.15E+00	3.80E+00	5.50E+00	5.34E+00	2.28E-01	3.00E-01	7.06E-02	3.69E-01	3.13E-01	4.28E-02	4.48E-02	3.41E-02	2.20E-02	1.65E+00
Na	g/L	1.71E+02	8.86E+01	3.86E+01	1.82E+02	6.58E+01	8.70E+01	1.01E+02	1.36E+02	1.45E+02	1.12E+02	5.85E+01	1.27E+02	1.16E+02	1.21E+02	9.21E+01	5.95E+01	1.06E+02
Ni	g/L	2.56E+00	5.63E+00	4.48E+00	2.68E+00	3.32E+00	7.68E-01	3.29E+00	1.22E+01	1.90E+01	3.22E-02	2.25E+01	1.98E+01	3.43E+01	3.58E+01	2.73E+01	1.76E+01	1.32E+01
NO2	g/L	2.76E+01	1.41E+01	2.13E+01	3.72E+01	1.68E+01	1.11E+01	3.76E+01	3.50E+01	5.08E+01	9.69E+00	4.37E+01	7.07E+01	1.05E+01	5.35E+01	2.45E+01	1.58E+01	3.00E+01
NO3	g/L	1.84E+02	6.12E+01	1.81E+00	2.00E+01	1.63E+01	5.57E-01	5.09E+01	6.28E+01	7.50E+01	1.45E+02	7.97E+01	9.47E+01	5.68E+01	1.60E+02	8.38E+01	5.41E+01	7.17E+01
Pb	g/L	2.33E+00	9.28E-01	5.84E-01	8.54E-01	7.18E-01	1.17E+00	1.07E+01	1.25E+00	3.45E+00	3.26E-01	6.45E+00	3.77E+00	2.43E+02	2.53E+02	1.93E+02	1.25E+02	5.29E+01
PO4	g/L	1.01E+02	1.18E+01	4.80E+00	3.28E+00	1.20E+01	6.80E+00	6.26E+01	1.19E+02	1.05E+02	8.43E+01	8.34E+01	9.92E+01	2.50E+00	2.75E+00	2.04E+00	1.32E+00	4.38E+01
Si	g/L	2.41E+01	3.07E+01	3.60E+01	1.04E+01	6.18E+01	4.91E-01	1.99E+00	8.16E+00	8.92E+00	9.39E+00	1.06E+01	3.94E+00	1.64E+01	1.71E+01	1.31E+01	8.45E+00	1.63E+01
SO4	g/L	1.92E+01	4.81E+00	3.69E+00	3.49E+00	7.08E+00	3.49E+00	8.97E+00	9.72E+00	1.23E+01	1.65E+01	6.87E+00	1.78E+01	2.85E+00	7.55E+00	4.02E+00	2.59E+00	8.18E+00
Sr	g/L	8.26E-01	1.32E-01	5.76E-02	8.92E-02	2.86E-01	4.71E-02	2.73E-01	5.96E-01	5.17E-01	1.66E-01	2.65E-01	4.91E-01	6.98E+00	7.28E+00	5.56E+00	3.59E+00	1.70E+00
TIC as CO3	g/L	3.48E+01	6.35E+01	3.72E+01	4.95E+01	3.30E+01	9.57E+01	1.21E+01	1.52E+01	3.85E+01	1.40E+01	3.11E+01	3.72E+01	1.63E+02	1.67E+02	1.30E+02	8.51E+01	6.29E+01
TOC	g/L	3.57E+00	1.31E+00	1.01E+01	1.45E+01	9.48E+00	3.80E+00	7.83E-01	1.37E+00	3.17E+00	7.74E-01	1.12E+00	6.16E+00	6.25E+01	5.38E+01	4.54E+01	2.93E+01	1.54E+01
UTOTAL	g/L	2.89E+01	6.81E+00	7.80E+00	3.60E+01	1.97E+01	9.57E-01	9.88E+00	6.12E-01	1.69E+01	2.92E+00	1.96E+01	6.13E+01	2.85E-01	2.98E-01	2.26E-01	1.46E-01	1.33E+01
Zr	g/L	5.98E-01	4.31E+00	1.07E+01	6.62E+01	3.60E-01	1.93E-02	7.86E-02	1.24E-01	4.25E-02	2.23E-01	2.45E-01	2.46E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.19E+00

12-1-2002 BBI Radionuclide values, decayed to 1/1/2001 for EIS data package

Analyte	Units	C-101	C-102	C-103	C-104	C-105	C-106	C-107	C-108	C-109	C-110	C-111	C-112	C-201	C-202	C-203	C-204	Average
106Ru	Ci/L	1.23E-14	5.24E-12	5.43E-11	1.85E-10	1.48E-14	1.22E-10	1.20E-08	3.05E-16	2.49E-12	8.72E-17	2.15E-12	2.42E-15	3.40E-11	3.55E-11	2.71E-11	1.75E-11	7.82E-10
113mCd	Ci/L	6.82E-07	4.93E-07	5.54E-05	1.97E-05	6.26E-07	1.28E-04	1.27E-03	7.04E-07	2.42E-06	2.17E-07	2.37E-06	1.48E-06	1.80E-05	1.88E-05	1.44E-05	9.24E-06	9.62E-05
125Sb	Ci/L	4.47E-08	1.85E-07	1.27E-05	1.81E-04	5.02E-08	2.05E-05	7.89E-06	1.46E-08	6.08E-08	4.30E-09	5.76E-08	9.90E-07	3.53E-07	3.68E-07	2.81E-07	1.81E-07	1.40E-05
126Sn	Ci/L	3.90E-08	2.20E-08	1.51E-05	1.76E-06	3.26E-08	1.55E-05	6.78E-05	5.12E-08	1.79E-07	1.59E-08	1.75E-07	1.06E-07	1.40E-06	1.46E-06	1.12E-06	7.21E-07	6.59E-06
129I	Ci/L	4.02E-09	2.29E-09	8.66E-08	7.69E-07	1.86E-07	1.23E-07	5.14E-08	5.28E-09	8.33E-09	1.63E-09	9.26E-09	1.08E-08	6.85E-09	7.13E-09	5.46E-09	3.52E-09	8.01E-08
134Cs	Ci/L	6.10E-10	8.95E-09	2.70E-07	4.59E-08	7.12E-10	5.12E-07	5.21E-07	2.64E-09	5.79E-09	9.54E-11	6.68E-09	6.74E-07	1.87E-10	1.95E-10	1.49E-10	9.59E-11	1.28E-07
137Cs	Ci/L	1.09E-01	2.49E-02	1.26E-01	9.74E-02	1.64E-01	1.27E-01	6.76E-02	3.26E-01	7.13E-01	2.14E-02	9.03E-02	7.25E-01	1.97E-02	2.06E-02	1.57E-02	1.01E-02	1.66E-01
137mBa	Ci/L	1.03E-01	2.36E-02	1.19E-01	9.21E-02	1.55E-01	1.20E-01	6.39E-02	3.08E-01	6.75E-01	2.03E-02	8.53E-02	6.84E-01	1.86E-02	1.94E-02	1.48E-02	9.59E-03	1.57E-01
14C	Ci/L	3.00E-07	2.37E-07	6.40E-06	1.89E-06	1.01E-06	4.15E-07	4.04E-06	5.24E-07	6.79E-08	4.94E-07	7.47E-07	9.19E-06	5.03E-07	5.23E-07	4.00E-07	2.58E-07	1.69E-06
151Sm	Ci/L	2.19E-04	1.10E-04	8.38E-02	9.59E-03	1.80E-04	8.62E-02	6.77E-01	3.00E-04	1.01E-03	9.33E-05	9.95E-04	6.16E-04	7.80E-03	8.13E-03	6.22E-03	4.01E-03	5.54E-02
152Eu	Ci/L	3.87E-07	6.45E-07	2.43E-05	2.48E-06	2.84E-07	2.38E-05	1.24E-04	5.24E-07	8.29E-06	2.42E-08	7.42E-06	1.30E-06	1.01E-04	1.06E-04	8.08E-05	5.20E-05	3.33E-05
154Eu	Ci/L	1.71E-06	2.76E-05	7.19E-03	1.12E-03	1.81E-06	1.93E-03	1.70E-03	2.31E-06	5.58E-06	2.12E-06	5.39E-06	5.62E-04	4.78E-05	4.98E-05	3.80E-05	2.45E-05	7.95E-04
155Eu	Ci/L	1.32E-05	2.18E-05	4.31E-03	8.21E-04	8.56E-06	1.37E-03	1.11E-03	1.14E-05	7.92E-05	1.60E-06	2.64E-04	3.89E-04	3.55E-03	3.70E-03	2.83E-03	1.82E-03	1.27E-03
226Ra	Ci/L	1.02E-11	6.25E-10	3.23E-09	6.40E-09	5.64E-12	2.97E-09	2.30E-08	2.34E-11	1.23E-09	7.61E-12	1.06E-09	4.66E-11	1.63E-08	1.70E-08	1.30E-08	8.37E-09	5.83E-09
227Ac	Ci/L	6.58E-11	1.68E-05	1.82E-08	1.11E-04	3.78E-11	1.67E-08	1.50E-07	1.48E-10	4.88E-09	4.78E-11	4.26E-09	2.95E-10	6.40E-08	6.65E-08	5.10E-08	3.28E-08	8.03E-06
228Ra	Ci/L	6.55E-16	2.20E-06	2.02E-10	2.31E-05	2.82E-16	2.28E-10	5.16E-08	1.45E-15	5.54E-15	8.89E-17	5.48E-15	3.51E-15	4.45E-14	4.63E-14	3.54E-14	2.28E-14	1.58E-06
229Th	Ci/L	2.47E-13	1.35E-07	1.73E-10	9.60E-07	1.02E-13	1.76E-10	2.59E-09	5.56E-13	2.10E-12	2.82E-14	2.08E-12	1.35E-12	1.66E-11	1.73E-11	1.32E-11	8.52E-12	6.87E-08
231Pa	Ci/L	1.20E-10	2.47E-05	2.34E-08	2.44E-04	7.10E-11	2.44E-08	2.04E-07	2.60E-10	5.13E-10	8.40E-11	5.44E-10	5.19E-10	2.16E-09	2.25E-09	1.73E-09	1.11E-09	1.68E-05
232Th	Ci/L	7.51E-17	2.71E-08	4.02E-11	5.69E-06	5.82E-17	1.84E-08	7.74E-08	1.15E-16	1.75E-16	3.61E-17	1.97E-16	2.35E-16	1.20E-16	1.25E-16	9.54E-17	6.14E-17	3.64E-07
232U	Ci/L	3.57E-10	1.91E-07	7.00E-08	1.97E-05	3.16E-10	3.84E-09	5.80E-09	2.24E-12	2.35E-10	1.07E-11	2.17E-10	3.66E-07	1.04E-12	6.50E-12	8.27E-13	5.35E-13	1.27E-06
233U	Ci/L	1.39E-11	8.01E-07	2.88E-07	4.21E-04	1.13E-11	1.58E-08	2.40E-08	1.43E-13	1.05E-11	6.85E-13	8.48E-12	1.52E-06	6.65E-14	1.83E-13	5.30E-14	3.42E-14	2.65E-05
234U	Ci/L	9.43E-06	2.27E-06	2.55E-06	2.12E-05	6.42E-06	3.12E-07	5.99E-07	2.01E-07	6.00E-06	9.66E-07	6.45E-06	2.03E-05	9.38E-08	9.98E-08	7.47E-08	4.82E-08	4.82E-06
235U	Ci/L	4.08E-07	9.78E-08	1.09E-07	6.15E-07	2.74E-07	1.33E-08	1.46E-07	9.04E-09	2.40E-07	4.35E-08	2.81E-07	8.91E-07	4.23E-09	4.20E-09	3.36E-09	2.17E-09	1.96E-07
236U	Ci/L	1.35E-07	3.72E-08	4.55E-08	6.98E-07	1.11E-07	5.55E-09	9.49E-08	1.29E-09	8.71E-08	6.17E-09	8.53E-08	2.51E-07	5.98E-10	2.32E-09	4.77E-10	3.08E-10	9.76E-08
237Np	Ci/L	1.33E-08	7.84E-09	1.41E-07	4.48E-06	1.12E-08	1.90E-06	8.59E-08	1.73E-08	4.08E-07	5.36E-09	2.98E-08	1.91E-06	1.07E-08	1.12E-08	8.53E-09	5.49E-09	5.65E-07
238Pu	Ci/L	3.12E-05	7.68E-05	8.89E-05	2.32E-04	6.10E-05	2.54E-05	7.24E-05	4.72E-08	6.46E-06	3.04E-07	6.36E-06	2.04E-05	3.63E-04	1.91E-04	3.81E-05	7.76E-07	7.58E-05
238U	Ci/L	9.64E-06	2.27E-06	2.60E-06	1.19E-05	6.58E-06	3.19E-07	3.30E-06	2.04E-07	5.67E-06	9.78E-07	6.54E-06	2.05E-05	9.50E-08	9.90E-08	7.56E-08	4.89E-08	4.43E-06
239Pu	Ci/L	1.61E-03	2.83E-03	5.51E-03	5.58E-03	4.12E-03	5.48E-04	2.30E-03	1.28E-05	2.53E-04	1.01E-04	6.04E-04	2.08E-04	1.62E-02	8.48E-03	1.70E-03	3.47E-05	3.13E-03
240Pu	Ci/L	2.69E-04	5.18E-04	8.49E-04	1.10E-03	6.28E-04	1.12E-04	4.18E-04	8.24E-07	4.29E-05	5.93E-06	6.64E-05	3.31E-05	2.68E-03	1.39E-03	2.79E-04	5.69E-06	5.25E-04
241Am	Ci/L	2.49E-05	9.70E-04	4.10E-03	6.47E-03	2.38E-03	1.63E-03	7.18E-03	2.63E-05	1.94E-04	5.82E-05	9.82E-04	1.21E-03	5.68E-03	2.98E-03	5.95E-04	1.21E-05	2.15E-03
241Pu	Ci/L	1.83E-03	4.47E-03	4.73E-03	1.51E-02	3.36E-03	1.34E-03	3.97E-03	7.92E-07	2.53E-04	2.70E-06	2.84E-04	2.05E-04	1.98E-02	1.04E-02	2.07E-03	4.23E-05	4.24E-03
242Cm	Ci/L	1.08E-08	1.80E-06	5.14E-06	5.49E-06	7.62E-07	2.58E-06	5.71E-06	5.48E-07	3.38E-07	6.69E-08	1.42E-05	3.84E-06	8.53E-06	4.45E-06	8.93E-07	1.81E-08	3.40E-06
242Pu	Ci/L	7.99E-09	2.37E-08	2.64E-08	9.68E-08	1.79E-08	1.20E-08	2.91E-08	4.32E-12	3.77E-09	1.16E-11	1.82E-09	1.05E-09	1.37E-07	7.13E-08	1.43E-08	2.92E-10	2.77E-08
243Am	Ci/L	5.59E-12	3.05E-09	9.42E-08	3.18E-07	6.52E-10	1.59E-08	3.69E-07	1.82E-10	4.54E-09	1.72E-10	8.94E-09	3.05E-08	1.32E-07	6.88E-08	1.37E-08	2.80E-10	6.63E-08
243Cm	Ci/L	2.20E-10	5.68E-08	3.09E-07	4.40E-07	1.57E-08	2.04E-07	4.48E-07	9.80E-09	1.48E-08	8.66E-10	2.73E-07	1.27E-07	4.08E-07	2.13E-07	4.26E-08	8.70E-10	1.60E-07
244Cm	Ci/L	1.60E-10	5.56E-07	2.33E-06	1.53E-05	2.40E-08	4.37E-06	1.66E-05	3.28E-09	7.29E-09	2.02E-09	2.45E-07	5.42E-08	1.80E-07	9.40E-08	1.88E-08	3.84E-10	2.49E-06
3H	Ci/L	1.43E-06	8.70E-07	1.30E-05	5.72E-05	1.17E-06	1.12E-05	3.18E-05	1.55E-06	5.63E-06	1.00E-06	2.59E-06	1.84E-05	2.45E-07	2.55E-07	1.95E-07	1.26E-07	9.17E-06
59Ni	Ci/L	8.53E-08	3.78E-08	5.03E-05	4.67E-06	7.06E-08	4.73E-05	3.43E-04	4.36E-06	2.31E-05	3.56E-08	2.28E-05	2.13E-05	1.88E-04	1.96E-04	1.50E-04	9.66E-05	7.17E-05
60Co	Ci/L	5.44E-08	1.15E-04	9.48E-04	2.78E-04	1.73E-04	1.01E-05	2.63E-04	3.64E-08	8.04E-08	1.09E-08	8.34E-08	1.10E-05	2.11E-07	2.19E-07	1.68E-07	1.08E-07	1.12E-04
63Ni	Ci/L	7.57E-06	3.53E-06	4.69E-03	4.38E-04	6.36E-06	4.41E-03	3.20E-02	3.72E-04	2.08E-03	3.04E-06	2.03E-03	1.93E-03	1.75E-02	1.82E-02	1.40E-02	8.99E-03	6.67E-03
79Se	Ci/L	6.34E-09	3.93E-09	2.30E-06	6.54E-06	5.28E-09	2.09E-06	1.90E-05	8.48E-09	2.23E-08	3.00E-09	2.81E-08	1.41E-06	2.20E-07	2.29E-07	1.75E-07	1.13E-07	2.01E-06
90Sr	Ci/L	8.59E-01	4.97E-01	3.94E+00	4.94E-01	9.52E-01	2.04E+00	2.38E+00	3.38E-02	1.05E+00	5.52E-03	4.10E+00	1.65E+00	1.03E-01	1.08E-01	8.23E-02	5.32E-02	1.15E+00
90Y	Ci/L	8.59E-01	4.97E-01	3.94E+00	4.94E-01	9.52E-01	2.04E+00	2.38E+00	3.38E-02	1.05E+00	5.52E-03	4.10E+00	1.65E+00	1.03E-01	1.08E-01	8.23E-02	5.32E-02	1.15E+00
93mNb	Ci/L	2.60E-07	1.37E-07	9.02E-05	1.01E-05	2.12E-07	9.28E-05	7.43E-04	3.60E-07	1.16E-06	1.12E-07	1.14E-06	7.38E-07	8.63E-06	8.98E-06	6.88E-06	4.43E-06	6.05E-05
93Zr	Ci/L	3.00E-07	1.66E-07	9.71E-05	1.19E-05	2.48E-07	1.04E-04	8.24E-04	4.04E-07	1.30E-06	1.26E-07	1.29E-06	8.30E-07	9.70E-06	1.01E-05	7.73E-06	4.98E-06	6.72E-05
99Tc	Ci/L	2.09E-06	1.10E-06	4.48E-05	5.92E-05	1.63E-04	2.28E-05	4.03E-05	2.48E-05	1.35E-04	4.72E-05	1.24E-05	1.55E-04	3.53E-06	3.68E-06	2.82E-06	1.81E-06	4.50E-05

12-2002 BBI Radionuclide values, decayed to 1/1/2020 for closure comparisons

Analyte	Units	C-101	C-102	C-103	C-104	C-105	C-106	C-107	C-108	C-109	C-110	C-111	C-112	C-201	C-202	C-203	C-204	Average
106Ru	Ci/L	3.03E-20	1.30E-17	1.34E-16	4.57E-16	3.66E-20	3.03E-16	2.97E-14	7.54E-22	6.16E-18	2.16E-22	5.31E-18	5.98E-21	8.41E-17	8.78E-17	6.70E-17	4.33E-17	1.93E-15
113mCd	Ci/L	2.68E-07	1.94E-07	2.18E-05	7.74E-06	2.46E-07	5.04E-05	4.98E-04	2.77E-07	9.51E-07	8.51E-08	9.31E-07	5.81E-07	7.07E-06	7.37E-06	5.66E-06	3.63E-06	3.78E-05
125Sb	Ci/L	3.78E-10	1.56E-09	1.07E-07	1.52E-06	4.24E-10	1.73E-07	6.66E-08	1.23E-10	5.14E-10	3.63E-11	4.86E-10	8.36E-09	2.98E-09	3.10E-09	2.37E-09	1.53E-09	1.18E-07
126Sn	Ci/L	3.90E-08	2.20E-08	1.51E-05	1.76E-06	3.26E-08	1.55E-05	6.78E-05	5.12E-08	1.79E-07	1.59E-08	1.75E-07	1.06E-07	1.40E-06	1.46E-06	1.12E-06	7.21E-07	6.59E-06
129I	Ci/L	4.02E-09	2.29E-09	8.66E-08	7.69E-07	1.86E-07	1.23E-07	5.14E-08	5.28E-09	8.33E-09	1.63E-09	9.26E-09	1.08E-08	6.85E-09	7.12E-09	5.46E-09	3.52E-09	8.01E-08
134Cs	Ci/L	1.04E-12	1.52E-11	4.58E-10	7.81E-11	1.21E-12	8.71E-10	8.86E-10	4.50E-12	9.85E-12	1.62E-13	1.14E-11	1.15E-09	3.17E-13	3.31E-13	2.53E-13	1.63E-13	2.18E-10
137Cs	Ci/L	7.05E-02	1.61E-02	8.12E-02	6.29E-02	1.06E-01	8.18E-02	4.36E-02	2.10E-01	4.60E-01	1.38E-02	5.83E-02	4.68E-01	1.27E-02	1.33E-02	1.01E-02	6.52E-03	1.07E-01
137mBa	Ci/L	6.29E-02	1.44E-02	7.25E-02	5.61E-02	9.43E-02	7.33E-02	3.90E-02	1.88E-01	4.11E-01	1.24E-02	5.19E-02	4.17E-01	1.13E-02	1.18E-02	9.02E-03	5.84E-03	9.57E-02
14C	Ci/L	3.00E-07	2.36E-07	6.39E-06	1.88E-06	1.01E-06	4.14E-07	4.03E-06	5.23E-07	6.78E-08	4.93E-07	7.45E-07	9.16E-06	5.01E-07	5.21E-07	3.99E-07	2.57E-07	1.68E-06
151Sm	Ci/L	1.89E-04	9.53E-05	7.24E-02	8.29E-03	1.55E-04	7.45E-02	5.85E-01	2.60E-04	8.75E-04	8.06E-05	8.60E-04	5.32E-04	6.74E-03	7.02E-03	5.37E-03	3.46E-03	4.78E-02
152Eu	Ci/L	1.46E-07	2.44E-07	9.21E-06	9.38E-07	1.07E-07	8.99E-06	4.71E-05	1.98E-07	3.14E-06	9.14E-09	2.81E-06	4.93E-07	3.83E-05	3.99E-05	3.06E-05	1.97E-05	1.26E-05
154Eu	Ci/L	3.70E-07	5.96E-06	1.55E-03	2.42E-04	3.91E-07	4.18E-04	3.68E-04	4.99E-07	1.21E-06	4.58E-07	1.16E-06	1.21E-04	1.03E-05	1.07E-05	8.21E-06	5.29E-06	1.72E-04
155Eu	Ci/L	8.28E-07	1.36E-06	2.69E-04	5.14E-05	5.35E-07	8.56E-05	6.92E-05	7.10E-07	4.95E-06	1.00E-07	1.65E-05	2.43E-05	2.22E-04	2.31E-04	1.77E-04	1.14E-04	7.93E-05
226Ra	Ci/L	1.01E-11	6.19E-10	3.21E-09	6.35E-09	5.59E-12	2.95E-09	2.28E-08	2.32E-11	1.21E-09	7.55E-12	1.06E-09	4.62E-11	1.62E-08	1.68E-08	1.29E-08	8.30E-09	5.78E-09
227Ac	Ci/L	3.59E-11	9.18E-06	9.94E-09	6.07E-05	2.06E-11	9.14E-09	8.19E-08	8.08E-11	2.66E-09	2.61E-11	2.33E-09	1.61E-10	3.50E-08	3.63E-08	2.79E-08	1.79E-08	4.38E-06
228Ra	Ci/L	6.65E-17	2.24E-07	2.05E-11	2.34E-06	2.87E-17	2.32E-11	5.24E-09	1.47E-16	5.63E-16	9.03E-18	5.57E-16	3.57E-16	4.52E-15	4.70E-15	3.60E-15	2.32E-15	1.61E-07
229Th	Ci/L	2.46E-13	1.35E-07	1.72E-10	9.58E-07	1.02E-13	1.76E-10	2.58E-09	5.55E-13	2.10E-12	2.81E-14	2.07E-12	1.35E-12	1.65E-11	1.72E-11	1.32E-11	8.50E-12	6.85E-08
231Pa	Ci/L	1.19E-10	2.47E-05	2.34E-08	2.44E-04	7.10E-11	2.44E-08	2.04E-07	2.60E-10	5.12E-10	8.39E-11	5.44E-10	5.19E-10	2.16E-09	2.25E-09	1.73E-09	1.11E-09	1.68E-05
232Th	Ci/L	7.51E-17	2.71E-08	4.02E-11	5.69E-06	5.82E-17	1.84E-08	7.74E-08	1.15E-16	1.75E-16	3.61E-17	1.97E-16	2.35E-16	1.19E-16	1.24E-16	9.54E-17	6.14E-17	3.64E-07
232U	Ci/L	2.96E-10	1.58E-07	5.80E-08	1.63E-05	2.62E-10	3.18E-09	4.80E-09	1.85E-12	1.95E-10	8.86E-12	1.80E-10	3.03E-07	8.59E-13	5.38E-12	6.85E-13	4.43E-13	1.05E-06
233U	Ci/L	1.39E-11	8.01E-07	2.88E-07	4.21E-04	1.13E-11	1.58E-08	2.40E-08	1.43E-13	1.05E-11	6.85E-13	8.48E-12	1.52E-06	6.65E-14	1.83E-13	5.30E-14	3.42E-14	2.65E-05
234U	Ci/L	9.43E-06	2.27E-06	2.55E-06	2.12E-05	6.42E-06	3.12E-07	5.99E-07	2.01E-07	6.00E-06	9.66E-07	6.45E-06	2.03E-05	9.37E-08	9.97E-08	7.47E-08	4.82E-08	4.82E-06
235U	Ci/L	4.08E-07	9.78E-08	1.09E-07	6.15E-07	2.74E-07	1.33E-08	1.46E-07	9.04E-09	2.40E-07	4.35E-08	2.81E-07	8.91E-07	4.22E-09	4.20E-09	3.36E-09	2.17E-09	1.96E-07
236U	Ci/L	1.35E-07	3.72E-08	4.55E-08	6.98E-07	1.11E-07	5.55E-09	9.49E-08	1.29E-09	8.71E-08	6.17E-09	8.53E-08	2.51E-07	5.97E-10	2.32E-09	4.77E-10	3.08E-10	9.76E-08
237Np	Ci/L	1.33E-08	7.84E-09	1.41E-07	4.48E-06	1.12E-08	1.90E-06	8.59E-08	1.73E-08	4.07E-07	5.36E-09	2.98E-08	1.91E-06	1.07E-08	1.11E-08	8.53E-09	5.49E-09	5.65E-07
238Pu	Ci/L	2.69E-05	6.61E-05	7.65E-05	1.99E-04	5.25E-05	2.18E-05	6.23E-05	4.06E-08	5.56E-06	2.62E-07	5.47E-06	1.76E-05	3.12E-04	1.64E-04	3.28E-05	6.68E-07	6.52E-05
238U	Ci/L	9.64E-06	2.27E-06	2.60E-06	1.19E-05	6.58E-06	3.19E-07	3.30E-06	2.04E-07	5.67E-06	9.78E-07	6.54E-06	2.05E-05	9.50E-08	9.90E-08	7.56E-08	4.89E-08	4.43E-06
239Pu	Ci/L	1.61E-03	2.82E-03	5.51E-03	5.58E-03	4.12E-03	5.48E-04	2.30E-03	1.28E-05	2.53E-04	1.01E-04	6.03E-04	2.08E-04	1.62E-02	8.47E-03	1.70E-03	3.47E-05	3.13E-03
240Pu	Ci/L	2.68E-04	5.17E-04	8.48E-04	1.10E-03	6.27E-04	1.11E-04	4.17E-04	8.22E-07	4.28E-05	5.92E-06	6.62E-05	3.30E-05	2.67E-03	1.39E-03	2.78E-04	5.68E-06	5.24E-04
241Am	Ci/L	2.42E-05	9.41E-04	3.97E-03	6.28E-03	2.31E-03	1.58E-03	6.97E-03	2.55E-05	1.88E-04	5.64E-05	9.52E-04	1.17E-03	5.50E-03	2.89E-03	5.77E-04	1.17E-05	2.09E-03
241Pu	Ci/L	7.35E-04	1.79E-03	1.89E-03	6.05E-03	1.35E-03	5.37E-04	1.59E-03	3.17E-07	1.01E-04	1.08E-06	1.14E-04	8.22E-05	7.93E-03	4.15E-03	8.30E-04	1.70E-05	1.70E-03
242Cm	Ci/L	9.79E-09	1.64E-06	4.69E-06	5.00E-06	6.94E-07	2.35E-06	5.20E-06	4.99E-07	3.07E-07	6.09E-08	1.29E-05	3.50E-06	7.76E-06	4.05E-06	8.13E-07	1.65E-08	3.10E-06
242Pu	Ci/L	7.99E-09	2.37E-08	2.64E-08	9.68E-08	1.79E-08	1.20E-08	2.91E-08	4.32E-12	3.77E-09	1.16E-11	1.82E-09	1.05E-09	1.36E-07	7.12E-08	1.43E-08	2.92E-10	2.77E-08
243Am	Ci/L	5.58E-12	3.05E-09	9.41E-08	3.18E-07	6.51E-10	1.59E-08	3.68E-07	1.82E-10	4.53E-09	1.72E-10	8.92E-09	3.05E-08	1.31E-07	6.86E-08	1.37E-08	2.80E-10	6.61E-08
243Cm	Ci/L	1.40E-10	3.61E-08	1.96E-07	2.80E-07	1.00E-08	1.30E-07	2.85E-07	6.23E-09	9.38E-09	5.51E-10	1.74E-07	8.11E-08	2.59E-07	1.35E-07	2.71E-08	5.53E-10	1.02E-07
244Cm	Ci/L	7.75E-11	2.69E-07	1.13E-06	7.39E-06	1.16E-08	2.11E-06	8.02E-06	1.59E-09	3.52E-09	9.75E-10	1.18E-07	2.62E-08	8.70E-08	4.54E-08	9.08E-09	1.86E-10	1.20E-06
3H	Ci/L	4.91E-07	2.99E-07	4.48E-06	1.97E-05	4.02E-07	3.86E-06	1.09E-05	5.32E-07	1.93E-06	3.44E-07	8.89E-07	6.31E-06	8.41E-08	8.76E-08	6.70E-08	4.33E-08	3.15E-06
59Ni	Ci/L	8.53E-08	3.78E-08	5.03E-05	4.67E-06	7.06E-08	4.73E-05	3.42E-04	4.36E-06	2.31E-05	3.56E-08	2.28E-05	2.13E-05	1.88E-04	1.96E-04	1.50E-04	9.66E-05	7.17E-05
60Co	Ci/L	4.47E-09	9.42E-06	7.79E-05	2.28E-05	1.42E-05	8.34E-07	2.16E-05	3.00E-09	6.61E-09	9.00E-10	6.86E-09	9.06E-07	1.73E-08	1.80E-08	1.38E-08	8.88E-09	9.24E-06
63Ni	Ci/L	6.64E-06	3.10E-06	4.11E-03	3.84E-04	5.58E-06	3.87E-03	2.81E-02	3.27E-04	1.83E-03	2.67E-06	1.78E-03	1.69E-03	1.54E-02	1.60E-02	1.23E-02	7.89E-03	5.85E-03
79Se	Ci/L	6.34E-09	3.93E-09	2.30E-06	6.54E-06	5.28E-09	2.09E-06	1.90E-05	8.48E-09	2.22E-08	3.00E-09	2.81E-08	1.41E-06	2.20E-07	2.29E-07	1.75E-07	1.13E-07	2.01E-06
90Sr	Ci/L	5.44E-01	3.14E-01	2.49E+00	3.13E-01	6.02E-01	1.29E+00	1.51E+00	2.14E-02	6.62E-01	3.49E-03	2.60E+00	1.04E+00	6.53E-02	6.82E-02	5.21E-02	3.37E-02	7.26E-01
90Y	Ci/L	5.44E-01	3.14E-01	2.49E+00	3.13E-01	6.02E-01	1.29E+00	1.51E+00	2.14E-02	6.62E-01	3.49E-03	2.60E+00	1.04E+00	6.53E-02	6.82E-02	5.21E-02	3.37E-02	7.26E-01
93mNb	Ci/L	1.15E-07	6.05E-08	3.98E-05	4.46E-06	9.36E-08	4.09E-05	3.28E-04	1.59E-07	5.11E-07	4.94E-08	5.04E-07	3.26E-07	3.81E-06	3.96E-06	3.04E-06	1.96E-06	2.67E-05
93Zr	Ci/L	3.00E-07	1.66E-07	9.71E-05	1.19E-05	2.48E-07	1.04E-04	8.24E-04	4.04E-07	1.30E-06	1.26E-07	1.29E-06	8.30E-07	9.70E-06	1.01E-05	7.73E-06	4.98E-06	6.72E-05
99Tc	Ci/L	2.09E-06	1.10E-06	4.48E-05	5.92E-05	1.63E-04	2.28E-05	4.03E-05	2.48E-05	1.35E-04	4.72E-05	1.24E-05	1.55E-04	3.52E-06	3.67E-06	2.82E-06	1.81E-06	4.50E-05

SPREADSHEET FOR DATA ENTRY AND DECAY CALCULATION (SVF-2545)

Decay from	1/1/2001
Decay to	1/1/2020
Days of Decay	6939

Radionuclide	Alt Radionuclide Name	Half Life (years)	Lambda (1/day)	Decay Factor
Ru-106	106Ru	1.020	1.861E-03	0.0000
Cd-113m	113mCd	14.1	1.346E-04	0.3930
Sb-125	125Sb	2.758	6.881E-04	0.0084
Sn-126	126Sn	2.3E+05	8.251E-09	0.9999
I-129	129I	1.57E+07	1.209E-10	1.0000
Cs-134	134Cs	2.065	9.190E-04	0.0017
Cs-137	137Cs	30.07	6.311E-05	0.6454
Ba-137m	137mBa	4.852E-06	3.911E+02	0.6092
C-14	14C	5715	3.321E-07	0.9977
Sm-151	151Sm	90	2.109E-05	0.8639
Eu-152	152Eu	13.54	1.402E-04	0.3781
Eu-154	154Eu	8.593	2.208E-04	0.2160
Eu-155	155Eu	4.75	3.995E-04	0.0625
Ra-226	226Ra	1599	1.187E-06	0.9918
Ac-227 (2nd Order)	227Ac	21.772	8.716E-05	0.5462
Ra-228 (2nd Order)	228Ra	5.76	3.295E-04	0.1017
Th-229	229Th	7.3E+03	2.600E-07	0.9982
Pa-231	231Pa	3.28E+04	5.786E-08	0.9996
Th-232	232Th	1.40E+10	1.356E-13	1.0000
U-232	232U	69.8	2.719E-05	0.8281
U-233	233U	1.592E+05	1.192E-08	0.9999
U-234	234U	2.46E+05	7.714E-09	0.9999
U-235	235U	7.04E+08	2.696E-12	1.0000
U-236	236U	2.342E+07	8.103E-11	1.0000
Np-237	237Np	2.14E+06	8.868E-10	1.0000

Radionuclide	Alt Radionuclide Name	Half Life (years)	Lambda (1/day)	Decay Factor
Pu-238	238Pu	87.7	2.164E-05	0.8606
U-238	238U	4.47E+09	4.245E-13	1.0000
Pu-239	239Pu	2.410E+04	7.874E-08	0.9995
Pu-240	240Pu	6.56E+03	2.893E-07	0.9980
Am-241 (2nd Order)	241Am	432.7	4.386E-06	0.9700
Pu-241	241Pu	14.4	1.318E-04	0.4007
Cm-242	242Cm	4.46E-01		0.9108
Pu-242	242Pu	3.75E+05	5.061E-09	1.0000
Am-243	243Am	7.37E+03	2.575E-07	0.9982
Cm-243	243Cm	29.1	6.521E-05	0.6360
Cm-244	244Cm	18.1	1.048E-04	0.4831
H-3	3H	12.32	1.540E-04	0.3434
Ni-59	59Ni	7.6E+04	2.497E-08	0.9998
Co-60	60Co	5.271	3.600E-04	0.0822
Ni-63	63Ni	101	1.879E-05	0.8778
Se-79	79Se	2.9E+05	6.544E-09	1.0000
Sr-90	90Sr	28.78	6.594E-05	0.6328
Y-90	90Y	7.31E-03	2.596E-01	0.6328
Nb-93m (2nd Order)	93mNb	16.1	1.179E-04	0.4414
Zr-93	93Zr	1.5E+06	1.265E-09	1.0000
Tc-99	99Tc	2.13E+05	8.910E-09	0.9999

All half-lives taken from the Sixteenth Edition of the Chart of the Nuclides.

RPP-RPT-42323 Rev. 4, Appendix B.2

2019 BBI Inventory for SSTs

Spreadsheet Documentation

Spreadsheet Name	B_2 2019 BBI Inventory for SSTs.xlsx
Related Documents	RPP-RPT-42323, Rev. 4, Hanford C-Farm Tank and Ancillary Equipment Residual Waste Inventory Estimates
Purpose	This spreadsheet was developed to document C-Farm tank waste inventories and concentrations based on 2019 BBI estimates and is Appendix B-2 of RPP-RPT-42323.
Overview	Data for this worksheet was taken from the Best Basis Inventory (BBI) downloaded on 1-3-2019. BBI Radionuclides, decayed to 7-1-2015, were forward decayed to 1-1-2020 for RPP-RPT-42323. The spreadsheet also calculates waste concentrations for each tank and average C-farm residual tank waste concentrations.
Worksheet Descriptions	Inventory worksheet: This worksheet presents the 1-3-2019 BBI standard chemical and radionuclide inventory estimates (rows 2-80). The 2019 inventory estimates are decayed to 1-1-2020 (rows 83-129) by multiplying the BBI values by decay values in column Y from the "concentration" work sheet for each radionuclide as applicable.
	Concentration Worksheet: This worksheet calculates standard BBI chemical and radionuclide concentrations by dividing the inventory values from the "inventory" worksheet by BBI tank waste volume estimates (rows 4-76). The radionuclide concentrations are then decayed to 1-1-2020 values (Rows 80-125, colums C-S) by mutiplying by decay values for corresponding rows in column Y. The decay values in column Y are calculated based on the 1/2 life of radionuclides and formulas in SVF-2545, Spreadsheet for Data Entry and Decay Calculation (Rows 71-125, Columns W-AA). Start and end decay dates are inputs in cells Y71 and Y72, respectively. SVF-2545 is based on 1/2 life values taken from the 16th edition of chart of the nuclides. Column S shows average residual concentrations for all of the C-Farm tanks for each applicable constituent.
	RPP-RPT-42323 Worksheet: This is a title page for this spreadsheet.
Macros and Add-in software	None
Key Assumptions	None
Units	Inventory units are shown (kg or Ci). Concentration units g/L or Ci/L as shown. Waste volumes are shown as kL and ft3. Conversions: 1 gal = 3.785 L, 1 ft3 = 7.481 gal.
Input Data	BBI inventory values and Start and end dates for decay calculations, "concentration" worksheet cells Y73 and Y74.
Verification	By: Kristin Singleton
	Date: Approval date for RPP-RPT-42323, Rev. 4 report
	Summary: Checked and verified worksheet inputs and formulas

1-3-2019 BBI Summary Download

Analyte	units	C-101	C-102	C-103	C-104	C-105	C-106	C-107	C-108	C-109	C-110	C-111	C-112	C-201	C-202	C-203	C-204	C-Farm Sum	2002 inv	2019/2002
Volume	kL	20.7	59	9.6	7.2	5.5	10.49	39	12.9	7.6	8	18.5	37.5	0.54	0.56	0.52	0.52	238.13		
Al	kg	5.11E+03	2.46E+04	3.63E+03	1.14E+03	8.77E+02	3.82E+02	1.79E+04	3.47E+03	2.15E+03	1.29E+03	2.08E+03	1.13E+04	4.11E+00	8.48E+00	0.00E+00	5.88E+00	7.39E+04	7.03E+05	0.11
Bi	kg	1.68E-01	1.72E+00	9.49E-05	2.90E+00	9.07E-01	2.94E+00	2.24E+02	7.56E+01	1.98E+00	3.63E+01	7.62E+00	3.85E+00	6.10E-01	6.34E-01	1.29E+00	0.00E+00	3.61E+02	3.85E+04	0.01
Ca	kg	1.86E+01	1.57E+01	2.17E+01	1.35E+01	1.39E+02	1.18E+02	2.33E+01	2.40E+01	1.56E+01	5.84E+00	9.27E+01	1.38E+02	6.76E+00	7.12E+00	2.02E+00	5.90E-01	6.42E+02	4.71E+04	0.01
Cl	kg	1.31E+01	8.31E+00	1.94E-01	5.94E-01	3.01E-01	6.14E+00	2.54E+00	9.01E-02	6.47E-02	6.26E-01	2.22E+00	4.98E+00	2.93E-01	2.87E-01	5.86E-02	5.58E-03	3.98E+01	7.44E+03	0.01
TIC as CO3	kg	2.86E+03	8.44E+02	1.68E+01	4.77E+02	2.26E+03	7.58E+01	9.41E+02	2.77E+02	2.03E+02	5.21E+02	1.80E+02	6.59E+02	3.36E+01	3.43E+01	1.50E+01	1.41E+01	9.41E+03	2.53E+05	0.04
Cr	kg	4.96E+00	1.10E+01	2.38E+00	3.06E+00	1.48E+00	3.78E+00	6.65E+00	6.31E-01	1.76E-01	1.12E+00	1.46E+00	5.31E+00	1.22E+01	9.09E+00	2.60E+00	1.36E+00	6.73E+01	5.60E+03	0.01
F	kg	8.29E+00	2.85E+02	1.62E-01	1.53E+01	1.86E+00	5.43E-01	6.60E+01	1.21E+02	9.68E+01	1.38E+02	2.54E+02	5.15E+02	2.69E+00	2.26E+00	1.64E+00	8.05E-03	1.51E+03	5.80E+04	0.03
Fe	kg	2.23E+02	1.62E+02	1.19E+02	3.23E+02	2.12E+02	2.07E+02	6.25E+02	2.82E+02	9.28E+01	1.90E+02	2.69E+02	1.01E+03	1.10E+02	8.70E+01	1.28E+01	3.21E+01	3.96E+03	2.35E+05	0.02
Hg	kg	5.12E-02	4.16E-01	1.06E+00	1.34E+00	4.22E-01	1.93E+00	1.28E+00	2.03E-02	1.84E-02	1.07E-01	7.19E-02	1.37E-01	1.07E-01	2.87E-01	2.23E-03	1.47E-01	7.40E+00	3.93E+02	0.02
K	kg	1.99E+01	1.07E+01	3.60E+00	1.31E+00	6.45E+00	1.77E+01	1.88E+00	2.74E+00	2.61E-01	4.46E-01	1.79E+00	4.40E+00	8.91E-01	9.09E-01	1.83E+00	2.02E+00	7.68E+01	6.77E+03	0.01
La	kg	6.48E-01	6.47E-02	1.82E-01	2.34E-02	1.56E-01	2.44E+00	3.22E-01	1.32E-02	1.20E-01	9.98E-03	1.38E+00	4.81E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E+01	1.46E+03	0.01
Mn	kg	4.41E+01	4.72E+01	4.42E+00	4.28E+01	6.15E+00	5.49E+02	1.03E+01	4.08E+00	5.63E-01	7.61E-01	1.34E+00	1.10E+01	1.90E+01	1.69E+01	5.13E-01	2.39E-01	7.58E+02	1.75E+04	0.04
Na	kg	2.52E+03	3.10E+03	9.60E+01	1.15E+03	5.22E+02	1.88E+02	1.46E+03	3.27E+03	1.30E+03	1.20E+03	4.96E+03	6.57E+03	4.91E+01	4.58E+01	5.59E+01	3.33E+01	2.65E+04	7.20E+05	0.04
Ni	kg	2.11E+01	1.17E+02	4.58E+00	5.99E+00	4.85E+00	3.02E+01	7.94E+01	7.45E+01	1.33E+01	4.13E-01	1.58E+02	1.90E+02	6.15E+00	7.28E+00	2.04E-01	8.01E-01	7.14E+02	3.95E+04	0.02
NO2	kg	5.11E+02	2.78E+02	4.82E-01	5.05E+00	7.23E+00	4.14E+01	4.55E+01	5.78E+00	3.83E+00	2.74E+00	2.96E+01	1.46E+02	5.27E-01	4.52E-01	9.94E-01	3.13E-02	1.08E+03	1.90E+05	0.01
NO3	kg	7.23E+02	5.47E+02	8.71E-01	9.37E+00	1.27E+01	3.48E+01	6.74E+01	9.16E+00	4.52E+00	6.73E+00	6.12E+01	1.80E+02	1.35E+00	1.25E+00	3.76E+00	2.22E-02	1.66E+03	4.00E+05	0.00
Oxalate	kg	1.70E+01	2.31E+01	9.71E-02	2.36E+02	4.17E+00	3.32E+02	3.69E+00	1.47E+00	1.38E+00	1.02E+00	5.41E+00	8.03E+00	5.10E+01	3.76E+01	9.94E-01	8.56E-03	7.23E+02	NA	NA
Pb	kg	8.10E+00	4.21E+00	8.50E+00	6.47E+00	5.54E+00	2.56E+01	5.45E+01	1.71E+01	5.39E+00	5.62E+00	6.85E+01	1.16E+02	6.25E+00	5.84E+00	3.07E+00	1.02E+00	3.42E+02	2.32E+04	0.01
PO4	kg	3.76E+02	7.02E+02	2.99E+01	4.28E+01	1.12E+02	9.00E+01	1.01E+03	1.18E+03	9.82E+02	1.40E+03	4.94E+03	5.94E+03	5.46E+01	3.46E+01	7.24E+01	7.96E+01	1.70E+04	2.89E+05	0.06
Si	kg	5.44E+01	8.47E+01	1.27E+02	1.31E+02	4.12E+02	1.60E+01	2.88E+02	8.78E+01	2.79E+01	2.05E+01	9.11E+01	5.96E+01	6.99E+00	8.60E+00	2.01E+00	7.33E+00	1.42E+03	129977.4	0.01
SO4	kg	1.26E+02	5.58E+01	2.16E+00	1.15E+00	1.13E+01	3.90E+00	2.51E+01	2.93E+00	2.86E+00	7.46E+00	1.47E+01	5.84E+01	3.66E+00	4.01E-01	6.58E-01	1.28E-02	3.16E+02	5.59E+04	0.01
Sr	kg	6.71E+00	1.05E+00	2.41E+00	9.33E-01	2.91E+00	1.83E+00	4.71E+00	1.97E+01	4.91E-01	5.63E+01	2.06E+00	1.45E+01	9.09E-01	1.22E+00	2.30E-01	3.67E-01	1.16E+02	1.75E+03	0.07
TOC	kg	5.84E+01	8.18E+01	1.25E+01	6.52E+01	5.34E+01	9.07E+01	6.07E+01	3.96E+00	3.39E+01	1.28E+01	1.60E+01	5.84E+01	2.43E+01	2.48E+01	4.47E+00	3.54E+01	6.37E+02	3.62E+04	0.02
UTOTAL	kg	5.20E+03	6.02E+02	4.91E+01	1.31E+03	3.58E+02	2.70E+00	4.33E+02	1.21E+02	2.86E+01	7.76E+00	2.00E+01	1.47E+03	1.11E+02	9.88E+01	3.26E+02	2.43E+02	1.04E+04	1.13E+05	0.09
Zr	kg	1.17E+00	3.92E+01	1.33E+01	2.48E+01	2.19E+00	2.79E+00	7.83E+00	5.98E-01	7.07E+00	3.62E-01	1.07E+00	2.61E+00	1.02E-02	9.45E-02	1.05E-01	0.00E+00	1.03E+02	7.90E+04	0.00
SUM	kg	1.79E+04	3.16E+04	4.15E+03	5.01E+03	5.01E+03	2.23E+03	2.33E+04	9.05E+03	4.97E+03	4.91E+03	1.33E+04	2.85E+04	5.06E+02	4.34E+02	5.09E+02	4.57E+02	1.52E+05		

Radionuclide values decayed to 7/1/2015

Analyte	units	C-101	C-102	C-103	C-104	C-105	C-106	C-107	C-108	C-109	C-110	C-111	C-112	C-201	C-202	C-203	C-204	C-Farm Sum
106Ru	Ci	2.47E-18	5.38E-18	3.68E-15	4.57E-09	8.40E-19	1.83E-08	2.75E-15	1.50E-15	1.04E-15	2.94E-16	6.10E-16	2.23E-15	6.01E-10	6.13E-10	5.01E-10	4.69E-10	2.51E-08
113mCd	Ci	2.33E-03	6.25E-03	1.86E-02	6.37E-02	7.92E-04	2.66E+00	4.54E-03	2.46E-03	1.71E-03	4.85E-04	1.01E-03	3.67E-03	7.18E-04	7.33E-04	5.99E-04	5.61E-04	2.77E+00
125Sb	Ci	3.69E-06	8.81E-06	2.16E-06	2.21E-02	1.25E-06	1.12E-02	5.93E-06	3.23E-06	2.24E-06	6.34E-07	1.31E-06	4.80E-06	1.67E-04	1.71E-04	1.40E-04	1.31E-04	3.39E-02
126Sn	Ci	7.78E-02	1.82E-03	5.27E-05	8.79E-03	1.29E-01	1.76E+00	7.21E-04	3.91E-04	2.72E-04	2.38E-02	1.60E-04	5.83E-04	1.10E-04	1.13E-04	9.21E-05	8.61E-05	2.00E+00
129I	Ci	2.72E-03	1.60E-03	3.00E-03	2.12E-04	2.33E-03	6.31E-04	2.98E-03	3.81E-05	2.66E-05	2.82E-04	1.56E-05	5.70E-05	4.57E-07	7.35E-06	1.47E-05	3.57E-07	1.39E-02
134Cs	Ci	1.16E-08	2.61E-08	1.72E-08	3.25E-05	3.94E-09	6.99E-05	1.72E-09	9.31E-10	6.46E-10	1.83E-10	3.80E-10	1.39E-09	1.88E-07	1.91E-07	1.56E-07	1.46E-07	1.03E-04
137Cs	Ci	2.19E+03	6.35E+02	6.73E+02	6.89E+02	3.68E+03	1.11E+03	2.40E+02	9.47E+01	4.78E+01	2.24E+01	1.61E+02	6.32E+02	7.78E+00	6.85E+00	1.01E+01	4.57E+00	1.02E+04
137mBa	Ci	2.06E+03	5.99E+02	6.36E+02	6.51E+02	3.47E+03	1.05E+03	2.27E+02	8.94E+01	4.51E+01	2.12E+01	1.52E+02	5.97E+02	7.34E+00	6.47E+00	9.52E+00	4.32E+00	9.63E+03
14C	Ci	3.50E-03	8.24E-03	7.00E-03	3.08E-03	7.93E-04	8.21E-03	3.15E-02	3.98E-03	7.65E-04	1.51E-03	3.90E-03	1.75E-02	7.64E-04	2.03E-04	1.66E-04	1.87E-04	9.13E-02
151Sm	Ci	5.26E+00	1.49E+01	4.46E-01	3.29E+03	1.79E+00	8.10E+03	1.57E+04	6.90E+00	4.82E+00	1.37E+00	2.83E+00	1.03E+01	2.47E+01	2.52E+01	2.06E+01	1.93E+01	2.72E+04
152Eu	Ci	1.02E-04	2.43E-04	3.24E-05	4.45E-02	3.47E-05	2.54E+00	2.49E-04	1.35E-04	9.36E-05	2.66E-05	5.50E-05	2.01E-04	2.65E-03	2.70E-03	2.21E-03	2.07E-03	2.60E+00
154Eu	Ci	5.06E-03	1.24E-02	2.02E+00	2.26E+00	1.72E-03	3.24E+01	1.19E-02	6.49E-03	4.52E-03	1.28E-03	2.65E-03	9.66E-03	1.36E-01	1.38E-01	2.16E-02	8.09E-02	3.71E+01
155Eu	Ci	1.15E-03	2.94E-03	8.43E-01	4.43E-01	3.90E-04	1.48E+01	2.44E-03	1.32E-03	9.18E-04	2.60E-04	5.39E-04	1.97E-03	2.79E-02	2.85E-02	3.47E-02	2.18E-02	1.62E+01
226Ra	Ci	7.51E-07	1.10E-05	1.54E-08	3.25E-07	2.55E-07	5.14E-04	8.70E-07	4.73E-07	3.28E-07	9.29E-08	1.93E-07	7.03E-07	1.01E-09	1.03E-09	8.42E-10	7.88E-10	5.29E-04
227Ac	Ci	2.32E-06	2.54E-05	1.09E-07	2.87E-05	7.87E-07	2.54E-03	2.23E-05	7.31E-06	8.39E-06	2.38E-06	4.93E-06	1.80E-05	5.42E-09	5.53E-09	4.52E-09	4.23E-09	2.66E-03
228Ra	Ci	1.43E-12	2.70E-03	1.99E-04	3.69E-03	6.55E-05	5.60E-04	7.87E-05	1.57E-05	8.73E-12	2.48E-12	2.85E-06	1.88E-11	4.03E-06	4.11E-06	1.90E-06	1.42E-05	7.34E-03
229Th	Ci	1.68E-10	4.87E-10	2.60E-11	8.57E-08	5.72E-11	1.91E-05	2.76E-09	1.49E-09	1.04E-09	2.95E-10	6.11E-10	2.23E-09	1.18E-11	1.20E-11	9.81E-12	9.18E-12	1.92E-05
231Pa	Ci	3.14E-08	9.90E-08	1.66E-07	7.47E-05	1.07E-08	2.53E-03	5.58E-05	3.02E-05	2.10E-05	5.96E-06	1.23E-05	4.51E-05	6.79E-09	6.93E-09	5.67E-09	5.30E-09	2.78E-03
232Th	Ci	1.43E-12	2.70E-03	1.99E-04	3.69E-03	6.55E-05	5.60E-04	7.87E-05	1.57E-05	8.73E-12	2.48E-12	2.85E-06	1.88E-11	4.03E-06	4.11E-06	1.90E-06	1.42E-05	7.34E-03
232U	Ci	1.84E-05	3.75E-05	4.48E-06	3.69E-02	1.27E-06	5.10E-04	1.57E-06	4.71E-07	1.04E-07	2.82E-08	7.28E-08	7.51E-07	2.35E-06	2.09E-06	6.91E-06	5.15E-06	3.75E-02
233U	Ci	1.73E-06	3.14E-01	5.85E-03	2.18E+00	3.59E-02	1.82E-03	1.47E-07	4.10E-08	9.69E-09	2.63E-09	6.79E-09	3.96E-02	1.14E-05	1.02E-05	3.37E-05	2.51E-05	2.58E+00
234U	Ci	1.70E+00	1.95E-01	1.36E-02	4.16E-01	1.14E-01	9.40E-04	1.42E-01	3.25E-02	9.35E-03	2.64E-03	6.55E-03	6.77E-02	3.65E-02	3.52E-02	1.13E-01	8.27E-02	2.97E+00
235U	Ci	7.78E-02	8.40E-03	7.10E-04	1.98E-02	5.01E-03	3.86E-05	6.33E-03	1.82E-03	4.01E-04	1.14E-04	2.84E-04	2.20E-02	1.48E-03	1.42E-03	4.79E-03	3.42E-03	1.54E-01
236U	Ci	1.95E-02	5.48E-03	3.74E-04	4.84E-03	2.47E-03	1.73E-05	1.58E-03	2.85E-04	9.61E-05	2.93E-05	2.30E-04	5.88E-03	5.23E-04	3.52E-04	8.33E-04	5.13E-04	4.30E-02
237Np	Ci	2.48E-02	4.03E-03	1.35E-02	1.83E-03	2.21E-02	5.41E-02	2.40E-02	2.17E-05	6.48E-04	1.09E-03	1.31E-03	2.16E-02	3.42E-03	2.90E-03	2.70E-05	2.16E-02	1.97E-01
238Pu	Ci	3.14E-01	5.57E-01	1.35E+00	6.10E-01	2.73E-01	2.47E+00	1.03E-01	4.54E-03	1.62E-02	1.62E-02	8.73E-02	3.79E-01	4.58E-01	4.14E-01	1.41E-02	2.86E-04	7.07E+00
238U	Ci	1.73E+00	2.01E-01	1.64E-02	4.39E-01	1.20E-01	9.02E-04	1.44E-01	4.03E-02	9.53E-03	2.59E-03	6.68E-03	4.89E-01	3.69E-02	3.28E-02	1.09E-01	8.13E-02	3.46E+00
239Pu	Ci	1.92E+01	6.30E+01	4.99E+00	5.14E+00	1.08E+01	1.67E+01	1.60E+01	6.68E-01	4.01E-01	1.17E+00	7.62E-01	6.27E+00	1.58E+01	1.43E+01	4.86E-01	9.83E-03	1.76E+02
240Pu	Ci	2.06E+00	5.92E+00	1.04E+00	1.54E+00	1.16E+00	3.57E+00	1.74E+00	7.27E-02	4.36E-02	1.27E-01	8.29E-02	6.82E-01	3.40E+00	3.08E+00	1.05E-01	2.12E-03	2.46E+01
241Am	Ci	5.71E+00	1.69E+01	4.89E+00	8.71E+00	2.75E+00	6.46E+01	1.33E+01	9.54E-01	3.82E-01	5.62E-02	7.79E+00	2.00E+01	2.63E+00	1.35E+00	3.64E-02	3.27E-03	1.50E+02
241Pu	Ci	1.06E+01	2.67E+01	2.24E+00	1.42E+01	6.89E+00	2.29E+01	1.68E+00	9.84E-02	6.33E-01	4.45E-01	8.02E-02	1.28E+01	1.04E+01	9.38E+00	3.20E-01	6.47E-03	1.19E+02
242Cm	Ci	1.19E-02	1.69E-04	5.86E-05	3.19E-02	7.32E-03	1.49E-01	2.18E-03	1.63E-04	6.31E-05	8.94E-06	3.24E-02	3.74E-02	8.48E-02	4.09E-02	1.06E-03	1.06E-04	3.99E-01
242Pu	Ci	2.83E-05	2.00E-06	3.24E-05	1.97E-02	1.60E-05	4.16E-04	2.42E-05	1.01E-06	6.07E-07	1.77E-06	1.15E-06	1.02E-02	1.60E-04	1.45E-04	4.94E-06	9.98E-08	3.07E-02
243Am	Ci	5.95E-04	1.22E-03	3.70E-05	5.24E-03	1.87E-04	3.05E-03	1.35E-03	9.78E-05	3.91E-05	5.55E-06	7.90E-04	1.55E-04	9.77E-04	4.72E-04	1.22E-05	1.22E-06	1.42E-02
243Cm	Ci	8.60E-06	1.74E-05	8.52E-07	4.05E-03	4.51E-04	6.18E-02	1.96E-05	1.67E-06	5.67E-07	8.04E-08	6.80E-03	2.25E-06	3.45E-03	1.67E-03	4.31E-05	4.31E-06	7.83E-02
244Cm	Ci	1.64E-04	3.33E-04	1.80E-05	7.91E-02	8.61E-03	8.81E-01	3.73E-04	3.52E-05	1.08E-05	1.53E-06	1.30E-01	4.29E-05	6.59E-02	3.18E-02	8.25E-04	8.23E-05	1.20E+00
3H	Ci	4.01E-02	1.07E-01	5.13E-03	1.20E-02	1.08E-02	5.37E-03	1.81E-02	2.51E-02	4.52E-03	2.32E-03	6.00E-03	7.19E-02	2.02E-04	2.07E-04	1.69E-04	1.45E-04	3.09E-01
59Ni	Ci	9.18E-04	2.60E-03	1.12E-01	8.64E-02	3.12E-04	1.05E+01	1.72E-03	9.30E-04	6.47E-04	1.83E-04	3.80E-04	1.39E-03	4.07E-03	4.16E-03	3.40E-03	3.18E-03	1.07E+01
60Co	Ci	4.05E-04	1.04E-03	3.31E-02	6.66E-01	1.38E-04	4.03E+00	2.41E-03	1.31E-03	9.08E-04	2.57E-04	5.34E-04	1.95E-03	4.30E-03	4.39E-03	3.88E-03	3.36E-03	4.75E+00
63Ni	Ci	5.70E+01	5.81E+02	1.92E+01	1.02E+02	2.17E+01	6.73E+01	3.09E+02	2.89E+00	9.04E-01	4.20E-01	3.55E+00	3.62E+01	8.58E-01	2.06E-01	5.71E-02	1.51E-02	1.20E+03
79Se	Ci	4.51E-03	2.34E-03	2.64E-05	2.36E-03	1.21E-04	9.57E-03	3.94E-04	1.62E-03	1.49E-04	4.21E-05	8.73E-05	3.19E-04	5.49E-05	5.61E-05	4.58E-05	4.29E-05	2.17E-02
90Sr	Ci	1.02E+04	5.54E+02	7.55E+03	5.44E+03	4.28E+03	5.01E+04	9.33E+03	1.39E+03	2.59E+03	2.92E+03	4.53E+04	7.17E+04	1.91E+02	3.69E+02	1.74E+02	1.15E+02	2.12E+05
90Y	Ci	1.02E+04	5.54E+02	7.55E+03	5.44E+03	4.28E+03	5.01E+04	9.33E+03	1.39E+03	2.59E+03	2.92E+03	4.53E+04	7.17E+04	1.91E+02	3.69E+02	1.74E+02	1.15E+02	2.12E+05
93mNb	Ci	3.99E-05	1.13E-04	6.42E-04	5.55E-02	1.36E-05	1.01E+01	2.12E-01	9.18E-02	7.98E-02	2.27E-02	4.70E-02	1.72E-01	1.31E-03	1.34E-03	1.09E-03	1.02E-03	1.08E+01
93Zr	Ci	4.25E-05	1.21E-04	7.03E-04	6.24E-02	1.45E-05	1.04E+01	2.25E-01	1.22E-01	8.47E-02	2.41E-02	4.99E-02	1.82E-01	1.46E-03	1.49E-03	1.22E-03	1.14E-03	1.12E+01
99Tc	Ci	7.88E-01	4.26E-01	4.48E-02	3.03E-01	4.85E-02	1.64E-01	8.83E-02	4.87E-02	8.77E-03	4.46E-02	4.97E-02	2.83E-01	2.63E-03	2.50E-03	2.32E-03	3.18E-03	2.31E+00
SUM	Ci	2.48E+04	3.05E+03	1.64E+04	1.56E+04	1.58E+04	1.11E+05	3.52E+04	2.98E+03	5.28E+03	5.89E+03	9.09E+04	1.45E+05	4.56E+02	8.06E+02	3.90E+02	2.59E+02	4.73E+05

Radionuclide values decayed to 1/1/2020 for closure data package

Analyte	units	C-101	C-102	C-103	C-104	C-105	C-106	C-107	C-108	C-109	C-110	C-111	C-112	C-201	C-202	C-203	C-204	C-Farm Sum	2002 inv	2015/2002 inv
106Ru	Ci	1.16E-19	2.52E-19	1.72E-16	2.14E-10	3.94E-20	8.58E-10	1.29E-16	7.03E-17	4.87E-17	1.38E-17	2.86E-17	1.05E-16	2.82E-11	2.87E-11	2.35E-11	2.20E-11	1.17E-09	2.86E-08	4.11E-02
113mCd	Ci	1.87E-03	5.01E-03	1.49E-02	5.10E-02	6.35E-04	2.13E+00	3.64E-03	1.97E-03	1.37E-03	3.89E-04	8.09E-04	2.94E-03	5.75E-04	5.87E-04	4.80E-04	4.50E-04	2.22E+00	5.00E+02	4.43E-03
125Sb	Ci	1.19E-06	2.84E-06	6.96E-07	7.13E-03	4.03E-07	3.61E-03	1.91E-06	1.04E-06	7.22E-07	2.04E-07	4.22E-07	1.55E-06	5.38E-05	5.51E-05	4.51E-05	4.22E-05	1.09E-02	1.67E+00	6.56E-03
126Sn	Ci	7.78E-02	1.82E-03	5.27E-05	8.79E-03	1.29E-01	1.76E+00	7.21E-04	3.91E-04	2.72E-04	2.38E-02	1.60E-04	5.83E-04	1.10E-04	1.13E-04	9.21E-05	8.61E-05	2.00E+00	7.93E+01	2.53E-02
129I	Ci	2.72E-03	1.60E-03	3.00E-03	2.12E-04	2.33E-03	6.31E-04	2.98E-03	3.81E-05	2.66E-05	2.82E-04	1.56E-05	5.70E-05	4.57E-07	7.35E-06	1.47E-05	3.57E-07	1.39E-02	9.93E-01	1.40E-02
134Cs	Ci	2.56E-09	5.76E-09	3.79E-09	7.17E-06	8.69E-10	1.54E-05	3.79E-10	2.05E-10	1.42E-10	4.04E-11	8.38E-11	3.07E-10	4.15E-08	4.21E-08	3.44E-08	3.22E-08	2.27E-05	1.86E-03	1.23E-02
137Cs	Ci	1.97E+03	5.72E+02	6.07E+02	6.21E+02	3.32E+03	1.00E+03	2.16E+02	8.54E+01	4.31E+01	2.02E+01	1.45E+02	5.70E+02	7.01E+00	6.17E+00	9.10E+00	4.12E+00	9.20E+03	6.41E+05	1.44E-02
137mBa	Ci	1.75E+03	5.10E+02	5.41E+02	5.54E+02	2.95E+03	8.93E+02	1.93E+02	7.61E+01	3.84E+01	1.80E+01	1.29E+02	5.08E+02	6.25E+00	5.51E+00	8.10E+00	3.68E+00	8.19E+03	5.72E+05	1.43E-02
14C	Ci	3.50E-03	8.24E-03	7.00E-03	3.08E-03	7.93E-04	8.21E-03	3.15E-02	3.98E-03	7.65E-04	1.51E-03	3.90E-03	1.75E-02	7.64E-04	2.03E-04	1.66E-04	1.87E-04	9.12E-02	1.57E+01	5.81E-03
151Sm	Ci	5.08E+00	1.44E+01	4.31E-01	3.18E+03	1.73E+00	7.82E+03	1.52E+04	6.66E+00	4.66E+00	1.32E+00	2.73E+00	9.95E+00	2.39E+01	2.43E+01	1.99E+01	1.86E+01	2.63E+04	6.24E+05	4.21E-02
152Eu	Ci	8.10E-05	1.93E-04	2.57E-05	3.53E-02	2.76E-05	2.02E+00	1.98E-04	1.07E-04	7.43E-05	2.11E-05	4.37E-05	1.60E-04	2.10E-03	2.14E-03	1.75E-03	1.64E-03	2.06E+00	5.63E+01	3.66E-02
154Eu	Ci	3.52E-03	8.62E-03	1.40E+00	1.57E+00	1.20E-03	2.25E+01	8.28E-03	4.51E-03	3.14E-03	8.90E-04	1.84E-03	6.72E-03	9.46E-02	9.60E-02	1.50E-02	5.63E-02	2.58E+01	1.88E+03	1.37E-02
155Eu	Ci	5.96E-04	1.52E-03	4.37E-01	2.30E-01	2.02E-04	7.67E+00	1.26E-03	6.84E-04	4.76E-04	1.35E-04	2.79E-04	1.02E-03	1.45E-02	1.48E-02	1.80E-02	1.13E-02	8.40E+00	3.54E+02	2.37E-02
226Ra	Ci	7.50E-07	1.10E-05	1.54E-08	3.24E-07	2.55E-07	5.13E-04	8.68E-07	4.72E-07	3.27E-07	9.27E-08	1.93E-07	7.02E-07	1.01E-09	1.03E-09	8.40E-10	7.86E-10	5.28E-04	3.21E-02	1.64E-02
227Ac	Ci	2.01E-06	2.20E-05	9.44E-08	2.49E-05	6.82E-07	2.20E-03	1.93E-05	6.33E-06	7.27E-06	2.06E-06	4.27E-06	1.56E-05	4.70E-09	4.79E-09	3.92E-09	3.66E-09	2.31E-03	7.06E+01	3.27E-05
228Ra	Ci	8.32E-13	1.57E-03	1.16E-04	2.15E-03	3.81E-05	3.26E-04	4.58E-05	9.13E-06	5.08E-12	1.44E-12	1.66E-06	1.09E-11	2.34E-06	2.39E-06	1.11E-06	8.26E-06	4.27E-03	2.57E+00	1.66E-03
229Th	Ci	1.68E-10	4.87E-10	2.60E-11	8.57E-08	5.72E-11	1.91E-05	2.76E-09	1.49E-09	1.04E-09	2.95E-10	6.11E-10	2.23E-09	1.18E-11	1.20E-11	9.81E-12	9.18E-12	1.92E-05	1.10E+00	1.74E-05
231Pa	Ci	3.14E-08	9.90E-08	1.66E-07	7.47E-05	1.07E-08	2.53E-03	5.58E-05	3.02E-05	2.10E-05	5.96E-06	1.23E-05	4.51E-05	6.79E-09	6.93E-09	5.67E-09	5.30E-09	2.78E-03	2.69E+02	1.03E-05
232Th	Ci	1.43E-12	2.70E-03	1.99E-04	3.69E-03	6.55E-05	5.60E-04	7.87E-05	1.57E-05	8.73E-12	2.48E-12	2.85E-06	1.88E-11	4.03E-06	4.11E-06	1.90E-06	1.42E-05	7.34E-03	5.69E+00	1.29E-03
232U	Ci	1.76E-05	3.59E-05	4.28E-06	3.53E-02	1.21E-06	4.88E-04	1.50E-06	4.50E-07	9.95E-08	2.70E-08	6.96E-08	7.18E-07	2.25E-06	2.00E-06	6.61E-06	4.92E-06	3.59E-02	1.63E+01	2.19E-03
233U	Ci	1.73E-06	3.14E-01	5.85E-03	2.18E+00	3.59E-02	1.82E-03	1.47E-07	4.10E-08	9.69E-09	2.63E-09	6.79E-09	3.96E-02	1.14E-05	1.02E-05	3.37E-05	2.51E-05	2.58E+00	4.15E+02	6.21E-03
234U	Ci	1.70E+00	1.95E-01	1.36E-02	4.16E-01	1.14E-01	9.40E-04	1.42E-01	3.25E-02	9.35E-03	2.64E-03	6.55E-03	6.77E-02	3.65E-02	3.52E-02	1.13E-01	8.27E-02	2.97E+00	4.39E+01	6.75E-02
235U	Ci	7.78E-02	8.40E-03	7.10E-04	1.98E-02	5.01E-03	3.86E-05	6.33E-03	1.82E-03	4.01E-04	1.14E-04	2.84E-04	2.20E-02	1.48E-03	1.42E-03	4.79E-03	3.42E-03	1.54E-01	1.72E+00	8.97E-02
236U	Ci	1.95E-02	5.48E-03	3.74E-04	4.84E-03	2.47E-03	1.73E-05	1.58E-03	2.85E-04	9.61E-05	2.93E-05	2.30E-04	5.88E-03	5.23E-04	3.52E-04	8.33E-04	5.13E-04	4.30E-02	1.10E+00	3.92E-02
237Np	Ci	2.48E-02	4.03E-03	1.35E-02	1.83E-03	2.21E-02	5.41E-02	2.40E-02	2.17E-05	6.48E-04	1.09E-03	1.31E-03	2.16E-02	3.42E-03	2.90E-03	2.70E-05	2.16E-02	1.97E-01	5.72E+00	3.44E-02
238Pu	Ci	3.03E-01	5.38E-01	1.30E+00	5.89E-01	2.63E-01	2.38E+00	9.94E-02	4.38E-03	1.56E-02	1.56E-02	8.42E-02	3.66E-01	4.42E-01	4.00E-01	1.36E-02	2.76E-04	6.82E+00	4.42E+02	1.54E-02
238U	Ci	1.73E+00	2.01E-01	1.64E-02	4.39E-01	1.20E-01	9.02E-04	1.44E-01	4.03E-02	9.53E-03	2.59E-03	6.68E-03	4.89E-01	3.69E-02	3.28E-02	1.09E-01	8.13E-02	3.46E+00	3.76E+01	9.20E-02
239Pu	Ci	1.92E+01	6.30E+01	4.99E+00	5.14E+00	1.08E+01	1.67E+01	1.60E+01	6.68E-01	4.01E-01	1.17E+00	7.62E-01	6.27E+00	1.58E+01	1.43E+01	4.86E-01	9.83E-03	1.76E+02	1.83E+04	9.58E-03
240Pu	Ci	2.06E+00	5.92E+00	1.04E+00	1.54E+00	1.16E+00	3.57E+00	1.74E+00	7.27E-02	4.36E-02	1.27E-01	8.29E-02	6.82E-01	3.40E+00	3.08E+00	1.05E-01	2.12E-03	2.46E+01	3.22E+03	7.65E-03
241Am	Ci	5.67E+00	1.68E+01	4.85E+00	8.65E+00	2.73E+00	6.41E+01	1.32E+01	9.47E-01	3.79E-01	5.58E-02	7.73E+00	1.99E+01	2.61E+00	1.34E+00	3.61E-02	3.25E-03	1.49E+02	1.90E+04	7.83E-03
241Pu	Ci	8.53E+00	2.15E+01	1.80E+00	1.14E+01	5.55E+00	1.84E+01	1.35E+00	7.92E-02	5.10E-01	3.58E-01	6.46E-02	1.03E+01	8.37E+00	7.55E+00	2.58E-01	5.21E-03	9.61E+01	1.21E+04	7.91E-03
242Cm	Ci	1.16E-02	1.65E-04	5.73E-05	3.12E-02	7.16E-03	1.46E-01	2.13E-03	1.59E-04	6.17E-05	8.74E-06	3.17E-02	3.66E-02	8.29E-02	4.00E-02	1.04E-03	1.04E-04	3.91E-01	2.05E+01	1.91E-02
242Pu	Ci	2.83E-05	2.00E-06	3.24E-05	1.97E-02	1.60E-05	4.16E-04	2.42E-05	1.01E-06	6.07E-07	1.77E-06	1.15E-06	1.02E-02	1.60E-04	1.45E-04	4.94E-06	9.98E-08	3.07E-02	1.87E-01	1.64E-01
243Am	Ci	5.95E-04	1.22E-03	3.70E-05	5.24E-03	1.87E-04	3.05E-03	1.35E-03	9.78E-05	3.91E-05	5.55E-06	7.90E-04	1.55E-04	9.77E-04	4.72E-04	1.22E-05	1.22E-06	1.42E-02	7.52E-01	1.89E-02
243Cm	Ci	7.73E-06	1.56E-05	7.65E-07	3.64E-03	4.05E-04	5.55E-02	1.76E-05	1.50E-06	5.09E-07	7.22E-08	6.11E-03	2.02E-06	3.10E-03	1.50E-03	3.87E-05	3.87E-06	7.04E-02	8.34E-01	8.44E-02
244Cm	Ci	1.38E-04	2.80E-04	1.51E-05	6.66E-02	7.25E-03	7.41E-01	3.14E-04	2.96E-05	9.09E-06	1.29E-06	1.09E-01	3.61E-05	5.55E-02	2.68E-02	6.94E-04	6.93E-05	1.01E+00	1.63E+01	6.19E-02
3H	Ci	3.11E-02	8.30E-02	3.98E-03	9.31E-03	8.38E-03	4.17E-03	1.40E-02	1.95E-02	3.51E-03	1.80E-03	4.66E-03	5.58E-02	1.57E-04	1.61E-04	1.31E-04	1.13E-04	2.40E-01	3.77E+01	6.36E-03
59Ni	Ci	9.18E-04	2.60E-03	1.12E-01	8.64E-02	3.12E-04	1.05E+01	1.72E-03	9.30E-04	6.47E-04	1.83E-04	3.80E-04	1.39E-03	4.07E-03	4.16E-03	3.40E-03	3.18E-03	1.07E+01	3.96E+02	2.71E-02
60Co	Ci	2.24E-04	5.75E-04	1.83E-02	3.68E-01	7.63E-05	2.23E+00	1.33E-03	7.25E-04	5.02E-04	1.42E-04	2.95E-04	1.08E-03	2.38E-03	2.43E-03	2.15E-03	1.86E-03	2.63E+00	1.21E+02	2.17E-02
63Ni	Ci	5.53E+01	5.63E+02	1.86E+01	9.89E+01	2.10E+01	6.53E+01	3.00E+02	2.80E+00	8.76E-01	4.07E-01	3.44E+00	3.51E+01	8.32E-01	2.00E-01	5.54E-02	1.46E-02	1.17E+03	3.24E+04	3.60E-02
79Se	Ci	4.51E-03	2.34E-03	2.64E-05	2.36E-03	1.21E-04	9.57E-03	3.94E-04	1.62E-03	1.49E-04	4.21E-05	8.73E-05	3.19E-04	5.49E-05	5.61E-05	4.58E-05	4.29E-05	2.17E-02	2.69E+01	8.07E-04
90Sr	Ci	9.15E+03	4.97E+02	6.77E+03	4.88E+03	3.84E+03	4.50E+04	8.37E+03	1.25E+03	2.32E+03	2.62E+03	4.06E+04	6.43E+04	1.71E+02	3.31E+02	1.56E+02	1.03E+02	1.90E+05	5.81E+06	3.28E-02
90Y	Ci	9.15E+03	4.97E+02	6.77E+03	4.88E+03	3.84E+03	4.50E+04	8.37E+03	1.25E+03	2.32E+03	2.62E+03	4.06E+04	6.43E+04	1.71E+02	3.31E+02	1.56E+02	1.03E+02	1.90E+05	5.81E+06	3.28E-02
93mNb	Ci	3.29E-05	9.31E-05	5.29E-04	4.57E-02	1.12E-05	8.32E+00	1.75E-01	7.56E-02	6.57E-02	1.87E-02	3.87E-02	1.42E-01	1.08E-03	1.10E-03	8.98E-04	8.40E-04	8.89E+00	3.49E+02	2.54E-02
93Zr	Ci	4.25E-05	1.21E-04	7.03E-04	6.24E-02	1.45E-05	1.04E+01	2.25E-01	1.22E-01	8.47E-02	2.41E-02	4.99E-02	1.82E-01	1.46E-03	1.49E-03	1.22E-03	1.14E-03	1.12E+01	8.77E+02	1.27E-02
99Tc	Ci	7.88E-01	4.26E-01	4.48E-02	3.03E-01	4.85E-02	1.64E-01	8.83E-02	4.87E-02	8.77E-03	4.46E-02	4.97E-02	2.83E-01	2.63E-03	2.50E-03	2.32E-03	3.18E-03	2.31E+00	3.51E+02	6.58E-03
SUM	Ci	2.21E+04	2.76E+03	1.47E+04	1.42E+04	1.40E+04	9.99E+04	3.26E+04	2.67E+03	4.74E+03	5.28E+03	8.16E+04	1.30E+05	4.12E+02	7.25E+02	3.51E+02	2.33E+02	4.26E+05		

1-3-2019 BBI C-Farm Tank Waste Concentrations and Average Concentrations by Constituent

Analyte	Units	C-101	C-102	C-103	C-104	C-105	C-106	C-107	C-108	C-109	C-110	C-111	C-112	C-201	C-202	C-203	C-204	Average
Tank Volume	kL	2.07E+01	5.90E+01	9.60E+00	7.20E+00	5.50E+00	1.05E+01	3.90E+01	1.29E+01	7.60E+00	8.00E+00	1.85E+01	3.75E+01	5.40E-01	5.60E-01	5.20E-01	5.20E-01	Conc.
Al	g/L	2.47E+02	4.17E+02	3.78E+02	1.58E+02	1.59E+02	3.64E+01	4.59E+02	2.69E+02	2.83E+02	1.61E+02	1.12E+02	3.01E+02	7.61E+00	1.51E+01	0.00E+00	1.13E+01	1.89E+02
Bi	g/L	8.12E-03	2.92E-02	9.89E-06	4.03E-01	1.65E-01	2.80E-01	5.74E+00	5.86E+00	2.61E-01	4.54E+00	4.12E-01	1.03E-01	1.13E+00	1.13E+00	2.48E+00	0.00E+00	1.41E+00
Ca	g/L	8.99E-01	2.66E-01	2.26E+00	1.88E+00	2.53E+01	1.12E+01	5.97E-01	1.86E+00	2.05E+00	7.30E-01	5.01E+00	3.68E+00	1.25E+01	1.27E+01	3.88E+00	1.13E+00	5.38E+00
Cl	g/L	6.33E-01	1.41E-01	2.02E-02	8.25E-02	5.47E-02	5.85E-01	6.51E-02	6.98E-03	8.51E-03	7.83E-02	1.20E-01	1.33E-01	5.43E-01	5.13E-01	1.13E-01	1.07E-02	1.94E-01
TIC as CO3	g/L	1.38E+02	1.43E+01	1.75E+00	6.63E+01	4.11E+02	7.23E+00	2.41E+01	2.15E+01	2.67E+01	6.51E+01	9.73E+00	1.76E+01	6.22E+01	6.13E+01	2.88E+01	2.71E+01	6.14E+01
Cr	g/L	2.40E-01	1.86E-01	2.48E-01	4.25E-01	2.69E-01	3.60E-01	1.71E-01	4.89E-02	2.32E-02	1.40E-01	7.89E-02	1.42E-01	2.26E+01	1.62E+01	5.00E+00	2.62E+00	3.05E+00
F	g/L	4.00E-01	4.83E+00	1.69E-02	2.13E+00	3.38E-01	5.18E-02	1.69E+00	9.38E+00	1.27E+01	1.73E+01	1.37E+01	1.37E+01	4.98E+00	4.04E+00	3.15E+00	1.55E-02	5.53E+00
Fe	g/L	1.08E+01	2.75E+00	1.24E+01	4.49E+01	3.85E+01	1.97E+01	1.60E+01	2.19E+01	1.22E+01	2.38E+01	1.45E+01	2.69E+01	2.04E+02	1.55E+02	2.46E+01	6.17E+01	4.31E+01
Hg	g/L	2.47E-03	7.05E-03	1.10E-01	1.86E-01	7.67E-02	1.84E-01	3.28E-02	1.57E-03	2.42E-03	1.34E-02	3.89E-03	3.65E-03	1.98E-01	5.13E-01	4.29E-03	2.83E-01	1.01E-01
K	g/L	9.61E-01	1.81E-01	3.75E-01	1.82E-01	1.17E+00	1.69E+00	4.82E-02	2.12E-01	3.43E-02	5.58E-02	9.68E-02	1.17E-01	1.65E+00	1.62E+00	3.52E+00	3.88E+00	9.88E-01
La	g/L	3.13E-02	1.10E-03	1.90E-02	3.25E-03	2.84E-02	2.33E-01	8.26E-03	1.02E-03	1.58E-02	1.25E-03	7.46E-02	1.28E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.40E-02
Mn	g/L	2.13E+00	8.00E-01	4.60E-01	5.94E+00	1.12E+00	5.23E+01	2.64E-01	3.16E-01	7.41E-02	9.51E-02	7.24E-02	2.93E-01	3.52E+01	3.02E+01	9.87E-01	4.60E-01	8.17E+00
Na	g/L	1.22E+02	5.25E+01	1.00E+01	1.60E+02	9.49E+01	1.79E+01	3.74E+01	2.53E+02	1.71E+02	1.50E+02	2.68E+02	1.75E+02	9.09E+01	8.18E+01	1.08E+02	6.40E+01	1.16E+02
Ni	g/L	1.02E+00	1.98E+00	4.77E-01	8.32E-01	8.82E-01	2.88E+00	2.04E+00	5.78E+00	1.75E+00	5.16E-02	8.54E+00	5.07E+00	1.14E+01	1.30E+01	3.92E-01	1.54E+00	3.60E+00
NO2	g/L	2.47E+01	4.71E+00	5.02E-02	7.01E-01	1.31E+00	3.95E+00	1.17E+00	4.48E-01	5.04E-01	3.43E-01	1.60E+00	3.89E+00	9.76E-01	8.07E-01	1.91E+00	6.02E-02	2.94E+00
NO3	g/L	3.49E+01	9.27E+00	9.07E-02	1.30E+00	2.31E+00	3.32E+00	1.73E+00	7.10E-01	5.95E-01	8.41E-01	3.31E+00	4.80E+00	2.50E+00	2.23E+00	7.23E+00	4.27E-02	4.70E+00
Pb	g/L	8.21E-01	3.92E-01	1.01E-02	3.28E+01	7.58E-01	3.16E+01	9.46E-02	1.14E-01	1.82E-01	1.28E-01	2.92E-01	2.14E-01	9.44E+01	6.71E+01	1.91E+00	1.65E-02	1.44E+01
Oxalate	g/L	3.91E-01	7.14E-02	8.85E-01	8.99E-01	1.01E+00	2.44E+00	1.40E+00	1.33E+00	7.09E-01	7.03E-01	3.70E+00	3.09E+00	1.16E+01	1.04E+01	5.90E+00	1.96E+00	2.91E+00
PO4	g/L	1.82E+01	1.19E+01	3.11E+00	5.94E+00	2.04E+01	8.58E+00	2.59E+01	9.15E+01	1.29E+02	1.75E+02	2.67E+02	1.58E+02	1.01E+02	6.18E+01	1.39E+02	1.53E+02	8.56E+01
Si	g/L	2.63E+00	1.44E+00	1.32E+01	1.82E+01	7.49E+01	1.53E+00	7.38E+00	6.81E+00	3.67E+00	2.56E+00	4.92E+00	1.59E+00	1.29E+01	1.54E+01	3.87E+00	1.41E+01	1.16E+01
SO4	g/L	6.09E+00	9.46E-01	2.25E-01	1.60E-01	2.05E+00	3.72E-01	6.44E-01	2.27E-01	3.76E-01	9.33E-01	7.95E-01	1.56E+00	6.78E+00	7.16E-01	1.27E+00	2.46E-02	1.45E+00
Sr	g/L	3.24E-01	1.78E-02	2.51E-01	1.30E-01	5.29E-01	1.74E-01	1.21E-01	1.53E+00	6.46E-02	7.04E+00	1.11E-01	3.87E-01	1.68E+00	2.18E+00	4.42E-01	7.06E-01	9.80E-01
TOC	g/L	2.82E+00	1.39E+00	1.30E+00	9.06E+00	9.71E+00	8.65E+00	1.56E+00	3.07E-01	4.46E+00	1.60E+00	8.65E-01	1.56E+00	4.50E+01	4.43E+01	8.60E+00	6.81E+01	1.31E+01
UTOTAL	g/L	2.51E+02	1.02E+01	5.11E+00	1.82E+02	6.51E+01	2.57E-01	1.11E+01	9.38E+00	3.76E+00	9.70E-01	1.08E+00	3.92E+01	2.06E+02	1.76E+02	6.27E+02	4.67E+02	1.28E+02
Zr	g/L	5.65E-02	6.64E-01	1.39E+00	3.44E+00	3.98E-01	2.66E-01	2.01E-01	4.64E-02	9.30E-01	4.53E-02	5.78E-02	6.96E-02	1.89E-02	1.69E-01	2.02E-01	0.00E+00	4.97E-01

Radioactivity		Radionuclides decayed to 7/1/2015																
106Ru	Ci/L	1.19E-22	9.12E-23	3.83E-19	6.35E-13	1.53E-22	1.74E-12	7.05E-20	1.16E-19	1.37E-19	3.68E-20	3.30E-20	5.95E-20	1.11E-12	1.09E-12	9.63E-13	9.02E-13	4.03E-13
113mCd	Ci/L	1.13E-07	1.06E-07	1.94E-06	8.85E-06	1.44E-07	2.54E-04	1.16E-07	1.91E-07	2.25E-07	6.06E-08	5.46E-08	9.79E-08	1.33E-06	1.31E-06	1.15E-06	1.08E-06	1.69E-05
125Sb	Ci/L	1.78E-10	1.49E-10	2.25E-10	3.07E-06	2.27E-10	1.07E-06	1.52E-10	2.50E-10	2.95E-10	7.93E-11	7.08E-11	1.28E-10	3.09E-07	3.05E-07	2.69E-07	2.52E-07	3.30E-07
126Sn	Ci/L	3.76E-06	3.08E-08	5.49E-09	1.22E-06	2.35E-05	1.68E-04	1.85E-08	3.03E-08	3.58E-08	2.98E-06	8.65E-09	1.55E-08	2.04E-07	2.02E-07	1.77E-07	1.66E-07	1.25E-05
129I	Ci/L	1.31E-07	2.71E-08	3.13E-07	2.94E-08	4.24E-07	6.02E-08	7.64E-08	2.95E-09	3.50E-09	3.53E-08	8.43E-10	1.52E-09	8.46E-10	1.31E-08	2.83E-08	6.87E-10	7.17E-08
134Cs	Ci/L	5.60E-13	4.42E-13	1.79E-12	4.51E-09	7.16E-13	6.66E-09	4.41E-14	7.22E-14	8.50E-14	2.29E-14	2.05E-14	3.71E-14	3.48E-10	3.41E-10	3.00E-10	2.81E-10	7.78E-10
137Cs	Ci/L	1.06E-01	1.08E-02	7.01E-02	9.57E-02	6.69E-01	1.06E-01	6.15E-03	7.34E-03	6.29E-03	2.80E-03	8.70E-03	1.69E-02	1.44E-02	1.22E-02	1.94E-02	8.79E-03	7.25E-02
137mBa	Ci/L	9.95E-02	1.02E-02	6.63E-02	9.04E-02	6.31E-01	1.00E-01	5.82E-03	6.93E-03	5.93E-03	2.65E-03	8.22E-03	1.59E-02	1.36E-02	1.16E-02	1.83E-02	8.31E-03	6.84E-02
14C	Ci/L	1.69E-07	1.40E-07	7.29E-07	4.28E-07	1.44E-07	7.83E-07	8.08E-07	3.09E-07	1.01E-07	1.89E-07	2.11E-07	4.67E-07	1.41E-06	3.63E-07	3.19E-07	3.60E-07	4.33E-07
151Sm	Ci/L	2.54E-04	2.53E-04	4.65E-05	4.57E-01	3.25E-04	7.72E-01	4.03E-01	5.35E-04	6.34E-04	1.71E-04	1.53E-04	2.75E-04	4.57E-02	4.50E-02	3.96E-02	3.71E-02	1.13E-01
152Eu	Ci/L	4.93E-09	4.12E-09	3.38E-09	6.18E-06	6.31E-09	2.42E-04	6.38E-09	1.05E-08	1.23E-08	3.33E-09	2.97E-09	5.36E-09	4.91E-06	4.82E-06	4.25E-06	3.98E-06	1.66E-05
154Eu	Ci/L	2.44E-07	2.10E-07	2.10E-04	3.14E-04	3.13E-07	3.09E-03	3.05E-07	5.03E-07	5.95E-07	1.60E-07	1.43E-07	2.58E-07	2.52E-04	2.46E-04	4.15E-05	1.56E-04	2.69E-04
155Eu	Ci/L	5.56E-08	4.98E-08	8.78E-05	6.15E-05	7.09E-08	1.41E-03	6.26E-08	1.02E-07	1.21E-07	3.25E-08	2.91E-08	5.25E-08	5.17E-05	5.09E-05	6.67E-05	4.19E-05	1.11E-04
226Ra	Ci/L	3.63E-11	1.86E-10	1.60E-12	4.51E-11	4.64E-11	4.90E-08	2.23E-11	3.67E-11	4.32E-11	1.16E-11	1.04E-11	1.87E-11	1.87E-12	1.84E-12	1.62E-12	1.52E-12	3.09E-09
227Ac	Ci/L	1.12E-10	4.31E-10	1.14E-11	3.99E-09	1.43E-10	2.42E-07	5.72E-10	5.67E-10	1.10E-09	2.98E-10	2.66E-10	4.80E-10	1.00E-11	9.88E-12	8.69E-12	8.13E-12	1.56E-08
228Ra	Ci/L	6.91E-17	4.58E-08	2.07E-08	5.13E-07	1.19E-08	5.34E-08	2.02E-09	1.22E-09	1.15E-15	3.10E-16	1.54E-10	5.01E-16	7.46E-09	7.34E-09	3.65E-09	2.73E-08	4.33E-08
229Th	Ci/L	8.12E-15	8.25E-15	2.71E-15	1.19E-11	1.04E-14	1.82E-09	7.08E-14	1.16E-13	1.37E-13	3.69E-14	3.30E-14	5.95E-14	2.19E-14	2.14E-14	1.89E-14	1.77E-14	1.15E-10
231Pa	Ci/L	1.52E-12	1.68E-12	1.73E-11	1.04E-08	1.95E-12	2.41E-07	1.43E-09	2.34E-09	2.76E-09	7.45E-10	6.65E-10	1.20E-09	1.26E-11	1.24E-11	1.09E-11	1.02E-11	1.63E-08
232Th	Ci/L	6.91E-17	4.58E-08	2.07E-08	5.13E-07	1.19E-08	5.34E-08	2.02E-09	1.22E-09	1.15E-15	3.10E-16	1.54E-10	5.01E-16	7.46E-09	7.34E-09	3.65E-09	2.73E-08	4.33E-08
232U	Ci/L	8.89E-10	6.36E-10	4.67E-10	5.13E-06	2.31E-10	4.86E-08	4.03E-11	3.65E-11	1.37E-11	3.53E-12	3.94E-12	2.00E-11	4.35E-09	3.73E-09	1.33E-08	9.90E-09	3.25E-07
233U	Ci/L	8.36E-11	5.32E-06	6.09E-07	3.03E-04	6.53E-06	1.73E-07	3.77E-12	3.18E-12	1.28E-12	3.29E-13	3.67E-13	1.06E-06	2.11E-08	1.82E-08	6.48E-08	4.83E-08	1.98E-05
234U	Ci/L	8.21E-05	3.31E-06	1.42E-06	5.78E-05	2.07E-05	8.96E-08	3.64E-06	2.52E-06	1.23E-06	3.30E-07	3.54E-07	1.81E-06	6.76E-05	6.29E-05	2.17E-04	1.59E-04	4.26E-05
235U	Ci/L	3.76E-06	1.42E-07	7.40E-08	2.75E-06	9.11E-07	3.68E-09	1.62E-07	1.41E-07	5.28E-08	1.43E-08	1.54E-08	5.87E-07	2.74E-06	2.54E-06	9.21E-06	6.58E-06	1.85E-06
236U	Ci/L	9.42E-07	9.29E-08	3.90E-08	6.72E-07	4.49E-07	1.65E-09	4.05E-08	2.21E-08	1.26E-08	3.66E-09	1.24E-08	1.57E-07	9.69E-07	6.29E-07	1.60E-06	9.87E-07	4.14E-07
237Np	Ci/L	1.20E-06	6.83E-08	1.41E-06	2.54E-07	4.02E-06	5.16E-06	6.15E-07	1.68E-09	8.53E-08	1.36E-07	7.08E-08	5.76E-07	6.33E-06	5.18E-06	5.19E-08	4.15E-05	4.17E-06
238Pu	Ci/L	1.52E-05	9.44E-06	1.41E-04	8.47E-05	4.96E-05	2.35E-04	2.64E-06	3.52E-07	2.13E-06	2.03E-06	4.72E-06	1.01E-05	8.48E-04	7.39E-04	2.71E-05	5.50E-07	1.36E-04
238U	Ci/L	8.36E-05	3.41E-06	1.71E-06	6.10E-05	2.18E-05	8.60E-08	3.69E-06	3.12E-06	1.25E-06	3.24E-07	3.61E-07	1.30E-05	6.83E-05	5.86E-05	2.10E-04	1.56E-04	4.29E-05
239Pu	Ci/L	9.28E-04	1.07E-03	5.20E-04	7.14E-04	1.96E-03	1.59E-03	4.10E-04	5.18E-05	5.28E-05	1.46E-04	4.12E-05	1.67E-04	2.93E-02	2.55E-02	9.35E-04	1.89E-05	3.96E-03
240Pu	Ci/L	9.95E-05	1.00E-04	1.08E-04	2.14E-04	2.11E-04	3.40E-04	4.46E-05	5.64E-06	5.74E-06	1.59E-05	4.48E-06	1.82E-05	6.30E-03	5.50E-03	2.02E-04	4.08E-06	8.23E-04
241Am	Ci/L	2.76E-04	2.86E-04	5.09E-04	1.21E-03	5.00E-04	6.16E-03	3.41E-04	7.40E-05	5.03E-05	7.03E-06	4.21E-04	5.33E-04	4.87E-03	2.41E-03	7.00E-05	6.29E-06	1.11E-03
241Pu	Ci/L	5.12E-04	4.53E-04	2.33E-04	1.97E-03	1.25E-03	2.18E-03	4.31E-05	7.63E-06	8.33E-05	5.56E-05	4.34E-06	3.41E-04	1.93E-02	1.68E-02	6.15E-04	1.24E-05	2.74E-03
242Cm	Ci/L	5.75E-07	2.86E-09	6.10E-09	4.43E-06	1.33E-06	1.42E-05	5.59E-08	1.26E-08	8.30E-09	1.12E-09	1.75E-06	9.97E-07	1.57E-04	7.30E-05	2.04E-06	2.04E-07	1.60E-05
242Pu	Ci/L	1.37E-09	3.39E-11	3.38E-09	2.74E-06	2.91E-09	3.97E-08	6.21E-10	7.83E-11	7.99E-11	2.21E-10	6.22E-11	2.72E-07	2.96E-07	2.59E-07	9.50E-09	1.92E-10	2.26E-07
243Am	Ci/L	2.87E-08	2.07E-08	3.85E-09	7.28E-07	3.40E-08	2.91E-07	3.46E-08	7.58E-09	5.14E-09	6.94E-10	4.27E-08	4.13E-09	1.81E-06	8.43E-07	2.35E-08	2.35E-09	2.42E-07
243Cm	Ci/L	4.15E-10	2.95E-10	8.88E-11	5.63E-07	8.20E-08	5.89E-06	5.03E-10	1.29E-10	7.46E-11	1.01E-11	3.68E-07	6.00E-11	6.39E-06	2.98E-06	8.29E-08	8.29E-09	1.02E-06
244Cm	Ci/L	7.92E-09	5.64E-09	1.88E-09	1.10E-05	1.57E-06	8.40E-05	9.56E-09	2.73E-09	1.42E-09	1.91E-10	7.03E-06	1.14E-09	1.22E-04	5.68E-05	1.59E-06	1.58E-07	1.78E-05
3H	Ci/L	1.94E-06	1.81E-06	5.34E-07	1.67E-06	1.96E-06	5.12E-07	4.64E-07	1.95E-06	5.95E-07	2.90E-07	3.24E-07	1.92E-06	3.74E-07	3.70E-07	3.25E-07	2.79E-07	9.57E-07
59Ni	Ci/L	4.43E-08	4.41E-08	1.17E-05	1.20E-05	5.67E-08	1.00E-03	4.41E-08	7.21E-08	8.51E-08	2.29E-08	2.05E-08	3.71E-08	7.54E-06	7.43E-06	6.54E-06	6.12E-06	6.58E-05
60Co	Ci/L	1.96E-08	1.76E-08	3.45E-06	9.25E-05	2.51E-08	3.84E-04	6.18E-08	1.02E-07	1.19E-07	3.21E-08	2.89E-08	5.20E-08	7.96E-06	7.84E-06	7.46E-06	6.46E-06	3.19E-05
63Ni	Ci/L	2.75E-03	9.85E-03	2.00E-03	1.42E-02	3.95E-03	6.42E-03	7.92E-03	2.24E-04	1.19E-04	5.25E-05	1.92E-04	9.65E-04	1.59E-03	3.68E-04	1.10E-04	2.90E-05	3.17E-03
79Se	Ci/L	2.18E-07	3.97E-08	2.75E-09	3.28E-07	2.20E-08	9.12E-07	1.01E-08	1.26E-07	1.96E-08	5.26E-09	4.72E-09	8.51E-09	1.02E-07	1.00E-07	8.81E-08	8.25E-08	1.29E-07
90Sr	Ci/L	4.93E-01	9.39E-03	7.86E-01	7.56E-01	7.78E-01	4.78E+00	2.39E-01	1.08E-01	3.41E-01	3.65E-01	2.45E+00	1.91E+00	3.54E-01	6.59E-01	3.35E-01	2.21E-01	9.11E-01
90Y	Ci/L	4.93E-01	9.39E-03	7.86E-01	7.56E-01	7.78E-01	4.78E+00	2.39E-01	1.08E-01	3.41E-01	3.65E-01	2.45E+00	1.91E+00	3.54E-01	6.59E-01	3.35E-01	2.21E-01	9.11E-01
93mNb	Ci/L	1.93E-09	1.92E-09	6.69E-08	7.71E-06	2.47E-09	9.63E-04	5.44E-06	7.12E-06	1.05E-05	2.84E-06	2.54E-06	4.59E-06	2.43E-06	2.39E-06	2.10E-06	1.96E-06	6.33E-05
93Zr	Ci/L	2.05E-09	2.05E-09	7.32E-08	8.67E-06	2.64E-09	9.91E-04	5.77E-06	9.46E-06	1.11E-05	3.01E-06	2.70E-06	4.85E-06	2.70E-06	2.66E-06	2.35E-06	2.19E-06	6.54E-05
99Tc	Ci/L	3.81E-05	7.22E-06	4.67E-06	4.21E-05	8.82E-06	1.56E-05	2.26E-06	3.78E-06	1.15E-06	5.58E-06	2.69E-06	7.55E-06	4.87E-06	4.46E-06	4.46E-06	6.12E-06	9.96E-06

Radioactivity		Radionuclides decayed to 1/1/2020 (decay date for C-Farm Closure data package)																
106Ru	Ci/L	5.59E-24	4.27E-24	1.80E-20	2.97E-14	7.16E-24	8.18E-14	3.30E-21	5.45E-21	6.41E-21	1.72E-21	1.55E-21	2.79E-21	5.22E-14	5.13E-14	4.51E-14	4.23E-14	1.89E-14
113mCd	Ci/L	9.02E-08	8.49E-08	1.55E-06	7.09E-06	1.15E-07	2.03E-04	9.33E-08	1.53E-07	1.80E-07	4.86E-08	4.38E-08	7.84E-08	1.07E-06	1.05E-06	9.23E-07	8.65E-07	1.35E-05
125Sb	Ci/L	5.75E-11	4.81E-11	7.25E-11	9.90E-07	7.33E-11	3.44E-07	4.90E-11	8.07E-11	9.50E-11	2.56E-11	2.28E-11	4.13E-11	9.97E-08	9.85E-08	8.68E-08	8.12E-08	1.06E-07
126Sn	Ci/L	3.76E-06	3.08E-08	5.49E-09	1.22E-06	2.35E-05	1.68E-04	1.85E-08	3.03E-08	3.58E-08	2.97E-06	8.65E-09	1.55E-08	2.04E-07	2.02E-07	1.77E-07	1.66E-07	1.25E-05
129I	Ci/L	1.31E-07	2.71E-08	3.12E-07	2.94E-08	4.24E-07	6.02E-08	7.64E-08	2.95E-09	3.50E-09	3.52E-08	8.43E-10	1.52E-09	8.46E-10	1.31E-08	2.83E-08	6.87E-10	7.17E-08
134Cs	Ci/L	1.24E-13	9.76E-14	3.95E-13	9.95E-10	1.58E-13	1.47E-09	9.73E-15	1.59E-14	1.87E-14	5.04E-15	4.53E-15	8.17E-15	7.68E-11	7.52E-11	6.62E-11	6.19E-11	1.72E-10
137Cs	Ci/L	9.54E-02	9.70E-03	6.32E-02	8.63E-02	6.03E-01	9.54E-02	5.55E-03	6.62E-03	5.67E-03	2.52E-03	7.84E-03	1.52E-02	1.30E-02	1.10E-02	1.75E-02	7.92E-03	6.54E-02
137mBa	Ci/L	8.47E-02	8.64E-03	5.64E-02	7.69E-02	5.37E-01	8.52E-02	4.95E-03	5.90E-03	5.05E-03	2.25E-03	6.99E-03	1.35E-02	1.16E-02	9.83E-03	1.56E-02	7.07E-03	5.82E-02
14C	Ci/L	1.69E-07	1.40E-07	7.29E-07	4.28E-07	1.44E-07	7.82E-07	8.07E-07	3.08E-07	1.01E-07	1.89E-07	2.11E-07	4.66E-07	1.41E-06	3.62E-07	3.19E-07	3.59E-07	4.33E-07
151Sm	Ci/L	2.45E-04	2.44E-04	4.49E-05	4.41E-01	3.14E-04	7.46E-01	3.89E-01	5.17E-04	6.13E-04	1.65E-04	1.48E-04	2.65E-04	4.42E-02	4.35E-02	3.83E-02	3.59E-02	1.09E-01
152Eu	Ci/L	3.91E-09	3.27E-09	2.68E-09	4.91E-06	5.01E-09	1.92E-04	5.07E-09	8.31E-09	9.78E-09	2.64E-09	2.36E-09	4.26E-09	3.90E-06	3.83E-06	3.37E-06	3.16E-06	1.32E-05
154Eu	Ci/L	1.70E-07	1.46E-07	1.46E-04	2.18E-04	2.17E-07	2.15E-03	2.12E-07	3.50E-07	4.14E-07	1.11E-07	9.96E-08	1.79E-07	1.75E-04	1.71E-04	2.89E-05	1.08E-04	1.87E-04
155Eu	Ci/L	2.88E-08	2.58E-08	4.55E-05	3.19E-05	3.68E-08	7.31E-04	3.24E-08	5.30E-08	6.26E-08	1.68E-08	1.51E-08	2.72E-08	2.68E-05	2.64E-05	3.46E-05	2.17E-05	5.74E-05
226Ra	Ci/L	3.62E-11	1.86E-10	1.60E-12	4.51E-11	4.63E-11	4.89E-08	2.23E-11	3.66E-11	4.31E-11	1.16E-11	1.04E-11	1.87E-11	1.87E-12	1.84E-12	1.62E-12	1.51E-12	3.09E-09
227Ac	Ci/L	9.71E-11	3.73E-10	9.84E-12	3.45E-09	1.24E-10	2.10E-07	4.95E-10	4.91E-10	9.56E-10	2.58E-10	2.31E-10	4.16E-10	8.70E-12	8.56E-12	7.53E-12	7.05E-12	1.35E-08
228Ra	Ci/L	4.02E-17	2.66E-08	1.21E-08	2.98E-07	6.93E-09	3.10E-08	1.17E-09	7.08E-10	6.68E-16	1.80E-16	8.96E-11	2.92E-16	4.34E-09	4.27E-09	2.13E-09	1.59E-08	2.52E-08
229Th	Ci/L	8.11E-15	8.25E-15	2.71E-15	1.19E-11	1.04E-14	1.82E-09	7.07E-14	1.15E-13	1.37E-13	3.69E-14	3.30E-14	5.94E-14	2.18E-14	2.14E-14	1.89E-14	1.76E-14	1.15E-10
231Pa	Ci/L	1.52E-12	1.68E-12	1.73E-11	1.04E-08	1.95E-12	2.41E-07	1.43E-09	2.34E-09	2.76E-09	7.45E-10	6.65E-10	1.20E-09	1.26E-11	1.24E-11	1.09E-11	1.02E-11	1.63E-08
232Th	Ci/L	6.91E-17	4.58E-08	2.07E-08	5.12E-07	1.19E-08	5.34E-08	2.02E-09	1.22E-09	1.15E-15	3.10E-16	1.54E-10	5.01E-16	7.46E-09	7.34E-09	3.65E-09	2.73E-08	4.33E-08
232U	Ci/L	8.50E-10	6.08E-10	4.46E-10	4.90E-06	2.21E-10	4.65E-08	3.85E-11	3.49E-11	1.31E-11	3.37E-12	3.76E-12	1.92E-11	4.16E-09	3.57E-09	1.27E-08	9.47E-09	3.11E-07
233U	Ci/L	8.36E-11	5.32E-06	6.09E-07	3.03E-04	6.53E-06	1.73E-07	3.77E-12	3.18E-12	1.27E-12	3.29E-13	3.67E-13	1.06E-06	2.11E-08	1.82E-08	6.48E-08	4.83E-08	1.98E-05
234U	Ci/L	8.21E-05	3.31E-06	1.42E-06	5.78E-05	2.07E-05	8.96E-08	3.64E-06	2.52E-06	1.23E-06	3.30E-07	3.54E-07	1.81E-06	6.76E-05	6.29E-05	2.17E-04	1.59E-04	4.26E-05
235U	Ci/L	3.76E-06	1.42E-07	7.40E-08	2.75E-06	9.11E-07	3.68E-09	1.62E-07	1.41E-07	5.28E-08	1.42E-08	1.54E-08	5.87E-07	2.74E-06	2.54E-06	9.21E-06	6.58E-06	1.85E-06
236U	Ci/L	9.42E-07	9.29E-08	3.90E-08	6.72E-07	4.49E-07	1.65E-09	4.05E-08	2.21E-08	1.26E-08	3.66E-09	1.24E-08	1.57E-07	9.69E-07	6.29E-07	1.60E-06	9.87E-07	4.14E-07
237Np	Ci/L	1.20E-06	6.83E-08	1.41E-06	2.54E-07	4.02E-06	5.16E-06	6.15E-07	1.68E-09	8.53E-08	1.36E-07	7.08E-08	5.76E-07	6.33E-06	5.18E-06	5.19E-08	4.15E-05	4.17E-06
238Pu	Ci/L	1.46E-05	9.11E-06	1.36E-04	8.18E-05	4.79E-05	2.27E-04	2.55E-06	3.40E-07	2.06E-06	1.95E-06	4.55E-06	9.75E-06	8.18E-04	7.13E-04	2.62E-05	5.31E-07	1.31E-04
238U	Ci/L	8.36E-05	3.41E-06	1.71E-06	6.10E-05	2.18E-05	8.60E-08	3.69E-06	3.12E-06	1.25E-06	3.24E-07	3.61E-07	1.30E-05	6.83E-05	5.86E-05	2.10E-04	1.56E-04	4.29E-05
239Pu	Ci/L	9.27E-04	1.07E-03	5.20E-04	7.14E-04	1.96E-03	1.59E-03	4.10E-04	5.18E-05	5.28E-05	1.46E-04	4.12E-05	1.67E-04	2.93E-02	2.55E-02	9.34E-04	1.89E-05	3.96E-03
240Pu	Ci/L	9.95E-05	1.00E-04	1.08E-04	2.14E-04	2.11E-04	3.40E-04	4.46E-05	5.63E-06	5.73E-06	1.59E-05	4.48E-06	1.82E-05	6.29E-03	5.50E-03	2.02E-04	4.07E-06	8.23E-04
241Am	Ci/L	2.74E-04	2.84E-04	5.06E-04	1.20E-03	4.96E-04	6.11E-03	3.39E-04	7.34E-05	4.99E-05	6.97E-06	4.18E-04	5.29E-04	4.84E-03	2.39E-03	6.95E-05	6.24E-06	1.10E-03
241Pu	Ci/L	4.12E-04	3.64E-04	1.88E-04	1.59E-03	1.01E-03	1.76E-03	3.47E-05	6.14E-06	6.71E-05	4.48E-05	3.49E-06	2.75E-04	1.55E-02	1.35E-02	4.95E-04	1.00E-05	2.20E-03
242Cm	Ci/L	5.62E-07	2.80E-09	5.97E-09	4.33E-06	1.30E-06	1.39E-05	5.47E-08	1.24E-08	8.12E-09	1.09E-09	1.71E-06	9.75E-07	1.54E-04	7.14E-05	1.99E-06	1.99E-07	1.56E-05
242Pu	Ci/L	1.37E-09	3.39E-11	3.37E-09	2.74E-06	2.91E-09	3.97E-08	6.21E-10	7.83E-11	7.99E-11	2.21E-10	6.22E-11	2.72E-07	2.96E-07	2.59E-07	9.50E-09	1.92E-10	2.26E-07
243Am	Ci/L	2.87E-08	2.07E-08	3.85E-09	7.27E-07	3.40E-08	2.91E-07	3.46E-08	7.58E-09	5.14E-09	6.93E-10	4.27E-08	4.13E-09	1.81E-06	8.43E-07	2.35E-08	2.35E-09	2.42E-07
243Cm	Ci/L	3.73E-10	2.65E-10	7.97E-11	5.05E-07	7.37E-08	5.29E-06	4.51E-10	1.16E-10	6.70E-11	9.03E-12	3.30E-07	5.39E-11	5.74E-06	2.68E-06	7.45E-08	7.45E-09	9.19E-07
244Cm	Ci/L	6.67E-09	4.75E-09	1.58E-09	9.25E-06	1.32E-06	7.07E-05	8.05E-09	2.30E-09	1.20E-09	1.61E-10	5.91E-06	9.63E-10	1.03E-04	4.78E-05	1.34E-06	1.33E-07	1.49E-05
3H	Ci/L	1.50E-06	1.41E-06	4.15E-07	1.29E-06	1.52E-06	3.97E-07	3.60E-07	1.51E-06	4.62E-07	2.25E-07	2.52E-07	1.49E-06	2.90E-07	2.87E-07	2.52E-07	2.16E-07	7.43E-07
59Ni	Ci/L	4.43E-08	4.41E-08	1.17E-05	1.20E-05	5.67E-08	1.00E-03	4.41E-08	7.21E-08	8.51E-08	2.29E-08	2.05E-08	3.71E-08	7.54E-06	7.43E-06	6.54E-06	6.12E-06	6.58E-05
60Co	Ci/L	1.08E-08	9.75E-09	1.91E-06	5.12E-05	1.39E-08	2.12E-04	3.42E-08	5.62E-08	6.61E-08	1.78E-08	1.60E-08	2.88E-08	4.40E-06	4.34E-06	4.13E-06	3.57E-06	1.76E-05
63Ni	Ci/L	2.67E-03	9.55E-03	1.94E-03	1.37E-02	3.83E-03	6.22E-03	7.68E-03	2.17E-04	1.15E-04	5.09E-05	1.86E-04	9.36E-04	1.54E-03	3.57E-04	1.06E-04	2.82E-05	3.07E-03
79Se	Ci/L	2.18E-07	3.97E-08	2.75E-09	3.28E-07	2.20E-08	9.12E-07	1.01E-08	1.26E-07	1.96E-08	5.26E-09	4.72E-09	8.51E-09	1.02E-07	1.00E-07	8.81E-08	8.25E-08	1.29E-07
90Sr	Ci/L	4.42E-01	8.42E-03	7.06E-01	6.78E-01	6.98E-01	4.29E+00	2.15E-01	9.67E-02	3.06E-01	3.27E-01	2.20E+00	1.72E+00	3.17E-01	5.91E-01	3.00E-01	1.98E-01	8.18E-01
90Y	Ci/L	4.42E-01	8.42E-03	7.06E-01	6.78E-01	6.98E-01	4.29E+00	2.15E-01	9.67E-02	3.06E-01	3.27E-01	2.20E+00	1.72E+00	3.17E-01	5.91E-01	3.00E-01	1.98E-01	8.18E-01
93mNb	Ci/L	1.59E-09	1.58E-09	5.51E-08	6.35E-06	2.04E-09	7.93E-04	4.48E-06	5.86E-06	8.65E-06	2.34E-06	2.09E-06	3.78E-06	2.00E-06	1.97E-06	1.73E-06	1.62E-06	5.21E-05
93Zr	Ci/L	2.05E-09	2.05E-09	7.32E-08	8.67E-06	2.64E-09	9.91E-04	5.77E-06	9.46E-06	1.11E-05	3.01E-06	2.70E-06	4.85E-06	2.70E-06	2.66E-06	2.35E-06	2.19E-06	6.54E-05
99Tc	Ci/L	3.81E-05	7.22E-06	4.67E-06	4.21E-05	8.82E-06	1.56E-05	2.26E-06	3.78E-06	1.15E-06	5.57E-06	2.69E-06	7.55E-06	4.87E-06	4.46E-06	4.46E-06	6.12E-06	9.96E-06

SPREADSHEET FOR DATA ENTRY AND DECAY CALCULATION (SVF-2545)

Decay from	7/1/2015
Decay to	1/1/2020
Days of Decay	1645

Radionuclide	Alt Radionuclide Name	Half Life (years)	Lambda (1/day)	Decay Factor
Ru-106	106Ru	1.020	1.861E-03	0.0469
Cd-113m	113mCd	14.1	1.346E-04	0.8014
Sb-125	125Sb	2.758	6.881E-04	0.3224
Sn-126	126Sn	2.3E+05	8.251E-09	1.0000
I-129	129I	1.57E+07	1.209E-10	1.0000
Cs-134	134Cs	2.065	9.190E-04	0.2205
Cs-137	137Cs	30.07	6.311E-05	0.9014
Ba-137m	137mBa	4.852E-06	3.911E+02	0.8509
C-14	14C	5715	3.321E-07	0.9995
Sm-151	151Sm	90	2.109E-05	0.9659
Eu-152	152Eu	13.54	1.402E-04	0.7941
Eu-154	154Eu	8.593	2.208E-04	0.6954
Eu-155	155Eu	4.75	3.995E-04	0.5183
Ra-226	226Ra	1599	1.187E-06	0.9980
Ac-227 (2nd Order)	227Ac	21.772	8.716E-05	0.8664
Ra-228 (2nd Order)	228Ra	5.76	3.295E-04	0.5816
Th-229	229Th	7.3E+03	2.600E-07	0.9996
Pa-231	231Pa	3.28E+04	5.786E-08	0.9999
Th-232	232Th	1.40E+10	1.356E-13	1.0000
U-232	232U	69.8	2.719E-05	0.9563
U-233	233U	1.592E+05	1.192E-08	1.0000
U-234	234U	2.46E+05	7.714E-09	1.0000
U-235	235U	7.04E+08	2.696E-12	1.0000
U-236	236U	2.342E+07	8.103E-11	1.0000
Np-237	237Np	2.14E+06	8.868E-10	1.0000
Pu-238	238Pu	87.7	2.164E-05	0.9650

Radionuclide	Alt Radionuclide Name	Half Life (years)	Lambda (1/day)	Decay Factor
U-238	238U	4.47E+09	4.245E-13	1.0000
Pu-239	239Pu	2.410E+04	7.874E-08	0.9999
Pu-240	240Pu	6.56E+03	2.893E-07	0.9995
Am-241 (2nd Order)	241Am	432.7	4.386E-06	0.9928
Pu-241	241Pu	14.4	1.318E-04	0.8051
Cm-242	242Cm	4.46E-01		0.9781
Pu-242	242Pu	3.75E+05	5.061E-09	1.0000
Am-243	243Am	7.37E+03	2.575E-07	0.9996
Cm-243	243Cm	29.1	6.521E-05	0.8983
Cm-244	244Cm	18.1	1.048E-04	0.8416
H-3	3H	12.32	1.540E-04	0.7762
Ni-59	59Ni	7.6E+04	2.497E-08	1.0000
Co-60	60Co	5.271	3.600E-04	0.5531
Ni-63	63Ni	101	1.879E-05	0.9696
Se-79	79Se	2.9E+05	6.544E-09	1.0000
Sr-90	90Sr	28.78	6.594E-05	0.8972
Y-90	90Y	7.31E-03	2.596E-01	0.8972
Nb-93m (2nd Order)	93mNb	16.1	1.179E-04	0.8237
Zr-93	93Zr	1.5E+06	1.265E-09	1.0000
Tc-99	99Tc	2.13E+05	8.910E-09	1.0000

All half-lives taken from the Sixteenth Edition of the Chart of the Nuclides.

REFERENCES

DOE/EIS-0391, 2012, *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*, Rev. 0, U.S. Department of Energy, Office of River Protection, Richland, Washington.

SVF-2545, Rev. 01, "SVF-2545 Rev 0 TWINS Radionuclide Decay Calculator.xlsx," This spreadsheet is being canceled, as it has been superseded by RPP-PLAN-61464, Rev. 0, Software Management Plan for Grade D Utility Calculation Software TWINS Radioactive Decay Calculator., M. J. Rodgers, TNK WST INVENTORY & CHARACTZTN, H4-30, 509-376-2993, 6/26/2017

APPENDIX C

C-FARM TANK RESIDUAL INVENTORY ESTIMATES

This page intentionally left blank.

APPENDIX C

C-FARM TANK RESIDUAL INVENTORY ESTIMATES

C.1 2002 Residual Inventory (Excel®[2] file)

C.2 Ancillary Equipment Inventory (Excel® file)

[2] Excel® is a registered trademark of Microsoft Corporation, Redmond, Washington.

RPP-RPT-42323 Rev. 4, Appendix C.1

2002 Residual Inventory

Spreadsheet Documentation

Spreadsheet Name	C_1 2002 Residual Inventory.xlsx
Spreadsheet Owner	J. G. Field, 376-3753
Related Documents	RPP-RPT-42323, Hanford C-Farm Tank and Ancillary Equipment Residual Waste Inventory Estimates
Purpose	This spreadsheet was developed to estimate C-Farm residual tank waste inventories for DOE/EIS-0391, Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland Washington and as Appendix C-1 of RPP-RPT-42323.
Overview	Data for this spreadsheet was taken from the 12-1-2002 Best Basis Inventory (BBI) for 99% calculations and from HTWOS residual waste calculations. Radionuclides from the 12-1-2002 BBI were decayed to 1-1-2020 for RPP-42323. The spreadsheet also calculates HTWOS waste concentrations for tank C-103 and compares these values with tank C-103 residual waste concentration sample analyses after retrieval.
Worksheet Descriptions	HFFACO case worksheet: Rows 4-24 show residual tank inventory estimates for standard BBI radionuclides and chemicals based on HTWOS case model results for HNF-SD-WM-SP-012, Rev. 4 and assuming a residual waste volume of 360 ft3 in 100-series SSTs and 30 ft3 in 200-series SSTs. Radionuclides are decayed to 1-1-2001. These values were used for inventory estimates in Appendix A.3 and A.4 of the 2002 data package (DOE/ORP-2003-02) provided for DOE/EIS-0391 (RPP-RPT-42323, Rev. 1). Rows 27-47 show radionuclide inventories decayed to 1-1-2020 for RPP-RPT-42323, Rev. 4. The 12-1-2002 estimates were decayed by multiplying by applicable decay values in row 49; these decay values are from the "decay" worksheet.
	99% worksheet: This worksheet presents residual inventories for individual chemicals and presents the sums of chemical and radionuclide inventories if 99% of the waste (starting 12-1-2002 BBI waste volume) is retrieved.
	RPP-RPT-42323 Worksheet: This is a title page for this spreadsheet.
	Decay worksheet: Copied from SVF-2545, "Spreadsheet for Data Entry and Decay Calculation." The decay values in column E are calculated based on the 1/2 life of radionuclides and formulas in Rows 12-57, Columns B-D). Start and end decay dates are inputs in cells H5 and H6 respectively. SVF-2545 is based on 1/2 life values taken from the 16th edition of chart of the nuclides.
	C-103 Conc worksheet: This worksheet compares HTWOS estimated residual waste chemical and radionuclide concentrations from the HFFACO case worksheet with -2014 BBI concentrations from Appendix B-2.
Macros and Add-in software	None
Key Assumptions	For the HFFACO case: Assumes 360 ft3 of residual waste will remain in 100-series tanks and 30 ft3 in 200-series tanks. The 99% retrieval inventories assume 99% of the starting waste volume on 12-1-2002 is retrieved and that the concentration of residual waste will be the same as the concentration for the starting waste volume.

Units	Inventory units are shown (kg or Ci). Concentration units are g/L or Ci/L as shown. Waste volumes are shown as kL and ft3. Conversions: 1 gal = 3.785 L, 1 ft3 = 7.481 gal.
Input Data	BBI inventory values, SVF-2545 spreadsheet, and Start and end dates for decay values.
Verification	By: K. M. Singleton Date: Approval date for RPP-RPT-42323, Rev. 4 report Summary: Checked and verified worksheet inputs and formulas

2002 Summary of Residual Inventory Estimates at Closure from EIS data Package (Radionuclides Decayed to 1/1/2001).

Assumed Residual Waste Voume, 10.2 kL (360 ft3) for 100-series tanks, 0.85 kL (30 ft3 for 200-series tanks)

	HFFACO Estimate at Closure Based on HTWOS Modeling		Specific Analyte Inventories at Closure (Ci) from EIS Inventory data Package Based on HTWOS Modeling (radionuclides decayed to 1/1/2001)																	
Tank	**Total Ci**	**Total kg**	**106Ru**	**113mCd**	**125Sb**	**126Sn**	**129I**	**134Cs**	**137Cs**	**137mBa**	**14C**	**151Sm**	**152Eu**	**154Eu**	**155Eu**	**226Ra**	**227Ac**	**228Ra**	**229Th**	**231Pa**
241-C-101	2.49E+03	1.08E+03	1.58E-11	8.78E-04	5.78E-05	5.02E-05	5.17E-06	7.85E-07	1.41E+02	1.33E+02	3.88E-04	2.83E-01	5.00E-04	2.21E-03	1.71E-02	1.31E-08	8.48E-08	8.42E-13	3.18E-10	1.54E-07
241-C-102	2.95E+03	1.09E+03	1.47E-08	1.38E-03	5.16E-04	6.17E-05	6.44E-06	2.50E-05	6.99E+01	6.61E+01	6.64E-04	3.10E-01	1.81E-03	7.74E-02	6.12E-02	1.75E-06	4.70E-02	6.16E-03	3.80E-04	6.95E-02
241-C-103	1.15E+04	4.55E+02	5.73E-08	5.82E-02	3.83E-03	1.81E-02	8.29E-05	8.76E-05	1.51E+02	1.43E+02	6.07E-03	1.01E+02	2.86E-02	1.01E+01	6.01E+00	3.94E-06	2.22E-05	2.46E-07	2.11E-07	2.82E-05
241-C-104	1.63E+03	7.49E+02	2.46E-07	2.64E-02	2.42E-01	2.34E-03	1.03E-03	6.14E-05	1.30E+02	1.23E+02	2.53E-03	1.28E+01	3.32E-03	1.50E+00	1.10E+00	8.57E-06	1.49E-01	3.08E-02	1.28E-03	3.27E-01
241-C-105	1.71E+03	4.53E+02	1.14E-11	4.80E-04	3.84E-05	2.49E-05	1.43E-04	5.46E-07	1.25E+02	1.19E+02	7.77E-04	1.38E-01	2.18E-04	1.39E-03	6.57E-03	4.32E-09	2.89E-08	2.17E-13	7.83E-11	5.43E-08
241-C-106	3.88E+04	2.24E+03	1.08E-06	1.12E+00	1.79E-01	1.36E-01	1.08E-03	4.48E-03	1.11E+03	1.05E+03	3.64E-03	7.56E+02	2.08E-01	1.69E+01	1.20E+01	2.60E-05	1.46E-04	2.00E-06	1.53E-06	2.14E-04
241-C-107	1.04E+04	8.64E+02	1.84E-05	1.94E+00	1.22E-02	1.88E-01	7.95E-05	8.01E-04	8.64E+01	8.19E+01	6.31E-03	1.04E+03	1.92E-01	3.19E+00	2.08E+00	3.54E-05	1.82E-04	5.38E-06	4.80E-06	3.22E-04
241-C-108	1.78E+03	1.35E+03	7.73E-13	1.79E-03	3.70E-05	1.30E-04	1.34E-05	6.70E-06	8.28E+02	7.82E+02	1.33E-03	7.62E-01	1.33E-03	5.87E-03	2.88E-02	5.95E-08	3.76E-07	3.67E-12	1.41E-09	6.60E-07
241-C-109	6.63E+03	1.18E+03	4.74E-09	4.61E-03	1.15E-04	3.39E-04	1.58E-05	1.10E-05	1.35E+03	1.28E+03	1.29E-04	1.93E+00	1.58E-02	1.07E-02	1.50E-01	2.33E-06	9.25E-06	1.06E-11	4.00E-09	9.71E-07
241-C-110	2.72E+02	2.38E+03	4.48E-13	1.11E-03	2.21E-05	8.13E-05	8.43E-06	4.90E-07	1.10E+02	1.04E+02	2.54E-03	4.79E-01	1.24E-04	1.09E-02	8.24E-03	3.91E-08	2.46E-07	4.56E-13	1.45E-10	4.31E-07
241-C-111	1.33E+04	9.07E+02	3.40E-09	3.76E-03	9.16E-05	2.77E-04	1.47E-05	1.06E-05	1.43E+02	1.35E+02	1.19E-03	1.58E+00	1.17E-02	8.53E-03	4.19E-01	1.69E-06	6.75E-06	8.69E-12	3.30E-09	8.65E-07
241-C-112	1.24E+04	1.54E+03	6.35E-12	3.89E-03	2.60E-03	2.77E-04	2.85E-05	1.77E-03	1.90E+03	1.80E+03	2.41E-02	1.62E+00	3.43E-03	1.48E+00	1.02E+00	1.22E-07	7.77E-07	9.19E-12	3.56E-09	1.36E-06
241-C-201	2.86E+01	9.21E+01	3.05E-09	1.62E-03	3.17E-05	1.26E-04	6.15E-07	1.67E-08	1.77E+00	1.67E+00	4.51E-05	7.00E-01	9.09E-03	4.29E-03	3.19E-01	1.46E-06	5.75E-06	4.00E-12	1.49E-09	1.94E-07
241-C-202	2.75E+01	1.07E+02	3.16E-09	1.67E-03	3.27E-05	1.30E-04	6.33E-07	1.73E-08	1.83E+00	1.73E+00	4.64E-05	7.22E-01	9.38E-03	4.42E-03	3.29E-01	1.51E-06	5.91E-06	4.11E-12	1.54E-09	2.00E-07
241-C-203	2.58E+01	1.01E+02	3.13E-09	1.66E-03	3.25E-05	1.29E-04	6.31E-07	1.72E-08	1.82E+00	1.71E+00	4.62E-05	7.19E-01	9.34E-03	4.39E-03	3.27E-01	1.50E-06	5.90E-06	4.09E-12	1.53E-09	2.00E-07
241-C-204	2.52E+01	1.01E+02	3.13E-09	1.65E-03	3.23E-05	1.29E-04	6.29E-07	1.71E-08	1.80E+00	1.71E+00	4.61E-05	7.16E-01	9.29E-03	4.38E-03	3.25E-01	1.50E-06	5.86E-06	4.07E-12	1.52E-09	1.98E-07
All Tanks	**1.04E+05**	**1.47E+04**	**1.99E-05**	**3.17E+00**	**4.41E-01**	**3.46E-01**	**2.51E-03**	**7.25E-03**	**6.16E+03**	**5.83E+03**	**4.99E-02**	**1.92E+03**	**5.04E-01**	**3.33E+01**	**2.42E+01**	**8.58E-05**	**1.96E-01**	**3.70E-02**	**1.67E-03**	**3.97E-01**

Tank	232Th	232U	233U	234U	235U	236U	237Np	238Pu	238U	239Pu	240Pu	241Am	241Pu	242Cm	242Pu	243Am	243Cm	244Cm	3H	59Ni
241-C-101	9.72E-14	4.62E-07	1.79E-08	1.22E-02	5.28E-04	1.73E-04	1.72E-05	4.04E-02	1.24E-02	2.07E+00	3.46E-01	3.21E-02	2.36E+00	1.39E-05	1.03E-05	7.20E-09	2.83E-07	2.06E-07	1.84E-03	1.10E-04
241-C-102	7.60E-05	5.34E-04	2.25E-03	6.38E-03	2.75E-04	1.04E-04	2.20E-05	2.16E-01	6.37E-03	7.92E+00	1.45E+00	2.71E+00	1.25E+01	5.05E-03	6.67E-05	8.55E-06	1.59E-04	1.56E-03	2.45E-03	1.06E-04
241-C-103	4.93E-08	2.71E-05	1.12E-04	2.77E-03	1.18E-04	4.90E-05	1.36E-04	1.21E-01	2.84E-03	7.70E+00	1.19E+00	5.74E+00	6.60E+00	7.19E-03	3.71E-05	1.32E-04	4.02E-04	2.51E-03	1.39E-03	6.15E-02
241-C-104	7.62E-03	2.64E-02	5.64E-01	2.84E-02	8.23E-04	9.34E-04	6.00E-03	3.11E-01	1.60E-02	7.47E+00	1.47E+00	8.67E+00	2.02E+01	7.35E-03	1.30E-04	4.26E-04	5.89E-04	2.05E-02	7.66E-02	6.25E-03
241-C-105	4.45E-14	2.42E-07	8.67E-09	4.92E-03	2.09E-04	8.51E-05	8.59E-06	4.67E-02	5.04E-03	3.15E+00	4.82E-01	1.82E+00	2.57E+00	5.84E-04	1.37E-05	4.99E-07	1.21E-05	1.84E-05	8.96E-04	5.40E-05
241-C-106	1.61E-04	3.35E-05	1.38E-04	2.73E-03	1.16E-04	4.86E-05	1.66E-02	2.22E-01	2.79E-03	4.80E+00	9.82E-01	1.43E+01	1.17E+01	2.26E-02	1.05E-04	1.40E-04	1.78E-03	3.82E-02	9.79E-02	4.14E-01
241-C-107	4.94E-07	8.51E-06	3.32E-05	3.49E-03	1.44E-04	1.56E-04	1.34E-04	6.74E-02	3.08E-03	2.55E+00	4.03E-01	7.49E+00	3.46E+00	8.14E-03	2.84E-05	3.75E-04	4.99E-04	1.65E-02	4.89E-02	5.27E-01
241-C-108	2.92E-13	5.68E-09	3.63E-10	5.10E-04	2.30E-05	3.27E-06	4.39E-05	1.20E-04	5.17E-04	3.23E-02	2.09E-03	6.68E-02	2.01E-03	1.39E-03	1.10E-08	4.61E-07	2.49E-05	8.33E-06	3.93E-03	1.11E-02
241-C-109	3.32E-13	4.47E-07	2.00E-08	1.14E-02	4.55E-04	1.65E-04	7.75E-04	1.23E-02	1.07E-02	4.81E-01	8.17E-02	3.69E-01	4.82E-01	6.42E-04	7.17E-06	8.65E-06	2.81E-05	1.39E-05	1.07E-02	4.39E-02
241-C-110	1.86E-13	5.50E-08	3.53E-09	4.96E-03	2.24E-04	3.17E-05	2.75E-05	1.56E-03	5.03E-03	5.17E-01	3.05E-02	2.99E-01	1.39E-02	3.44E-04	5.96E-08	8.85E-07	4.45E-06	1.04E-05	5.15E-03	1.83E-04
241-C-111	3.13E-13	3.44E-07	1.35E-08	1.02E-02	4.46E-04	1.35E-04	4.72E-05	1.01E-02	1.04E-02	9.54E-01	1.05E-01	1.56E+00	4.50E-01	2.25E-02	2.89E-06	1.42E-05	4.33E-04	3.89E-04	4.11E-03	3.61E-02
241-C-112	6.17E-13	9.64E-04	4.00E-03	5.33E-02	2.34E-03	6.60E-04	5.02E-03	5.37E-02	5.39E-02	5.47E-01	8.70E-02	3.17E+00	5.39E-01	1.01E-02	2.74E-06	8.03E-05	3.34E-04	1.43E-04	4.83E-02	5.59E-02
241-C-201	1.07E-14	9.32E-11	5.97E-12	8.42E-06	3.79E-07	5.36E-08	9.61E-07	3.25E-02	8.53E-06	1.45E+00	2.40E-01	5.10E-01	1.78E+00	7.65E-04	1.23E-05	1.18E-05	3.66E-05	1.62E-05	2.20E-05	1.69E-02
241-C-202	1.11E-14	5.78E-10	1.62E-11	8.87E-06	3.73E-07	2.06E-07	9.91E-07	1.69E-02	8.80E-06	7.53E-01	1.24E-01	2.64E-01	9.20E-01	3.96E-04	6.33E-06	6.11E-06	1.89E-05	8.35E-06	2.27E-05	1.74E-02
241-C-203	1.10E-14	9.56E-11	6.13E-12	8.64E-06	3.88E-07	5.51E-08	9.86E-07	4.40E-03	8.74E-06	1.97E-01	3.23E-02	6.88E-02	2.39E-01	1.03E-04	1.65E-06	1.58E-06	4.93E-06	2.17E-06	2.25E-05	1.73E-02
241-C-204	1.10E-14	9.56E-11	6.11E-12	8.61E-06	3.88E-07	5.50E-08	9.81E-07	1.39E-04	8.74E-06	6.20E-03	1.02E-03	2.16E-03	7.56E-03	3.23E-06	5.22E-08	5.00E-08	1.55E-07	6.86E-08	2.25E-05	1.73E-02
All Tanks	**7.85E-03**	**2.80E-02**	**5.71E-01**	**1.41E-01**	**5.70E-03**	**2.55E-03**	**2.89E-02**	**1.16E+00**	**1.29E-01**	**4.06E+01**	**7.03E+00**	**4.70E+01**	**6.39E+01**	**8.72E-02**	**4.23E-04**	**1.21E-03**	**4.33E-03**	**7.99E-02**	**3.02E-01**	**1.22E+00**

									Specific Analyte Inventories at Closure (Kg)											
Tank	**60Co**	**63Ni**	**79Se**	**90Sr**	**90Y**	**93mNb**	**93Zr**	**99Tc**	**Al**	**Bi**	**Ca**	**Cl**	**Cr**	**F**	**Fe**	**Hg**	**K**	**La**	**Mn**	**Na**
241-C-101	7.03E-05	9.73E-03	8.19E-06	1.11E+03	1.11E+03	3.36E-04	3.86E-04	2.70E-03	2.53E+02	2.42E+00	1.44E+01	2.08E+00	1.16E+00	1.84E+00	6.21E+01	1.59E-01	2.21E+00	7.70E-01	1.77E+00	2.21E+02
241-C-102	3.21E-01	9.89E-03	1.10E-05	1.39E+03	1.39E+03	3.85E-04	4.66E-04	3.10E-03	1.94E+02	6.16E+00	1.60E+01	4.32E+00	1.72E+00	9.61E+00	4.73E+01	2.88E-02	3.35E+00	4.65E-01	3.82E+00	2.49E+02
241-C-103	1.32E+00	5.73E+00	2.77E-03	5.52E+03	5.52E+03	1.09E-01	1.17E-01	4.28E-02	2.50E+02	6.67E-01	4.77E+00	8.38E-01	1.25E+00	1.32E+00	2.04E+01	2.57E-01	8.38E-01	2.64E-01	6.10E-01	3.32E+01
241-C-104	3.71E-01	5.85E-01	8.74E-03	6.61E+02	6.61E+02	1.35E-02	1.59E-02	7.91E-02	1.23E+02	6.56E-02	4.07E+00	1.09E+00	1.99E+00	4.72E+01	3.77E+01	9.19E-02	1.82E+00	6.65E-02	9.57E+00	2.43E+02
241-C-105	1.32E-01	4.87E-03	4.04E-06	7.29E+02	7.29E+02	1.63E-04	1.90E-04	1.25E-01	2.64E+02	5.70E-01	3.03E+00	5.73E-01	6.33E-01	1.33E+00	4.32E+00	2.13E-02	1.32E+00	5.59E-01	2.91E+00	5.06E+01
241-C-106	8.91E-02	3.85E+01	1.83E-02	1.79E+04	1.79E+04	8.06E-01	9.10E-01	1.99E-01	1.31E+02	4.94E-02	5.22E+00	2.04E+00	3.91E+00	1.06E+00	1.93E+02	2.82E-01	6.85E+00	7.80E-01	4.81E+01	7.58E+02
241-C-107	4.94E-01	4.92E+01	2.93E-02	4.56E+03	4.56E+03	1.14E+00	1.27E+00	6.81E-02	1.03E+02	4.27E+01	2.61E+00	1.88E+00	2.15E+00	1.91E+01	9.01E+01	0.00E+00	1.11E+00	2.13E-01	3.29E+00	2.45E+02
241-C-108	9.24E-05	9.44E-01	2.15E-05	8.56E+01	8.56E+01	9.13E-04	1.02E-03	6.28E-02	1.92E+02	4.48E+01	4.66E+01	2.67E+00	2.36E+00	1.56E+01	2.63E+01	2.09E-01	1.39E+00	4.48E-02	5.78E-01	3.46E+02
241-C-109	1.52E-04	3.95E+00	4.23E-05	1.99E+03	1.99E+03	2.20E-03	2.48E-03	2.56E-01	1.85E+02	9.04E+00	4.48E+01	2.20E+00	9.37E-01	5.12E+00	5.17E+01	1.71E-02	1.39E+00	2.00E-02	5.71E-01	2.76E+02
241-C-110	5.62E-05	1.56E-02	1.54E-05	2.84E+01	2.84E+01	5.75E-04	6.45E-04	2.43E-01	9.99E+01	1.13E+02	8.01E+00	7.56E+00	3.20E+00	5.15E+01	7.50E+01	3.04E-03	3.90E+00	9.81E-03	3.63E-01	5.74E+02
241-C-111	1.32E-04	3.23E+00	4.45E-05	6.50E+03	6.50E+03	1.81E-03	2.04E-03	1.97E-02	2.09E+02	1.23E+01	2.92E+01	1.98E+00	6.22E-01	6.31E+00	9.73E+01	0.00E+00	2.11E+00	7.65E-01	5.85E-01	9.29E+01
241-C-112	2.90E-02	5.07E+00	3.72E-03	4.34E+03	4.34E+03	1.94E-03	2.19E-03	4.08E-01	8.25E+01	1.36E+01	7.81E+01	3.55E+00	9.29E-01	2.85E+00	9.14E+01	1.85E-02	2.00E+00	3.01E-01	8.21E-01	3.35E+02
241-C-201	1.89E-05	1.57E+00	1.97E-05	9.27E+00	9.27E+00	7.74E-04	8.71E-04	3.17E-04	6.15E-01	0.00E+00	2.78E+00	7.83E-02	5.14E-02	2.81E-01	2.38E+01	0.00E+00	1.54E-01	2.69E-01	3.84E-03	1.04E+01
241-C-202	1.95E-05	1.62E+00	2.04E-05	9.58E+00	9.58E+00	7.98E-04	8.98E-04	3.27E-04	6.35E-01	0.00E+00	2.89E+00	2.20E-01	5.31E-02	5.11E-01	2.47E+01	0.00E+00	1.59E-01	2.78E-01	3.98E-03	1.07E+01
241-C-203	1.94E-05	1.62E+00	2.02E-05	9.52E+00	9.52E+00	7.95E-04	8.94E-04	3.26E-04	6.31E-01	0.00E+00	2.87E+00	1.49E-01	5.28E-02	3.98E-01	2.45E+01	0.00E+00	1.57E-01	2.76E-01	3.94E-03	1.06E+01
241-C-204	1.93E-05	1.61E+00	2.02E-05	9.50E+00	9.50E+00	7.91E-04	8.90E-04	3.23E-04	6.31E-01	0.00E+00	2.86E+00	1.49E-01	5.27E-02	3.97E-01	2.45E+01	0.00E+00	1.58E-01	2.75E-01	3.93E-03	1.06E+01
All Tanks	**2.75E+00**	**1.14E+02**	**6.30E-02**	**4.49E+04**	**4.49E+04**	**2.08E+00**	**2.32E+00**	**1.51E+00**	**2.09E+03**	**2.45E+02**	**2.68E+02**	**3.14E+01**	**2.11E+01**	**1.64E+02**	**8.95E+02**	**1.09E+00**	**2.89E+01**	**5.36E+00**	**7.30E+01**	**3.47E+03**

Tank	Ni	NO2	NO3	Pb	PO4	Si	SO4	Sr	TIC as CO3	TOC	UTOTAL	Zr
241-C-101	3.30E+00	3.55E+01	2.38E+02	3.01E+00	1.30E+02	3.10E+01	2.47E+01	1.05E+00	4.49E+01	4.60E+00	0.00E+00	7.70E-01
241-C-102	1.58E+01	3.98E+01	1.71E+02	2.61E+00	3.31E+01	8.60E+01	1.35E+01	3.60E-01	1.78E+02	3.68E+00	0.00E+00	1.21E+01
241-C-103	5.59E+00	2.03E+01	1.98E+00	8.16E-01	4.03E+00	4.54E+01	3.34E+00	4.07E-02	3.33E+01	1.05E+01	0.00E+00	1.48E+01
241-C-104	3.60E+00	4.99E+01	2.67E+01	1.14E+00	4.38E+00	1.40E+01	4.67E+00	1.15E-01	6.61E+01	1.93E+01	1.67E-01	8.86E+01
241-C-105	2.54E+00	1.29E+01	1.25E+01	5.50E-01	9.21E+00	4.73E+01	5.42E+00	2.13E-01	2.54E+01	7.25E+00	0.00E+00	2.76E-01
241-C-106	6.76E+00	9.70E+01	4.87E+00	1.02E+01	5.95E+01	4.30E+00	3.05E+01	2.82E-01	8.39E+02	3.33E+01	0.00E+00	1.68E-01
241-C-107	2.83E+00	7.67E+01	1.16E+02	4.38E+00	7.98E+01	2.54E+01	1.74E+01	3.70E-01	2.57E+01	1.28E+00	7.65E-03	3.25E+00
241-C-108	3.09E+01	8.86E+01	1.60E+02	3.16E+00	3.02E+02	2.07E+01	2.46E+01	1.51E+00	3.85E+01	3.48E+00	0.00E+00	3.16E-01
241-C-109	3.61E+01	9.68E+01	1.43E+02	6.55E+00	1.99E+02	1.70E+01	2.33E+01	9.68E-01	7.33E+01	6.02E+00	0.00E+00	8.11E-02
241-C-110	1.65E-01	4.98E+01	7.47E+02	1.68E+00	4.32E+02	4.83E+01	8.48E+01	8.54E-01	7.18E+01	3.98E+00	3.25E-05	1.14E+00
241-C-111	3.58E+01	6.93E+01	1.26E+02	1.02E+01	1.32E+02	1.69E+01	1.09E+01	3.72E-01	4.94E+01	1.79E+00	0.00E+00	3.88E-01
241-C-112	5.21E+01	1.86E+02	2.48E+02	9.85E+00	2.61E+02	1.03E+01	4.69E+01	1.26E+00	9.76E+01	1.61E+01	0.00E+00	6.45E-02
241-C-201	3.08E+00	9.38E-01	5.10E+00	2.18E+01	2.24E-01	1.47E+00	2.56E-01	6.26E-01	1.46E+01	5.61E+00	2.54E-05	0.00E+00
241-C-202	3.18E+00	4.75E+00	1.42E+01	2.24E+01	2.44E-01	1.52E+00	6.71E-01	6.47E-01	1.48E+01	4.78E+00	7.66E-05	0.00E+00
241-C-203	3.16E+00	2.83E+00	9.69E+00	2.23E+01	2.36E-01	1.51E+00	4.65E-01	6.43E-01	1.50E+01	5.25E+00	0.00E+00	0.00E+00
241-C-204	3.14E+00	2.82E+00	9.67E+00	2.23E+01	2.36E-01	1.51E+00	4.63E-01	6.41E-01	1.52E+01	5.23E+00	0.00E+00	0.00E+00
All Tanks	**2.08E+02**	**8.34E+02**	**2.03E+03**	**1.43E+02**	**1.65E+03**	**3.73E+02**	**2.92E+02**	**9.96E+00**	**1.60E+03**	**1.32E+02**	**1.75E-01**	**1.22E+02**

2002 Summary of Residual Inventory Estimates at Closure (Radionuclides Decayed to 1/1/2020).

	HFFACO Estimate at Closure Based on HTWOS Modeling		Specific Analyte Inventories at Closure (Ci) Based on HTWOS Modeling (radionuclides decayed to 1/1/2020)																
Tank	**Total Ci**	**Total kg**	**106Ru**	**113mCd**	**125Sb**	**126Sn**	**129I**	**134Cs**	**137Cs**	**137mBa**	**14C**	**151Sm**	**152Eu**	**154Eu**	**155Eu**	**226Ra**	**227Ac**	**228Ra**	**229Th**
241-C-101	1.58E+03	1.08E+03	3.91E-17	3.45E-04	4.88E-07	5.02E-05	5.17E-06	1.34E-09	9.08E+01	8.11E+01	3.87E-04	2.44E-01	1.89E-04	4.76E-04	1.07E-03	1.30E-08	4.63E-08	8.56E-14	3.18E-10
241-C-102	1.86E+03	1.09E+03	3.63E-14	5.43E-04	4.36E-06	6.17E-05	6.44E-06	4.25E-08	4.51E+01	4.02E+01	6.62E-04	2.67E-01	6.84E-04	1.67E-02	3.83E-03	1.74E-06	2.57E-02	6.26E-04	3.79E-04
241-C-103	7.28E+03	4.55E+02	1.42E-13	2.29E-02	3.24E-05	1.81E-02	8.29E-05	1.49E-07	9.73E+01	8.69E+01	6.06E-03	8.73E+01	1.08E-02	2.17E+00	3.76E-01	3.91E-06	1.21E-05	2.50E-08	2.11E-07
241-C-104	1.03E+03	7.49E+02	6.09E-13	1.04E-02	2.04E-03	2.34E-03	1.03E-03	1.04E-07	8.41E+01	7.51E+01	2.53E-03	1.11E+01	1.25E-03	3.23E-01	6.87E-02	8.50E-06	8.12E-02	3.13E-03	1.28E-03
241-C-105	1.08E+03	4.53E+02	2.81E-17	1.89E-04	3.24E-07	2.49E-05	1.43E-04	9.29E-10	8.09E+01	7.22E+01	7.75E-04	1.19E-01	8.23E-05	3.00E-04	4.10E-04	4.28E-09	1.58E-08	2.20E-14	7.82E-11
241-C-106	2.47E+04	2.24E+03	2.66E-12	4.39E-01	1.51E-03	1.36E-01	1.08E-03	7.61E-06	7.18E+02	6.42E+02	3.63E-03	6.53E+02	7.87E-02	3.66E+00	7.49E-01	2.58E-05	7.99E-05	2.03E-07	1.53E-06
241-C-107	6.84E+03	8.64E+02	4.56E-11	7.63E-01	1.03E-04	1.88E-01	7.95E-05	1.36E-06	5.58E+01	4.99E+01	6.30E-03	9.00E+02	7.25E-02	6.88E-01	1.30E-01	3.51E-05	9.92E-05	5.47E-07	4.79E-06
241-C-108	1.12E+03	1.35E+03	1.91E-18	7.04E-04	3.13E-07	1.30E-04	1.34E-05	1.14E-08	5.34E+02	4.77E+02	1.33E-03	6.58E-01	5.02E-04	1.27E-03	1.80E-03	5.90E-08	2.05E-07	3.73E-13	1.40E-09
241-C-109	4.18E+03	1.18E+03	1.17E-14	1.81E-03	9.75E-07	3.39E-04	1.58E-05	1.87E-08	8.74E+02	7.80E+02	1.29E-04	1.66E+00	5.98E-03	2.30E-03	9.38E-03	2.31E-06	5.05E-06	1.07E-12	3.99E-09
241-C-110	1.72E+02	2.38E+03	1.11E-18	4.37E-04	1.86E-07	8.13E-05	8.43E-06	8.33E-10	7.09E+01	6.32E+01	2.53E-03	4.14E-01	4.70E-05	2.36E-03	5.15E-04	3.87E-08	1.34E-07	4.64E-14	1.45E-10
241-C-111	8.41E+03	9.07E+02	8.42E-15	1.48E-03	7.73E-07	2.77E-04	1.47E-05	1.80E-08	9.24E+01	8.25E+01	1.18E-03	1.36E+00	4.43E-03	1.84E-03	2.62E-02	1.67E-06	3.69E-06	8.83E-13	3.30E-09
241-C-112	7.82E+03	1.54E+03	1.57E-17	1.53E-03	2.19E-05	2.77E-04	2.85E-05	3.01E-06	1.23E+03	1.10E+03	2.41E-02	1.40E+00	1.30E-03	3.19E-01	6.40E-02	1.21E-07	4.25E-07	9.35E-13	3.55E-09
241-C-201	1.88E+01	9.21E+01	7.55E-15	6.35E-04	2.67E-07	1.26E-04	6.15E-07	2.85E-11	1.14E+00	1.02E+00	4.50E-05	6.05E-01	3.44E-03	9.26E-04	1.99E-02	1.45E-06	3.14E-06	4.06E-13	1.49E-09
241-C-202	1.80E+01	1.07E+02	7.80E-15	6.55E-04	2.76E-07	1.30E-04	6.33E-07	2.94E-11	1.18E+00	1.05E+00	4.63E-05	6.24E-01	3.55E-03	9.55E-04	2.06E-02	1.50E-06	3.23E-06	4.18E-13	1.53E-09
241-C-203	1.67E+01	1.01E+02	7.75E-15	6.54E-04	2.74E-07	1.29E-04	6.31E-07	2.93E-11	1.17E+00	1.04E+00	4.61E-05	6.21E-01	3.53E-03	9.49E-04	2.05E-02	1.49E-06	3.22E-06	4.16E-13	1.52E-09
241-C-204	1.63E+01	1.01E+02	7.73E-15	6.49E-04	2.73E-07	1.29E-04	6.29E-07	2.91E-11	1.16E+00	1.04E+00	4.60E-05	6.19E-01	3.51E-03	9.46E-04	2.03E-02	1.48E-06	3.20E-06	4.14E-13	1.52E-09
All Tanks	6.62E+04	1.47E+04	4.91E-11	1.25E+00	3.72E-03	3.46E-01	2.51E-03	1.23E-05	3.98E+03	3.55E+03	4.98E-02	1.66E+03	1.91E-01	7.19E+00	1.51E+00	8.51E-05	1.07E-01	3.76E-03	1.67E-03
	Decay Factors		0.0000	0.3930	0.0084	0.9999	1.0000	0.0017	0.6454	0.6092	0.9977	0.8639	0.3781	0.2160	0.0625	0.9918	0.5462	0.1017	0.9982

Tank	231Pa	232Th	232U	233U	234U	235U	236U	237Np	238Pu	238U	239Pu	240Pu	241Am	241Pu	242Cm	242Pu	243Am	243Cm	244Cm	3H
241-C-101	1.54E-07	9.72E-14	3.82E-07	1.79E-08	1.22E-02	5.28E-04	1.73E-04	1.72E-05	3.48E-02	1.24E-02	2.07E+00	3.46E-01	3.12E-02	9.46E-01	1.27E-05	1.03E-05	7.19E-09	1.80E-07	9.97E-08	6.31E-04
241-C-102	6.94E-02	7.60E-05	4.42E-04	2.25E-03	6.38E-03	2.75E-04	1.04E-04	2.20E-05	1.85E-01	6.37E-03	7.92E+00	1.45E+00	2.63E+00	5.03E+00	4.60E-03	6.67E-05	8.54E-06	1.01E-04	7.53E-04	8.40E-04
241-C-103	2.82E-05	4.93E-08	2.24E-05	1.12E-04	2.77E-03	1.18E-04	4.90E-05	1.36E-04	1.04E-01	2.84E-03	7.70E+00	1.19E+00	5.57E+00	2.65E+00	6.55E-03	3.71E-05	1.32E-04	2.56E-04	1.21E-03	4.76E-04
241-C-104	3.27E-01	7.62E-03	2.19E-02	5.64E-01	2.84E-02	8.23E-04	9.34E-04	6.00E-03	2.67E-01	1.60E-02	7.47E+00	1.47E+00	8.41E+00	8.08E+00	6.69E-03	1.29E-04	4.26E-04	3.74E-04	9.91E-03	2.63E-02
241-C-105	5.43E-08	4.45E-14	2.00E-07	8.67E-09	4.92E-03	2.09E-04	8.51E-05	8.59E-06	4.02E-02	5.04E-03	3.15E+00	4.81E-01	1.77E+00	1.03E+00	5.32E-04	1.37E-05	4.98E-07	7.67E-06	8.88E-06	3.08E-04
241-C-106	2.14E-04	1.61E-04	2.78E-05	1.38E-04	2.73E-03	1.16E-04	4.86E-05	1.66E-02	1.91E-01	2.79E-03	4.79E+00	9.80E-01	1.38E+01	4.70E+00	2.06E-02	1.05E-04	1.39E-04	1.13E-03	1.85E-02	3.36E-02
241-C-107	3.22E-04	4.94E-07	7.05E-06	3.32E-05	3.49E-03	1.44E-04	1.56E-04	1.34E-04	5.80E-02	3.08E-03	2.55E+00	4.02E-01	7.27E+00	1.39E+00	7.41E-03	2.84E-05	3.75E-04	3.18E-04	7.97E-03	1.68E-02
241-C-108	6.59E-07	2.92E-13	4.71E-09	3.63E-10	5.10E-04	2.30E-05	3.27E-06	4.39E-05	1.03E-04	5.17E-04	3.23E-02	2.09E-03	6.48E-02	8.05E-04	1.27E-03	1.10E-08	4.60E-07	1.58E-05	4.02E-06	1.35E-03
241-C-109	9.71E-07	3.32E-13	3.70E-07	2.00E-08	1.14E-02	4.55E-04	1.65E-04	7.75E-04	1.06E-02	1.07E-02	4.80E-01	8.15E-02	3.58E-01	1.93E-01	5.85E-04	7.17E-06	8.64E-06	1.79E-05	6.70E-06	3.66E-03
241-C-110	4.31E-07	1.86E-13	4.56E-08	3.52E-09	4.96E-03	2.24E-04	3.17E-05	2.75E-05	1.35E-03	5.03E-03	5.17E-01	3.04E-02	2.90E-01	5.56E-03	3.13E-04	5.96E-08	8.83E-07	2.83E-06	5.01E-06	1.77E-03
241-C-111	8.65E-07	3.13E-13	2.85E-07	1.35E-08	1.02E-02	4.46E-04	1.35E-04	4.72E-05	8.68E-03	1.04E-02	9.54E-01	1.05E-01	1.51E+00	1.80E-01	2.05E-02	2.89E-06	1.42E-05	2.75E-04	1.88E-04	1.41E-03
241-C-112	1.36E-06	6.17E-13	7.98E-04	4.00E-03	5.33E-02	2.34E-03	6.60E-04	5.02E-03	4.62E-02	5.39E-02	5.47E-01	8.68E-02	3.07E+00	2.16E-01	9.22E-03	2.74E-06	8.02E-05	2.13E-04	6.90E-05	1.66E-02
241-C-201	1.94E-07	1.07E-14	7.71E-11	5.97E-12	8.42E-06	3.79E-07	5.36E-08	9.61E-07	2.80E-02	8.53E-06	1.45E+00	2.40E-01	4.94E-01	7.12E-01	6.97E-04	1.23E-05	1.18E-05	2.33E-05	7.81E-06	7.55E-06
241-C-202	2.00E-07	1.11E-14	4.78E-10	1.62E-11	8.86E-06	3.73E-07	2.06E-07	9.91E-07	1.46E-02	8.80E-06	7.53E-01	1.24E-01	2.56E-01	3.69E-01	3.60E-04	6.33E-06	6.10E-06	1.20E-05	4.04E-06	7.78E-06
241-C-203	2.00E-07	1.10E-14	7.92E-11	6.13E-12	8.64E-06	3.88E-07	5.51E-08	9.86E-07	3.79E-03	8.74E-06	1.96E-01	3.22E-02	6.67E-02	9.59E-02	9.40E-05	1.65E-06	1.58E-06	3.13E-06	1.05E-06	7.74E-06
241-C-204	1.98E-07	1.10E-14	7.92E-11	6.11E-12	8.61E-06	3.88E-07	5.50E-08	9.81E-07	1.19E-04	8.74E-06	6.20E-03	1.01E-03	2.10E-03	3.03E-03	2.95E-06	5.22E-08	4.99E-08	9.89E-08	3.31E-08	7.73E-06
All Tanks	3.97E-01	7.85E-03	2.32E-02	5.71E-01	1.41E-01	5.70E-03	2.55E-03	2.89E-02	9.94E-01	1.29E-01	4.06E+01	7.01E+00	4.56E+01	2.56E+01	7.94E-02	4.23E-04	1.20E-03	2.75E-03	3.86E-02	1.04E-01
	0.9996	1.0000	0.8281	0.9999	0.9999	1.0000	1.0000	1.0000	0.8606	1.0000	0.9995	0.9980	0.9700	0.4007	0.9108	1.0000	0.9982	0.6360	0.4831	0.3434

										Specific Analyte Inventories at Closure (Kg)										
Tank	**59Ni**	**60Co**	**63Ni**	**79Se**	**90Sr**	**90Y**	**93mNb**	**93Zr**	**99Tc**	**Al**	**Bi**	**Ca**	**Cl**	**Cr**	**F**	**Fe**	**Hg**	**K**	**La**	**Mn**
241-C-101	1.10E-04	5.78E-06	8.54E-03	8.19E-06	7.00E+02	7.00E+02	1.48E-04	3.86E-04	2.70E-03	2.53E+02	2.42E+00	1.44E+01	2.08E+00	1.16E+00	1.84E+00	6.21E+01	1.59E-01	2.21E+00	7.70E-01	1.77E+00
241-C-102	1.06E-04	2.64E-02	8.68E-03	1.10E-05	8.81E+02	8.81E+02	1.70E-04	4.66E-04	3.10E-03	1.94E+02	6.16E+00	1.60E+01	4.32E+00	1.72E+00	9.61E+00	4.73E+01	2.88E-02	3.35E+00	4.65E-01	3.82E+00
241-C-103	6.15E-02	1.08E-01	5.03E+00	2.77E-03	3.49E+03	3.49E+03	4.80E-02	1.17E-01	4.28E-02	2.50E+02	6.67E-01	4.77E+00	8.38E-01	1.25E+00	1.32E+00	2.04E+01	2.57E-01	8.38E-01	2.64E-01	6.10E-01
241-C-104	6.25E-03	3.05E-02	5.14E-01	8.74E-03	4.18E+02	4.18E+02	5.97E-03	1.59E-02	7.91E-02	1.23E+02	6.56E-02	4.07E+00	1.09E+00	1.99E+00	4.72E+01	3.77E+01	9.19E-02	1.82E+00	6.65E-02	9.57E+00
241-C-105	5.40E-05	1.09E-02	4.28E-03	4.04E-06	4.61E+02	4.61E+02	7.20E-05	1.90E-04	1.25E-01	2.64E+02	5.70E-01	3.03E+00	5.73E-01	6.33E-01	1.33E+00	4.32E+00	2.13E-02	1.32E+00	5.59E-01	2.91E+00
241-C-106	4.14E-01	7.33E-03	3.38E+01	1.82E-02	1.13E+04	1.13E+04	3.56E-01	9.10E-01	1.99E-01	1.31E+02	4.94E-02	5.22E+00	2.04E+00	3.91E+00	1.06E+00	1.93E+02	2.82E-01	6.85E+00	7.80E-01	4.81E+01
241-C-107	5.27E-01	4.06E-02	4.31E+01	2.93E-02	2.89E+03	2.89E+03	5.04E-01	1.27E+00	6.81E-02	1.03E+02	4.27E+01	2.61E+00	1.88E+00	2.15E+00	1.91E+01	9.01E+01	0.00E+00	1.11E+00	2.13E-01	3.29E+00
241-C-108	1.11E-02	7.60E-06	8.29E-01	2.15E-05	5.42E+01	5.42E+01	4.03E-04	1.02E-03	6.28E-02	1.92E+02	4.48E+01	4.66E+01	2.67E+00	2.36E+00	1.56E+01	2.63E+01	2.09E-01	1.39E+00	4.48E-02	5.78E-01
241-C-109	4.39E-02	1.25E-05	3.47E+00	4.23E-05	1.26E+03	1.26E+03	9.73E-04	2.48E-03	2.56E-01	1.85E+02	9.04E+00	4.48E+01	2.20E+00	9.37E-01	5.12E+00	5.17E+01	1.71E-02	1.39E+00	2.00E-02	5.71E-01
241-C-110	1.82E-04	4.63E-06	1.37E-02	1.54E-05	1.80E+01	1.80E+01	2.54E-04	6.45E-04	2.43E-01	9.99E+01	1.13E+02	8.01E+00	7.56E+00	3.20E+00	5.15E+01	7.50E+01	3.04E-03	3.90E+00	9.81E-03	3.63E-01
241-C-111	3.61E-02	1.09E-05	2.83E+00	4.45E-05	4.12E+03	4.12E+03	8.00E-04	2.04E-03	1.97E-02	2.09E+02	1.23E+01	2.92E+01	1.98E+00	6.22E-01	6.31E+00	9.73E+01	0.00E+00	2.11E+00	7.65E-01	5.85E-01
241-C-112	5.59E-02	2.38E-03	4.45E+00	3.72E-03	2.75E+03	2.75E+03	8.56E-04	2.19E-03	4.08E-01	8.25E+01	1.36E+01	7.81E+01	3.55E+00	9.29E-01	2.85E+00	9.14E+01	1.85E-02	2.00E+00	3.01E-01	8.21E-01
241-C-201	1.69E-02	1.55E-06	1.38E+00	1.97E-05	5.87E+00	5.87E+00	3.42E-04	8.71E-04	3.16E-04	6.15E-01	0.00E+00	2.78E+00	7.83E-02	5.14E-02	2.81E-01	2.38E+01	0.00E+00	1.54E-01	2.69E-01	3.84E-03
241-C-202	1.74E-02	1.60E-06	1.42E+00	2.04E-05	6.06E+00	6.06E+00	3.52E-04	8.98E-04	3.27E-04	6.35E-01	0.00E+00	2.89E+00	2.20E-01	5.31E-02	5.11E-01	2.47E+01	0.00E+00	1.59E-01	2.78E-01	3.98E-03
241-C-203	1.73E-02	1.60E-06	1.42E+00	2.02E-05	6.02E+00	6.02E+00	3.51E-04	8.94E-04	3.26E-04	6.31E-01	0.00E+00	2.87E+00	1.49E-01	5.28E-02	3.98E-01	2.45E+01	0.00E+00	1.57E-01	2.76E-01	3.94E-03
241-C-204	1.73E-02	1.59E-06	1.41E+00	2.02E-05	6.01E+00	6.01E+00	3.49E-04	8.90E-04	3.23E-04	6.31E-01	0.00E+00	2.86E+00	1.49E-01	5.27E-02	3.97E-01	2.45E+01	0.00E+00	1.58E-01	2.75E-01	3.93E-03
All Tanks	1.22E+00	2.26E-01	9.98E+01	6.30E-02	2.84E+04	2.84E+04	9.19E-01	2.32E+00	1.51E+00	2.09E+03	2.45E+02	2.68E+02	3.14E+01	2.11E+01	1.64E+02	8.95E+02	1.09E+00	2.89E+01	5.36E+00	7.30E+01
	0.9998	0.0822	0.8778	1.0000	0.6328	0.6328	0.4414	1.0000	0.9999											

Tank	Na	Ni	NO2	NO3	Pb	PO4	Si	SO4	Sr	TIC as CO3	TOC	UTOTAL	Zr
241-C-101	2.21E+02	3.30E+00	3.55E+01	2.38E+02	3.01E+00	1.30E+02	3.10E+01	2.47E+01	1.05E+00	4.49E+01	4.60E+00	0.00E+00	7.70E-01
241-C-102	2.49E+02	1.58E+01	3.98E+01	1.71E+02	2.61E+00	3.31E+01	8.60E+01	1.35E+01	3.60E-01	1.78E+02	3.68E+00	0.00E+00	1.21E+01
241-C-103	3.32E+01	5.59E+00	2.03E+01	1.98E+00	8.16E-01	4.03E+00	4.54E+01	3.34E+00	4.07E-02	3.33E+01	1.05E+01	0.00E+00	1.48E+01
241-C-104	2.43E+02	3.60E+00	4.99E+01	2.67E+01	1.14E+00	4.38E+00	1.40E+01	4.67E+00	1.15E-01	6.61E+01	1.93E+01	1.67E-01	8.86E+01
241-C-105	5.06E+01	2.54E+00	1.29E+01	1.25E+01	5.50E-01	9.21E+00	4.73E+01	5.42E+00	2.13E-01	2.54E+01	7.25E+00	0.00E+00	2.76E-01
241-C-106	7.58E+02	6.76E+00	9.70E+01	4.87E+00	1.02E+01	5.95E+01	4.30E+00	3.05E+01	2.82E-01	8.39E+02	3.33E+01	0.00E+00	1.68E-01
241-C-107	2.45E+02	2.83E+00	7.67E+01	1.16E+02	4.38E+00	7.98E+01	2.54E+01	1.74E+01	3.70E-01	2.57E+01	1.28E+00	7.65E-03	3.25E+00
241-C-108	3.46E+02	3.09E+01	8.86E+01	1.60E+02	3.16E+00	3.02E+02	2.07E+01	2.46E+01	1.51E+00	3.85E+01	3.48E+00	0.00E+00	3.16E-01
241-C-109	2.76E+02	3.61E+01	9.68E+01	1.43E+02	6.55E+00	1.99E+02	1.70E+01	2.33E+01	9.68E-01	7.33E+01	6.02E+00	0.00E+00	8.11E-02
241-C-110	5.74E+02	1.65E-01	4.98E+01	7.47E+02	1.68E+00	4.32E+02	4.83E+01	8.48E+01	8.54E-01	7.18E+01	3.98E+00	3.25E-05	1.14E+00
241-C-111	9.29E+01	3.58E+01	6.93E+01	1.26E+02	1.02E+01	1.32E+02	1.69E+01	1.09E+01	3.72E-01	4.94E+01	1.79E+00	0.00E+00	3.88E-01
241-C-112	3.35E+02	5.21E+01	1.86E+02	2.48E+02	9.85E+00	2.61E+02	1.03E+01	4.69E+01	1.26E+00	9.76E+01	1.61E+01	0.00E+00	6.45E-02
241-C-201	1.04E+01	3.08E+00	9.38E-01	5.10E+00	2.18E+01	2.24E-01	1.47E+00	2.56E-01	6.26E-01	1.46E+01	5.61E+00	2.54E-05	0.00E+00
241-C-202	1.07E+01	3.18E+00	4.75E+00	1.42E+01	2.24E+01	2.44E-01	1.52E+00	6.71E-01	6.47E-01	1.48E+01	4.78E+00	7.66E-05	0.00E+00
241-C-203	1.06E+01	3.16E+00	2.83E+00	9.69E+00	2.23E+01	2.36E-01	1.51E+00	4.65E-01	6.43E-01	1.50E+01	5.25E+00	0.00E+00	0.00E+00
241-C-204	1.06E+01	3.14E+00	2.82E+00	9.67E+00	2.23E+01	2.36E-01	1.51E+00	4.63E-01	6.41E-01	1.52E+01	5.23E+00	0.00E+00	0.00E+00
All Tanks	3.47E+03	2.08E+02	8.34E+02	2.03E+03	1.43E+02	1.65E+03	3.73E+02	2.92E+02	9.96E+00	1.60E+03	1.32E+02	1.75E-01	1.22E+02

2002 SUMMARY OF FINAL INVENTORY ESTIMATES

Based on 1% of original inventory (assumes 99% retrieval)

Tank	2002 Tank Volume Based on BBI (kL)	2002 Tank Radionuc Inventory Based on BBI (Ci)	2002 Tank Chemical Inventory Based on BBI (kg)	Estimate at Closure 1% of Starting BBI Inventory			Specific Analyte Inventories at Closure (Ci) 1% of starting BBI inventory, radionuclides decayed to 1/1/2020													
				Total kL	Total Ci	Total kg	106Ru	113mCd	125Sb	126Sn	129I	134Cs	137Cs	137mBa	14C	151Sm	152Eu	154Eu	155Eu	226Ra
241-C-101	3.33E+02	4.07E+05	2.88E+05	3.33E+00	4.07E+03	2.88E+03	1.01E-16	8.92E-04	1.26E-06	1.30E-04	1.34E-05	3.45E-09	2.35E+02	2.10E+02	9.98E-04	6.30E-01	4.88E-04	1.23E-03	2.76E-03	3.35E-08
241-C-102	1.20E+03	7.96E+05	4.74E+05	1.20E+01	7.96E+03	4.74E+03	1.55E-13	2.32E-03	1.87E-05	2.63E-04	2.74E-05	1.82E-07	1.92E+02	1.72E+02	2.82E-03	1.14E+00	2.92E-03	7.13E-02	1.63E-02	7.41E-06
241-C-103	7.64E+02	4.00E+06	2.89E+05	7.64E+00	4.00E+04	2.89E+03	1.03E-12	1.66E-01	8.19E-04	1.15E-01	6.62E-04	3.50E-06	6.20E+02	5.54E+02	4.88E-02	5.53E+02	7.03E-02	1.19E+01	2.06E+00	2.45E-05
241-C-104	9.80E+02	7.58E+05	5.83E+05	9.80E+00	7.58E+03	5.83E+03	4.48E-12	7.59E-02	1.49E-02	1.72E-02	7.54E-03	7.65E-07	6.16E+02	5.50E+02	1.85E-02	8.12E+01	9.19E-03	2.38E+00	5.03E-01	6.22E-05
241-C-105	5.00E+02	7.07E+05	3.05E+05	5.00E+00	7.07E+03	3.05E+03	1.83E-16	1.23E-03	2.12E-06	1.63E-04	9.30E-04	6.05E-09	5.28E+02	4.72E+02	5.06E-03	7.77E-01	5.37E-04	1.96E-03	2.68E-03	2.80E-08
241-C-106	1.38E+02	3.90E+05	3.54E+04	1.38E+00	3.90E+03	3.54E+02	4.18E-13	6.96E-02	2.39E-04	2.14E-02	1.70E-04	1.20E-06	1.13E+02	1.01E+02	5.72E-04	1.03E+02	1.24E-02	5.77E-01	1.18E-01	4.07E-06
241-C-107	9.40E+02	3.50E+06	4.70E+05	9.40E+00	3.50E+04	4.70E+03	2.79E-10	4.68E+00	6.26E-04	6.37E-01	4.83E-04	8.33E-06	4.10E+02	3.66E+02	3.79E-02	5.49E+03	4.42E-01	3.46E+00	6.50E-01	2.14E-04
241-C-108	2.50E+02	1.10E+05	1.33E+05	2.50E+00	1.10E+03	1.33E+03	1.88E-18	6.92E-04	3.08E-07	1.28E-04	1.32E-05	1.12E-08	5.26E+02	4.70E+02	1.31E-03	6.49E-01	4.95E-04	1.25E-03	1.78E-03	5.81E-08
241-C-109	2.40E+02	5.28E+05	1.53E+05	2.40E+00	5.28E+03	1.53E+03	1.48E-14	2.28E-03	1.23E-06	4.29E-04	2.00E-05	2.36E-08	1.10E+03	9.87E+02	1.63E-04	2.10E+00	7.52E-03	2.89E-03	1.19E-02	2.92E-06
241-C-110	6.74E+02	2.25E+04	3.14E+05	6.74E+00	2.25E+02	3.14E+03	1.45E-18	5.74E-04	2.45E-07	1.07E-04	1.10E-05	1.09E-09	9.29E+01	8.35E+01	3.32E-03	5.43E-01	6.16E-05	3.09E-03	6.75E-04	5.09E-08
241-C-111	2.17E+02	1.15E+06	1.28E+05	2.17E+00	1.15E+04	1.28E+03	1.15E-14	2.02E-03	1.06E-06	3.79E-04	2.01E-05	2.47E-08	1.26E+02	1.13E+02	1.62E-03	1.87E+00	6.09E-03	2.53E-03	3.58E-02	2.29E-06
241-C-112	3.93E+02	1.17E+06	2.55E+05	3.93E+00	1.17E+04	2.55E+03	2.35E-17	2.28E-03	3.28E-05	4.15E-04	4.26E-05	4.51E-06	1.84E+03	1.64E+03	3.60E-02	2.09E+00	1.94E-03	4.77E-01	9.57E-02	1.81E-07
241-C-201	4.00E+00	8.40E+02	4.11E+03	4.00E-02	8.40E+00	4.11E+01	3.36E-15	2.83E-04	1.19E-07	5.61E-05	2.74E-07	1.27E-11	5.08E-01	4.54E-01	2.01E-05	2.70E-01	1.53E-03	4.13E-04	8.88E-03	6.47E-07
241-C-202	4.00E+00	8.08E+02	4.83E+03	4.00E-02	8.08E+00	4.83E+01	3.51E-15	2.95E-04	1.24E-07	5.85E-05	2.85E-07	1.32E-11	5.30E-01	4.73E-01	2.09E-05	2.81E-01	1.60E-03	4.30E-04	9.25E-03	6.73E-07
241-C-203	1.00E+01	1.45E+03	8.72E+03	1.00E-01	1.45E+01	8.72E+01	6.70E-15	5.66E-04	2.37E-07	1.12E-04	5.46E-07	2.53E-11	1.01E+00	9.02E-01	3.99E-05	5.37E-01	3.06E-03	8.21E-04	1.77E-02	1.29E-06
241-C-204	1.00E+01	9.14E+02	5.65E+03	1.00E-01	9.14E+00	5.65E+01	4.33E-15	3.63E-04	1.53E-07	7.21E-05	3.52E-07	1.63E-11	6.52E-01	5.84E-01	2.57E-05	3.46E-01	1.97E-03	5.29E-04	1.14E-02	8.30E-07
All Tanks		**1.35E+07**	**3.45E+06**	**6.65E+01**	**1.35E+05**	**3.45E+04**	**2.86E-10**	**5.00E+00**	**1.67E-02**	**7.93E-01**	**9.93E-03**	**1.86E-05**	**6.41E+03**	**5.72E+03**	**1.57E-01**	**6.24E+03**	**5.63E-01**	**1.88E+01**	**3.54E+00**	**3.21E-04**

Tank	227Ac	228Ra	229Th	231Pa	232Th	232U	233U	234U	235U	236U	237Np	238Pu	238U	239Pu	240Pu	241Am	241Pu	242Cm	242Pu	243Am
241-C-101	1.20E-07	2.22E-13	8.21E-10	3.98E-07	2.50E-13	9.85E-07	4.62E-08	3.14E-02	1.36E-03	4.48E-04	4.44E-05	8.95E-02	3.21E-02	5.35E+00	8.93E-01	8.05E-02	2.45E+00	3.26E-05	2.66E-05	1.86E-08
241-C-102	1.10E-01	2.67E-03	1.62E-03	2.96E-01	3.24E-04	1.89E-03	9.58E-03	2.72E-02	1.17E-03	4.45E-04	9.38E-05	7.91E-01	2.72E-02	3.38E+01	6.19E+00	1.13E+01	2.14E+01	1.96E-02	2.84E-04	3.64E-05
241-C-103	7.59E-05	1.57E-07	1.32E-06	1.79E-04	3.07E-07	4.43E-04	2.20E-03	1.95E-02	8.32E-04	3.48E-04	1.08E-03	5.84E-01	1.99E-02	4.21E+01	6.48E+00	3.04E+01	1.45E+01	3.58E-02	2.02E-04	7.19E-04
241-C-104	5.95E-01	2.30E-02	9.39E-03	2.39E+00	5.58E-02	1.60E-01	4.13E+00	2.08E-01	6.03E-03	6.84E-03	4.39E-02	1.95E+00	1.17E-01	5.47E+01	1.08E+01	6.15E+01	5.93E+01	4.90E-02	9.49E-04	3.11E-03
241-C-105	1.03E-07	1.43E-13	5.10E-10	3.55E-07	2.91E-13	1.31E-06	5.65E-08	3.21E-02	1.37E-03	5.56E-04	5.61E-05	2.62E-01	3.29E-02	2.06E+01	3.13E+00	1.15E+01	6.73E+00	3.47E-03	8.94E-05	3.25E-06
241-C-106	1.26E-05	3.20E-08	2.43E-07	3.37E-05	2.54E-05	4.39E-06	2.18E-05	4.31E-04	1.84E-05	7.66E-06	2.62E-03	3.01E-02	4.40E-04	7.56E-01	1.54E-01	2.18E+00	7.41E-01	3.24E-03	1.65E-05	2.20E-05
241-C-107	7.70E-04	4.93E-05	2.43E-05	1.92E-03	7.28E-04	4.51E-05	2.26E-04	5.63E-03	1.37E-03	8.92E-04	8.07E-04	5.86E-01	3.10E-02	2.16E+01	3.92E+00	6.55E+01	1.49E+01	4.89E-02	2.74E-04	3.46E-03
241-C-108	2.02E-07	3.68E-13	1.39E-09	6.50E-07	2.88E-13	4.63E-09	3.58E-10	5.03E-04	2.26E-05	3.22E-06	4.32E-05	1.02E-04	5.09E-04	3.19E-02	2.06E-03	6.38E-02	7.93E-04	1.25E-03	1.08E-08	4.55E-07
241-C-109	6.39E-06	1.35E-12	5.04E-09	1.23E-06	4.19E-13	4.67E-07	2.52E-08	1.44E-02	5.75E-04	2.09E-04	9.78E-04	1.33E-02	1.36E-02	6.07E-01	1.03E-01	4.52E-01	2.43E-01	7.38E-04	9.05E-06	1.09E-05
241-C-110	1.76E-07	6.09E-14	1.90E-10	5.66E-07	2.43E-13	5.97E-08	4.62E-09	6.51E-03	2.93E-04	4.16E-05	3.61E-05	1.76E-03	6.59E-03	6.78E-01	3.99E-02	3.80E-01	7.29E-03	4.11E-04	7.82E-08	1.16E-06
241-C-111	5.05E-06	1.21E-12	4.50E-09	1.18E-06	4.28E-13	3.90E-07	1.84E-08	1.40E-02	6.10E-04	1.85E-04	6.46E-05	1.19E-02	1.42E-02	1.31E+00	1.44E-01	2.07E+00	2.47E-01	2.81E-02	3.95E-06	1.94E-05
241-C-112	6.34E-07	1.40E-12	5.31E-09	2.04E-06	9.24E-13	1.19E-03	5.99E-03	7.98E-02	3.50E-03	9.88E-04	7.51E-03	6.91E-02	8.06E-02	8.19E-01	1.30E-01	4.61E+00	3.23E-01	1.38E-02	4.11E-06	1.20E-04
241-C-201	1.40E-06	1.81E-13	6.62E-10	8.65E-08	4.78E-15	3.44E-11	2.66E-12	3.75E-06	1.69E-07	2.39E-08	4.28E-07	1.25E-02	3.80E-06	6.48E-01	1.07E-01	2.20E-01	3.17E-01	3.11E-04	5.46E-06	5.25E-06
241-C-202	1.45E-06	1.88E-13	6.90E-10	9.01E-08	4.98E-15	2.15E-10	7.31E-12	3.99E-06	1.68E-07	9.28E-08	4.46E-07	6.56E-03	3.96E-06	3.39E-01	5.56E-02	1.15E-01	1.66E-01	1.62E-04	2.85E-06	2.75E-06
241-C-203	2.79E-06	3.60E-13	1.32E-09	1.73E-07	9.54E-15	6.85E-11	5.30E-12	7.47E-06	3.36E-07	4.77E-08	8.53E-07	3.28E-03	7.56E-06	1.70E-01	2.78E-02	5.77E-02	8.30E-02	8.13E-05	1.43E-06	1.37E-06
241-C-204	1.79E-06	2.32E-13	8.50E-10	1.11E-07	6.14E-15	4.43E-11	3.42E-12	4.82E-06	2.17E-07	3.08E-08	5.49E-07	6.68E-05	4.89E-06	3.47E-03	5.68E-04	1.17E-03	1.70E-03	1.65E-06	2.92E-08	2.80E-08
All Tanks	**7.06E-01**	**2.57E-02**	**1.10E-02**	**2.69E+00**	**5.69E-02**	**1.63E-01**	**4.15E+00**	**4.39E-01**	**1.72E-02**	**1.10E-02**	**5.72E-02**	**4.42E+00**	**3.76E-01**	**1.83E+02**	**3.22E+01**	**1.90E+02**	**1.21E+02**	**2.05E-01**	**1.87E-03**	**7.52E-03**

													Specific Analyte Inventories at Closure (kg)							
Tank	**243Cm**	**244Cm**	**3H**	**59Ni**	**60Co**	**63Ni**	**79Se**	**90Sr**	**90Y**	**93mNb**	**93Zr**	**99Tc**	**Al**	**Bi**	**Ca**	**Cl**	**Cr**	**F**	**Fe**	**Hg**
241-C-101	4.65E-07	2.58E-07	1.63E-03	2.84E-04	1.49E-05	2.21E-02	2.11E-05	1.81E+03	1.81E+03	3.83E-04	9.98E-04	6.97E-03	6.53E+02	6.24E+00	3.71E+01	5.37E+00	2.99E+00	4.76E+00	1.60E+02	4.12E-01
241-C-102	4.32E-04	3.21E-03	3.57E-03	4.52E-04	1.13E-01	3.70E-02	4.70E-05	3.76E+03	3.76E+03	7.24E-04	1.99E-03	1.32E-02	8.25E+02	2.63E+01	6.82E+01	1.85E+01	7.35E+00	4.10E+01	2.02E+02	1.23E-01
241-C-103	1.50E-03	8.60E-03	3.42E-02	3.84E-01	5.95E-01	3.14E+01	1.76E-02	1.90E+04	1.90E+04	3.04E-01	7.42E-01	3.42E-01	1.36E+03	3.63E+00	2.60E+01	6.09E+00	6.90E+00	1.19E+01	1.11E+02	1.61E+00
241-C-104	2.74E-03	7.25E-02	1.93E-01	4.58E-02	2.24E-01	3.77E+00	6.41E-02	3.06E+03	3.06E+03	4.37E-02	1.17E-01	5.80E-01	9.01E+02	4.80E-01	2.99E+01	8.00E+00	1.46E+01	3.46E+02	2.76E+02	6.73E-01
241-C-105	5.01E-05	5.80E-05	2.01E-03	3.53E-04	7.10E-02	2.79E-02	2.64E-05	3.01E+03	3.01E+03	4.68E-04	1.24E-03	8.14E-01	1.72E+03	3.72E+00	1.97E+01	3.73E+00	4.13E+00	8.70E+00	2.82E+01	1.39E-01
241-C-106	1.79E-04	2.91E-03	5.32E-03	6.53E-02	1.15E-03	5.34E+00	2.88E-03	1.78E+03	1.78E+03	5.65E-02	1.44E-01	3.14E-02	2.06E+01	7.79E-03	8.23E-01	3.21E-01	6.18E-01	1.67E-01	3.06E+01	4.46E-02
241-C-107	2.68E-03	7.54E-02	1.03E-01	3.22E+00	2.03E-01	2.64E+02	1.79E-01	1.42E+04	1.42E+04	3.08E+00	7.75E+00	3.79E-01	5.86E+02	1.04E+02	1.24E+01	8.70E+00	9.30E+00	6.39E+01	1.03E+03	6.70E-01
241-C-108	1.56E-05	3.97E-06	1.33E-03	1.09E-02	7.49E-06	8.17E-01	2.12E-05	5.34E+01	5.34E+01	3.97E-04	1.01E-03	6.19E-02	1.89E+02	4.41E+01	4.59E+01	2.64E+00	2.32E+00	1.54E+01	2.60E+01	2.06E-01
241-C-109	2.25E-05	8.45E-06	4.64E-03	5.54E-02	1.59E-05	4.38E+00	5.34E-05	1.59E+03	1.59E+03	1.23E-03	3.13E-03	3.23E-01	2.34E+02	1.14E+01	5.65E+01	2.78E+00	1.18E+00	6.46E+00	6.53E+01	2.15E-02
241-C-110	3.71E-06	6.57E-06	2.32E-03	2.40E-04	6.07E-06	1.80E-02	2.02E-05	2.35E+01	2.35E+01	3.33E-04	8.46E-04	3.18E-01	1.31E+02	1.48E+02	1.05E+01	9.91E+00	4.20E+00	6.75E+01	9.84E+01	3.98E-03
241-C-111	3.77E-04	2.57E-04	1.93E-03	4.94E-02	1.49E-05	3.87E+00	6.10E-05	5.63E+03	5.63E+03	1.09E-03	2.79E-03	2.70E-02	2.86E+02	1.69E+01	4.00E+01	2.70E+00	8.52E-01	8.63E+00	1.33E+02	0.00E+00
241-C-112	3.19E-04	1.03E-04	2.48E-02	8.36E-02	3.56E-03	6.65E+00	5.56E-03	4.10E+03	4.10E+03	1.28E-03	3.26E-03	6.11E-01	1.24E+02	2.04E+01	1.17E+02	5.32E+00	1.39E+00	4.26E+00	1.37E+02	2.77E-02
241-C-201	1.04E-05	3.48E-06	3.37E-06	7.52E-03	6.92E-07	6.14E-01	8.79E-06	2.61E+00	2.61E+00	1.52E-04	3.88E-04	1.41E-04	2.74E-01	0.00E+00	1.24E+00	3.49E-02	2.29E-02	1.25E-01	1.06E+01	0.00E+00
241-C-202	5.42E-06	1.82E-06	3.50E-06	7.84E-03	7.21E-07	6.40E-01	9.16E-06	2.73E+00	2.73E+00	1.58E-04	4.04E-04	1.47E-04	2.86E-01	0.00E+00	1.30E+00	9.91E-02	2.39E-02	2.30E-01	1.11E+01	0.00E+00
241-C-203	2.71E-06	9.08E-07	6.70E-06	1.50E-02	1.38E-06	1.23E+00	1.75E-05	5.21E+00	5.21E+00	3.04E-04	7.73E-04	2.82E-04	5.46E-01	0.00E+00	2.48E+00	1.29E-01	4.57E-02	3.44E-01	2.12E+01	0.00E+00
241-C-204	5.53E-08	1.86E-08	4.33E-06	9.66E-03	8.88E-07	7.89E-01	1.13E-05	3.37E+00	3.37E+00	1.96E-04	4.98E-04	1.81E-04	3.53E-01	0.00E+00	1.60E+00	8.34E-02	2.95E-02	2.22E-01	1.37E+01	0.00E+00
All Tanks	**8.34E-03**	**1.63E-01**	**3.77E-01**	**3.96E+00**	**1.21E+00**	**3.24E+02**	**2.69E-01**	**5.81E+04**	**5.81E+04**	**3.49E+00**	**8.77E+00**	**3.51E+00**	**7.03E+03**	**3.85E+02**	**4.71E+02**	**7.44E+01**	**5.60E+01**	**5.80E+02**	**2.35E+03**	**3.93E+00**

Tank	K	La	Mn	Na	Ni	NO2	NO3	Pb	PO4	Si	SO4	Sr	TIC as CO3	TOC	UTOTAL	Zr
241-C-101	5.71E+00	1.99E+00	4.57E+00	5.70E+02	8.53E+00	9.18E+01	6.14E+02	7.77E+00	3.37E+02	8.02E+01	6.38E+01	2.75E+00	1.16E+02	1.19E+01	9.61E+01	1.99E+00
241-C-102	1.43E+01	1.99E+00	1.63E+01	1.06E+03	6.73E+01	1.69E+02	7.32E+02	1.11E+01	1.41E+02	3.67E+02	5.75E+01	1.58E+00	7.60E+02	1.57E+01	8.15E+01	5.15E+01
241-C-103	5.73E+00	1.44E+00	3.38E+00	2.95E+02	3.42E+01	1.63E+02	1.38E+01	4.46E+00	3.67E+01	2.75E+02	2.82E+01	4.40E-01	2.84E+02	7.74E+01	5.96E+01	8.20E+01
241-C-104	1.33E+01	4.87E-01	7.01E+01	1.78E+03	2.63E+01	3.65E+02	1.96E+02	8.37E+00	3.21E+01	1.02E+02	3.42E+01	8.74E-01	4.85E+02	1.42E+02	3.53E+02	6.49E+02
241-C-105	8.60E+00	3.65E+00	1.90E+01	3.29E+02	1.66E+01	8.42E+01	8.14E+01	3.59E+00	6.01E+01	3.09E+02	3.54E+01	1.43E+00	1.65E+02	4.74E+01	9.84E+01	1.80E+00
241-C-106	1.08E+00	1.23E-01	7.59E+00	1.20E+02	1.06E+00	1.53E+01	7.69E-01	1.61E+00	9.39E+00	6.78E-01	4.82E+00	6.50E-02	1.32E+02	5.25E+00	1.32E+00	2.66E-02
241-C-107	4.47E+00	2.70E+00	5.02E+01	9.52E+02	3.09E+01	3.53E+02	4.78E+02	1.01E+02	5.88E+02	1.87E+01	8.43E+01	2.57E+00	1.14E+02	7.36E+00	9.29E+01	7.39E-01
241-C-108	1.37E+00	4.41E-02	5.70E-01	3.41E+02	3.05E+01	8.74E+01	1.57E+02	3.12E+00	2.97E+02	2.04E+01	2.43E+01	1.49E+00	3.79E+01	3.43E+00	1.53E+00	3.11E-01
241-C-109	1.76E+00	2.52E-02	7.21E-01	3.48E+02	4.57E+01	1.22E+02	1.80E+02	8.27E+00	2.51E+02	2.14E+01	2.94E+01	1.24E+00	9.25E+01	7.60E+00	4.06E+01	1.02E-01
241-C-110	5.11E+00	1.28E-02	4.76E-01	7.53E+02	2.17E-01	6.53E+01	9.80E+02	2.20E+00	5.68E+02	6.33E+01	1.11E+02	1.12E+00	9.42E+01	5.22E+00	1.97E+01	1.50E+00
241-C-111	2.88E+00	1.05E+00	8.01E-01	1.27E+02	4.89E+01	9.49E+01	1.73E+02	1.40E+01	1.81E+02	2.31E+01	1.49E+01	5.74E-01	6.75E+01	2.44E+00	4.25E+01	5.31E-01
241-C-112	3.00E+00	4.51E-01	1.23E+00	5.01E+02	7.78E+01	2.78E+02	3.72E+02	1.48E+01	3.90E+02	1.55E+01	7.01E+01	1.93E+00	1.46E+02	2.42E+01	2.41E+02	9.65E-02
241-C-201	6.85E-02	1.20E-01	1.71E-03	4.62E+00	1.37E+00	4.18E-01	2.27E+00	9.71E+00	1.00E-01	6.56E-01	1.14E-01	2.79E-01	6.52E+00	2.50E+00	1.14E-02	0.00E+00
241-C-202	7.15E-02	1.25E-01	1.79E-03	4.82E+00	1.43E+00	2.14E+00	6.39E+00	1.01E+01	1.10E-01	6.85E-01	3.02E-01	2.91E-01	6.66E+00	2.15E+00	1.19E-02	0.00E+00
241-C-203	1.36E-01	2.39E-01	3.41E-03	9.21E+00	2.73E+00	2.45E+00	8.38E+00	1.93E+01	2.04E-01	1.31E+00	4.02E-01	5.56E-01	1.30E+01	4.54E+00	2.26E-02	0.00E+00
241-C-204	8.82E-02	1.54E-01	2.20E-03	5.95E+00	1.76E+00	1.58E+00	5.41E+00	1.25E+01	1.32E-01	8.45E-01	2.59E-01	3.59E-01	8.51E+00	2.93E+00	1.46E-02	0.00E+00
All Tanks	**6.77E+01**	**1.46E+01**	**1.75E+02**	**7.20E+03**	**3.95E+02**	**1.90E+03**	**4.00E+03**	**2.32E+02**	**2.89E+03**	**1.30E+03**	**5.59E+02**	**1.75E+01**	**2.53E+03**	**3.62E+02**	**1.13E+03**	**7.90E+02**

SPREADSHEET FOR DATA ENTRY AND DECAY CALCULATION (SVF-2545)

Decay from	1/1/2001
Decay to	1/1/2020
Days of Decay	6939

Radionuclide Name	Half Life (years)	Lambda (1/day)	Decay Factor	Decay Factors (values)
106Ru	1.020	1.861E-03	0.0000	0.0000
113mCd	14.1	1.346E-04	0.3930	0.3930
125Sb	2.758	6.881E-04	0.0084	0.0084
126Sn	2.3E+05	8.251E-09	0.9999	0.9999
129I	1.57E+07	1.209E-10	1.0000	1.0000
134Cs	2.065	9.190E-04	0.0017	0.0017
137Cs	30.07	6.311E-05	0.6454	0.6454
137mBa	4.852E-06	3.911E+02	0.6092	0.6092
14C	5715	3.321E-07	0.9977	0.9977
151Sm	90	2.109E-05	0.8639	0.8639
152Eu	13.54	1.402E-04	0.3781	0.3781
154Eu	8.593	2.208E-04	0.2160	0.2160
155Eu	4.75	3.995E-04	0.0625	0.0625
226Ra	1599	1.187E-06	0.9918	0.9918
227Ac	21.772	8.716E-05	0.5462	0.5462
228Ra	5.76	3.295E-04	0.1017	0.1017
229Th	7.3E+03	2.600E-07	0.9982	0.9982
231Pa	3.28E+04	5.786E-08	0.9996	0.9996
232Th	1.40E+10	1.356E-13	1.0000	1.0000
232U	69.8	2.719E-05	0.8281	0.8281
233U	1.592E+05	1.192E-08	0.9999	0.9999
234U	2.46E+05	7.714E-09	0.9999	0.9999
235U	7.04E+08	2.696E-12	1.0000	1.0000

Radionuclide Name	Half Life (years)	Lambda (1/day)	Decay Factor	Decay Factors (values)
236U	2.342E+07	8.103E-11	1.0000	1.0000
237Np	2.14E+06	8.868E-10	1.0000	1.0000
238Pu	87.7	2.164E-05	0.8606	0.8606
238U	4.47E+09	4.245E-13	1.0000	1.0000
239Pu	2.410E+04	7.874E-08	0.9995	0.9995
240Pu	6.56E+03	2.893E-07	0.9980	0.9980
241Am	432.7	4.386E-06	0.9700	0.9700
241Pu	14.4	1.318E-04	0.4007	0.4007
242Cm	4.46E-01		0.9108	0.9108
242Pu	3.75E+05	5.061E-09	1.0000	1.0000
243Am	7.37E+03	2.575E-07	0.9982	0.9982
243Cm	29.1	6.521E-05	0.6360	0.6360
244Cm	18.1	1.048E-04	0.4831	0.4831
3H	12.32	1.540E-04	0.3434	0.3434
59Ni	7.6E+04	2.497E-08	0.9998	0.9998
60Co	5.271	3.600E-04	0.0822	0.0822
63Ni	101	1.879E-05	0.8778	0.8778
79Se	2.9E+05	6.544E-09	1.0000	1.0000
90Sr	28.78	6.594E-05	0.6328	0.6328
90Y	7.31E-03	2.596E-01	0.6328	0.6328
93mNb	16.1	1.179E-04	0.4414	0.4414
93Zr	1.5E+06	1.265E-09	1.0000	1.0000
99Tc	2.13E+05	8.910E-09	0.9999	0.9999

Half Lives from the 16th Edition of Chart of the Nuclides

C-103 Residual Concentrations - HTWOS Estimate						
Inventory values from HFFACO worksheet (Pivot table)				C-103 Residual Inventory values from B.2		
		Radionuclide values decayed to 1/1/2020				
C-103	**Inv**	**Conc**		**2014 BBI values**		**RSD**
Radionuclides	**(Ci)**	**Ci/L**		**Ci/L**		**HTWOS est./2013 BBI**
106Ru	1.42E-13	1.39E-17		1.80E-20		7.71E+02
113mCd	2.29E-02	2.24E-06		1.55E-06		1.45E+00
125Sb	3.24E-05	3.17E-09		7.27E-11		4.37E+01
126Sn	1.81E-02	1.78E-06		5.51E-09		3.23E+02
129I	8.29E-05	8.13E-09		3.13E-07		2.59E-02
134Cs	1.49E-07	1.46E-11		3.95E-13		3.70E+01
137Cs	9.73E+01	9.55E-03		6.35E-02		1.50E-01
137mBa	8.69E+01	8.53E-03		5.66E-02		1.51E-01
14C	6.06E-03	5.94E-07		7.30E-07		8.14E-01
151Sm	8.73E+01	8.56E-03		4.50E-05		1.90E+02
152Eu	1.08E-02	1.06E-06		2.69E-09		3.95E+02
154Eu	2.17E+00	2.13E-04		1.47E-04		1.45E+00
155Eu	3.76E-01	3.69E-05		4.57E-05		8.07E-01
226Ra	3.91E-06	3.84E-10		1.61E-12		2.38E+02
227Ac	1.21E-05	1.19E-09		6.67E-12		1.78E+02
228Ra	2.50E-08	2.45E-12		4.91E-09		5.00E-04
229Th	2.11E-07	2.07E-11		2.71E-15		7.61E+03
231Pa	2.82E-05	2.77E-09		1.73E-11		1.60E+02
232Th	4.93E-08	4.84E-12		2.08E-08		2.33E-04
232U	2.24E-05	2.20E-09		4.48E-10		4.91E+00
233U	1.12E-04	1.10E-08		6.11E-07		1.79E-02
234U	2.77E-03	2.71E-07		1.42E-06		1.91E-01
235U	1.18E-04	1.16E-08		7.42E-08		1.56E-01
236U	4.90E-05	4.81E-09		3.91E-08		1.23E-01
237Np	1.36E-04	1.34E-08		1.41E-06		9.47E-03
238Pu	1.04E-01	1.02E-05		1.36E-04		7.50E-02
238U	2.84E-03	2.78E-07		1.71E-06		1.62E-01
239Pu	7.70E+00	7.55E-04		5.21E-04		1.45E+00
240Pu	1.19E+00	1.16E-04		1.09E-04		1.07E+00
241Am	5.57E+00	5.46E-04		5.04E-04		1.08E+00
241Pu	2.65E+00	2.60E-04		1.88E-04		1.38E+00
242Cm	6.55E-03	6.42E-07		5.99E-09		1.07E+02
242Pu	3.71E-05	3.64E-09		3.39E-09		1.08E+00
243Am	1.32E-04	1.29E-08		3.86E-09		3.35E+00
243Cm	2.56E-04	2.51E-08		8.01E-11		3.13E+02
244Cm	1.21E-03	1.19E-07		1.58E-09		7.52E+01

C-103 Residual Concentrations - HTWOS Estimate						
Inventory values from HFFACO worksheet (Pivot table)				C-103 Residual Inventory values from B.2		
		Radionuclide values decayed to 1/1/2020				
C-103	**Inv**	**Conc**		**2014 BBI values**		**RSD**
Radionuclides	**(Ci)**	**Ci/L**		**Ci/L**		**HTWOS est./2013 BBI**
3H	4.76E-04	4.67E-08		4.16E-07		1.12E-01
59Ni	6.15E-02	6.03E-06		1.17E-05		5.15E-01
60Co	1.08E-01	1.06E-05		1.91E-06		5.56E+00
63Ni	5.03E+00	4.93E-04		1.94E-03		2.54E-01
79Se	2.77E-03	2.72E-07		2.76E-09		9.85E+01
90Sr	3.49E+03	3.43E-01		7.08E-01		4.84E-01
90Y	3.49E+03	3.43E-01		7.08E-01		4.84E-01
93mNb	4.80E-02	4.71E-06		3.86E-08		1.22E+02
93Zr	1.17E-01	1.14E-05		7.35E-08		1.56E+02
99Tc	4.28E-02	4.20E-06		4.68E-06		8.97E-01
Chemicals	**(Kg)**	**g/L**		**g/L**		ratio
Al	2.50E+02	2.45E+01		3.79E+02		6.47E-02
Bi	6.67E-01	6.54E-02		9.92E-06		6.60E+03
Ca	4.77E+00	4.68E-01		2.27E+00		2.06E-01
Cl	8.38E-01	8.22E-02		2.03E-02		4.05E+00
Cr	1.25E+00	1.23E-01		2.49E-01		4.93E-01
F	1.32E+00	1.29E-01		1.69E-02		7.64E+00
Fe	2.04E+01	2.00E+00		1.24E+01		1.61E-01
Hg	2.57E-01	2.52E-02		1.11E-01		2.27E-01
K	8.38E-01	8.22E-02		3.76E-01		2.19E-01
La	2.64E-01	2.59E-02		1.90E-02		1.36E+00
Mn	6.10E-01	5.98E-02		4.62E-01		1.30E-01
Na	3.32E+01	3.26E+00		1.00E+01		3.25E-01
Ni	5.59E+00	5.48E-01		4.79E-01		1.15E+00
NO2	2.03E+01	1.99E+00		5.04E-02		3.96E+01
NO3	1.98E+00	1.94E-01		9.10E-02		2.13E+00
Pb	8.16E-01	8.01E-02		8.88E-01		9.02E-02
PO4	4.03E+00	3.95E-01		3.12E+00		1.27E-01
Si	4.54E+01	4.46E+00		1.33E+01		3.36E-01
SO4	3.34E+00	3.27E-01		2.26E-01		1.45E+00
Sr	4.07E-02	3.99E-03		2.52E-01		1.58E-02
TIC as CO3	3.33E+01	3.27E+00		1.76E+00		1.86E+00
TOC	1.05E+01	1.03E+00		1.31E+00		7.91E-01
UTOTAL	0.00E+00	0.00E+00		5.13E+00		0.00E+00
Zr	1.48E+01	1.45E+00		1.39E+00		1.04E+00

RPP-RPT-42323 Rev. 4, Appendix C.2

C-2 2019 Residual Inventory

Spreadsheet Documentation

Spreadsheet Name	C_2 Ancillary equipment inventory.xlsx
Spreadsheet Owner	J. G. Field, 376-3753
Related Documents	RPP-RPT-42323, Rev. 4, Hanford C-Farm Tank and Ancillary Equipment Residual Waste Inventory Estimates
Purpose	This spreadsheet was developed to report C-Farm ancillary equipment residual inventories from DOE/EIS-0391, Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland Washington and as Appendix C-2 of RPP-RPT-42323.
Overview	Ancillary equipment waste volume estimates for this spreadsheet are from the RPP-RPT-42323 report. Concentration estimates for the 2002 inventories are 2002 BBI average concentrations for tank waste. Concentrations for 2019 updates are the residual sample concentrations for C farm tanks.
Worksheet Descriptions	Ancillary Equip BBI: This worksheet presents residual inventory estimates for standard BBI constituents for catch tanks C-301, CR-Vault, pits, diversion boxes and pipelines in C-farm based on estimates reported in the TC&WM EIS (2002 estimates, column A-F) and based on updated volumes and inventories (2015 estimates, columns J-P). For the 2002 values, average C farm tank waste constituent concentrations from the 12/2002 BBI (cells B10-B33 for chemicals and B40-B85 for radionuclides) are multiplied by applicable residual volume estimates from the EIS (cells C5, D5 and E5) to calculate inventories for ancillary equipment in columns C, D, E and F. For the 2019 values, average C farm tank waste constituent concentrations from the 2019 BBI Average worksheet (cells I9-I35 for chemicals and I40-I85 for radionuclides) are multiplied by 2019 residual volume estimates (cells J5-P5) to calculate inventories for ancillary equipment in columns J-P rows 10-35 and 40-85.
	RPP-RPT-42323 Worksheet: This is a title page for this spreadsheet.
	2019 BBI Average: This worksheet shows 2019 constituent concentrations from links to the Appendix B2, 2015 inventory worksheet. The values are average residual waste concentrations from the 2019 BBI for C-Farm tanks downloaded 1/3/2019.
Macros and Add-in software	None
Key Assumptions	None
Units	Inventory units are shown (kg or Ci). Concentration units are g/L or Ci/L as shown. Waste volumes are shown as kL and ft3. Conversions: 1 gal = 3.785 L, 1 ft3 = 7.481 gal.
Input Data	Ancillary equipment residual volume estimates in RPP-RPT-42323, Rev. 4. Average tank residual waste concentrations from Appendix B-1 and B-2 of RPP-RPT-42323.
Verification	By: Kristin Singleton Date: Approval date for RPP-RPT-42323, Rev. 4 report Summary: Checked and verified worksheet inputs and formulas

Average Residual Sample Concentrations of Retrieved Tanks

Copied from Appendix B2, Column S, radionuclides decayed to 1/1/2020

Avg.	g/l	Avg.	Ci/l	Avg.	Ci/l
Al	1.89E+02	**106-Ru**	1.89E-14	**238-Pu**	1.31E-04
Bi	1.41E+00	**113m-Cd**	1.35E-05	**238-U**	4.29E-05
Ca	5.38E+00	**125-Sb**	1.06E-07	**239-Pu**	3.96E-03
Cl	1.94E-01	**126-Sn**	1.25E-05	**240-Pu**	8.23E-04
TIC as CO3	6.14E+01	**129-I**	7.17E-08	**241-Am**	1.10E-03
Cr	3.05E+00	**134-Cs**	1.72E-10	**241-Pu**	2.20E-03
F	5.53E+00	**137-Cs**	6.54E-02	**242-Cm**	1.56E-05
Fe	4.31E+01	**137m-Ba**	5.82E-02	**242-Pu**	2.26E-07
Hg	1.01E-01	**14-C**	4.33E-07	**243-Am**	2.42E-07
K	9.88E-01	**151-Sm**	1.09E-01	**243-Cm**	9.19E-07
La	3.40E-02	**152-Eu**	1.32E-05	**244-Cm**	1.49E-05
Mn	8.17E+00	**154-Eu**	1.87E-04	**3-H**	7.43E-07
Na	1.16E+02	**155-Eu**	5.74E-05	**59-Ni**	6.58E-05
Ni	3.60E+00	**226-Ra**	3.09E-09	**60-Co**	1.76E-05
NO2	2.94E+00	**227-Ac**	1.35E-08	**63-Ni**	3.07E-03
NO3	4.70E+00	**228-Ra**	2.52E-08	**79-Se**	1.29E-07
Pb	1.44E+01	**229-Th**	1.15E-10	**90-Sr**	8.18E-01
Oxalate	2.91E+00	**231-Pa**	1.63E-08	**90-Y**	8.18E-01
PO4	8.56E+01	**232-Th**	4.33E-08	**93m-Nb**	5.21E-05
Si	1.16E+01	**232-U**	3.11E-07	**93-Zr**	6.54E-05
SO4	1.45E+00	**233-U**	1.98E-05	**99-Tc**	9.96E-06
Sr	9.80E-01	**234-U**	4.26E-05		
TOC	1.31E+01	**235-U**	1.85E-06		
UTOTAL	1.28E+02	**236-U**	4.14E-07		
Zr	4.97E-01	**237-Np**	4.17E-06		

REFERENCES

DOE/EIS-0391, 2012, *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*, Rev. 0, U.S. Department of Energy, Office of River Protection, Richland, Washington.

DOE/ORP-2003-02, 2003, *Environmental Impact Statement for Retrieval, Treatment, and Disposal of Tank Waste and Closure of Single-Shell Tanks at the Hanford Site, Richland, WA Inventory and Source Term Data Package*, Rev. 0, U.S. Department of Energy, Office of River Protection, Richland, Washington.

HNF-SD-WM-SP-012, 2002, *Tank Farm Contractor Operation and Utilization Plan*, Rev. 4, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-RPT-42323, 2019, *Hanford C-Farm Tank and Ancillary Equipment Residual Waste Inventory Estimates*, Rev. 4, Washington River Protection Solutions LLC, Richland, Washington.

RPP-RPT-42323, 2010, *Hanford C-Farm Tank and Ancillary Equipment Residual Waste Inventory Estimates*, Rev. 1, Washington River Protection Solutions LLC, Richland, Washington.

SVF-2545, Rev. 01, “SVF-2545 Rev 0 TWINS Radionuclide Decay Calculator.xlsx,” This spreadsheet is being canceled, as it has been superseded by RPP-PLAN-61464, Rev. 0, Software Management Plan for Grade D Utility Calculation Software TWINS Radioactive Decay Calculator., M. J. Rodgers, TNK WST INVENTORY & CHARACTZTN, H4-30, 509-376-2993, 6/26/2017

12/2002 and 1/2019 Ancillary Equipment Residual Inventory Estimates for BBI Constituents

2002 Residual inventory Estimate

	Catch tanks	Pits	Pipelines	Total
Volume (L)	1.81E+03	1.21E+02	4.69E+02	2.40E+03

average concentration = average 2002 BBI C Farm tank concentrations

catch tank volume = 1% of current volume (assumes 99% retrieval)

	Avg Conc	Catch tanks	Pits	Pipelines	Total
Analyte	g/L	kg	kg	kg	
Al	8.34E+01	1.51E+02	1.01E+01	3.92E+01	2.00E+02
Bi	4.61E+00	8.34E+00	5.58E-01	2.16E+00	1.11E+01
Ca	1.41E+01	2.55E+01	1.70E+00	6.60E+00	3.38E+01
Cl	1.15E+00	2.09E+00	1.40E-01	5.41E-01	2.77E+00
Cr	6.80E-01	1.23E+00	8.24E-02	3.19E-01	1.63E+00
F	5.55E+00	1.01E+01	6.73E-01	2.61E+00	1.33E+01
Fe	8.03E+01	1.45E+02	9.73E+00	3.77E+01	1.93E+02
Hg	4.02E-02	7.28E-02	4.87E-03	1.89E-02	9.66E-02
K	1.12E+00	2.02E+00	1.35E-01	5.24E-01	2.68E+00
La	8.00E-01	1.45E+00	9.68E-02	3.75E-01	1.92E+00
Mn	1.65E+00	2.99E+00	2.00E-01	7.74E-01	3.96E+00
Na	1.06E+02	1.92E+02	1.29E+01	4.99E+01	2.55E+02
Ni	1.32E+01	2.39E+01	1.60E+00	6.20E+00	3.17E+01
NO2	3.00E+01	5.43E+01	3.63E+00	1.41E+01	7.20E+01
NO3	7.17E+01	1.30E+02	8.68E+00	3.36E+01	1.72E+02
Pb	5.29E+01	9.57E+01	6.40E+00	2.48E+01	1.27E+02
PO4	4.38E+01	7.93E+01	5.31E+00	2.06E+01	1.05E+02
Si	1.63E+01	2.96E+01	1.98E+00	7.67E+00	3.92E+01
SO4	8.18E+00	1.48E+01	9.90E-01	3.84E+00	1.96E+01
Sr	1.70E+00	3.07E+00	2.05E-01	7.96E-01	4.07E+00
TIC as CO3	6.29E+01	1.14E+02	7.62E+00	2.95E+01	1.51E+02
TOC	1.54E+01	2.80E+01	1.87E+00	7.25E+00	3.71E+01
UTOTAL	1.33E+01	2.40E+01	1.61E+00	6.23E+00	3.19E+01
Zr	5.19E+00	9.39E+00	6.28E-01	2.43E+00	1.24E+01
Sum		1.15E+03	7.68E+01	2.98E+02	1.52E+03

2019 Residual Inventory estimate

	Catch Tanks						
	All	C-301	CR-Vault	Pits	Diversion Boxes	Pipelines	Total
Volume (L)	8.23E+03	4.90E+03	3.33E+03	1.21E+02	2.35E+02	6.06E+03	1.46E+04

Catch tank volume = 10% of current volume estimate for catch tanks (assumes 90% retrieval)

No retrieval assumed for pits, diversion boxes or pipelines

	Avg Conc	Catch tanks			Pits	Diversion Boxes	Pipelines	Total
Analyte	g/L	All (kg)	C-301 (kg)	CR-Vault (kg)	kg	kg	kg	kg
Al	1.89E+02	1.55E+03	9.24E+02	6.28E+02	2.28E+01	4.42E+01	1.14E+03	2.76E+03
Bi	1.41E+00	1.16E+01	6.90E+00	4.69E+00	1.71E-01	3.31E-01	8.53E+00	2.06E+01
Ca	5.38E+00	4.42E+01	2.63E+01	1.79E+01	6.51E-01	1.26E+00	3.26E+01	7.87E+01
Cl	1.94E-01	1.60E+00	9.51E-01	6.47E-01	2.35E-02	4.56E-02	1.18E+00	2.84E+00
TIC as CO3	6.14E+01	5.06E+02	3.01E+02	2.05E+02	7.44E+00	1.44E+01	3.72E+02	8.99E+02
Cr	3.05E+00	2.51E+01	1.49E+01	1.02E+01	3.69E-01	7.15E-01	1.85E+01	4.46E+01
F	5.53E+00	4.55E+01	2.71E+01	1.84E+01	6.70E-01	1.30E+00	3.35E+01	8.10E+01
Fe	4.31E+01	3.55E+02	2.11E+02	1.44E+02	5.22E+00	1.01E+01	2.61E+02	6.31E+02
Hg	1.01E-01	8.34E-01	4.97E-01	3.38E-01	1.23E-02	2.38E-02	6.14E-01	1.48E+00
K	9.88E-01	8.13E+00	4.84E+00	3.29E+00	1.20E-01	2.32E-01	5.98E+00	1.45E+01
La	3.40E-02	2.80E-01	1.67E-01	1.13E-01	4.12E-03	7.99E-03	2.06E-01	4.99E-01
Mn	8.17E+00	6.72E+01	4.00E+01	2.72E+01	9.90E-01	1.92E+00	4.95E+01	1.20E+02
Na	1.16E+02	9.55E+02	5.69E+02	3.86E+02	1.41E+01	2.72E+01	7.03E+02	1.70E+03
Ni	3.60E+00	2.96E+01	1.76E+01	1.20E+01	4.36E-01	8.45E-01	2.18E+01	5.27E+01
NO2	2.94E+00	2.42E+01	1.44E+01	9.81E+00	3.57E-01	6.91E-01	1.78E+01	4.31E+01
NO3	4.70E+00	3.87E+01	2.30E+01	1.57E+01	5.69E-01	1.10E+00	2.85E+01	6.88E+01
Pb	1.44E+01	1.19E+02	7.07E+01	4.81E+01	1.75E+00	3.39E+00	8.74E+01	2.11E+02
Oxalate	2.91E+00	2.39E+01	1.42E+01	9.68E+00	3.52E-01	6.82E-01	1.76E+01	4.25E+01
PO4	8.56E+01	7.05E+02	4.20E+02	2.85E+02	1.04E+01	2.01E+01	5.19E+02	1.25E+03
Si	1.16E+01	9.52E+01	5.67E+01	3.85E+01	1.40E+00	2.72E+00	7.01E+01	1.69E+02
SO4	1.45E+00	1.19E+01	7.09E+00	4.82E+00	1.75E-01	3.40E-01	8.77E+00	2.12E+01
Sr	9.80E-01	8.07E+00	4.80E+00	3.26E+00	1.19E-01	2.30E-01	5.94E+00	1.44E+01
TOC	1.31E+01	1.08E+02	6.41E+01	4.35E+01	1.58E+00	3.07E+00	7.92E+01	1.91E+02
UTOTAL	1.28E+02	1.06E+03	6.30E+02	4.28E+02	1.56E+01	3.01E+01	7.78E+02	1.88E+03
Zr	4.97E-01	4.09E+00	2.44E+00	1.66E+00	6.02E-02	1.17E-01	3.01E+00	7.28E+00
Sum		5.80E+03	3.45E+03	2.34E+03	8.53E+01	1.65E+02	4.26E+03	1.03E+04

average concentration = average residual concentration for C farm tanks.

Radionuclides decayed to 1/1/2020

	Avg Conc	Catch tanks	Pits	Pipelines	Total
Analyte	Ci/L	Ci, decayed to 1/1/2020			
106Ru	1.93E-15	3.50E-12	2.34E-13	9.07E-13	4.64E-12
113mCd	3.78E-05	6.84E-02	4.58E-03	1.77E-02	9.07E-02
125Sb	1.18E-07	2.14E-04	1.43E-05	5.55E-05	2.84E-04
126Sn	6.59E-06	1.19E-02	7.98E-04	3.09E-03	1.58E-02
129I	8.01E-08	1.45E-04	9.70E-06	3.76E-05	1.92E-04
134Cs	2.18E-10	3.94E-07	2.64E-08	1.02E-07	5.23E-07
137Cs	1.07E-01	1.94E+02	1.30E+01	5.03E+01	2.57E+02
137mBa	9.57E-02	1.73E+02	1.16E+01	4.49E+01	2.30E+02
14C	1.68E-06	3.05E-03	2.04E-04	7.90E-04	4.04E-03
151Sm	4.78E-02	8.66E+01	5.79E+00	2.24E+01	1.15E+02
152Eu	1.26E-05	2.28E-02	1.53E-03	5.92E-03	3.03E-02
154Eu	1.72E-04	3.11E-01	2.08E-02	8.06E-02	4.12E-01
155Eu	7.93E-05	1.44E-01	9.60E-03	3.72E-02	1.90E-01
226Ra	5.78E-09	1.05E-05	7.00E-07	2.71E-06	1.39E-05
227Ac	4.38E-06	7.94E-03	5.31E-04	2.06E-03	1.05E-02
228Ra	1.61E-07	2.91E-04	1.95E-05	7.55E-05	3.86E-04
229Th	6.85E-08	1.24E-04	8.30E-06	3.22E-05	1.65E-04
231Pa	1.68E-05	3.04E-02	2.03E-03	7.88E-03	4.03E-02
232Th	3.64E-07	6.58E-04	4.40E-05	1.71E-04	8.73E-04
232U	1.05E-06	1.90E-03	1.27E-04	4.94E-04	2.53E-03
233U	2.65E-05	4.80E-02	3.21E-03	1.24E-02	6.36E-02
234U	4.82E-06	8.72E-03	5.83E-04	2.26E-03	1.16E-02
235U	1.96E-07	3.55E-04	2.38E-05	9.21E-05	4.71E-04
236U	9.76E-08	1.77E-04	1.18E-05	4.58E-05	2.34E-04
237Np	5.65E-07	1.02E-03	6.85E-05	2.65E-04	1.36E-03
238Pu	6.52E-05	1.18E-01	7.90E-03	3.06E-02	1.57E-01
238U	4.43E-06	8.02E-03	5.37E-04	2.08E-03	1.06E-02
239Pu	3.13E-03	5.66E+00	3.79E-01	1.47E+00	7.51E+00
240Pu	5.24E-04	9.48E-01	6.34E-02	2.46E-01	1.26E+00
241Am	2.09E-03	3.78E+00	2.53E-01	9.81E-01	5.02E+00
241Pu	1.70E-03	3.07E+00	2.06E-01	7.97E-01	4.08E+00
242Cm	3.10E-06	5.60E-03	3.75E-04	1.45E-03	7.43E-03
242Pu	2.77E-08	5.01E-05	3.35E-06	1.30E-05	6.65E-05
243Am	6.61E-08	1.20E-04	8.01E-06	3.10E-05	1.59E-04
243Cm	1.02E-07	1.84E-04	1.23E-05	4.78E-05	2.45E-04
244Cm	1.20E-06	2.17E-03	1.46E-04	5.64E-04	2.88E-03
3H	3.15E-06	5.70E-03	3.81E-04	1.48E-03	7.56E-03
59Ni	7.17E-05	1.30E-01	8.68E-03	3.36E-02	1.72E-01
60Co	9.24E-06	1.67E-02	1.12E-03	4.34E-03	2.22E-02
63Ni	5.85E-03	1.06E+01	7.09E-01	2.75E+00	1.41E+01
79Se	2.01E-06	3.64E-03	2.44E-04	9.45E-04	4.83E-03
90Sr	7.26E-01	1.31E+03	8.79E+01	3.41E+02	1.74E+03
90Y	7.26E-01	1.31E+03	8.79E+01	3.41E+02	1.74E+03
93mNb	2.67E-05	4.84E-02	3.24E-03	1.25E-02	6.41E-02
93Zr	6.72E-05	1.22E-01	8.14E-03	3.15E-02	1.61E-01
99Tc	4.50E-05	8.14E-02	5.44E-03	2.11E-02	1.08E-01
SUM		3.11E+03	2.08E+02	8.05E+02	4.12E+03

	Avg Conc	Catch tanks			Pits	Diversion Boxes	Pipelines	Total
Analyte	Ci/L	All (Ci)	C-301 (Ci)	CR-Vault (Ci)	Ci, decayed to 1/1/2020			
106-Ru	1.89E-14	1.56E-10	9.26E-11	6.29E-11	2.29E-12	4.43E-12	1.14E-10	2.77E-10
113m-Cd	1.35E-05	1.11E-01	6.63E-02	4.51E-02	1.64E-03	3.18E-03	8.20E-02	1.98E-01
125-Sb	1.06E-07	8.75E-04	5.21E-04	3.54E-04	1.29E-05	2.49E-05	6.44E-04	1.56E-03
126-Sn	1.25E-05	1.03E-01	6.13E-02	4.16E-02	1.51E-03	2.93E-03	7.57E-02	1.83E-01
129-I	7.17E-08	5.90E-04	3.51E-04	2.39E-04	8.69E-06	1.68E-05	4.34E-04	1.05E-03
134-Cs	1.72E-10	1.41E-06	8.41E-07	5.71E-07	2.08E-08	4.03E-08	1.04E-06	2.51E-06
137-Cs	6.54E-02	5.38E+02	3.20E+02	2.18E+02	7.92E+00	1.53E+01	3.96E+02	9.57E+02
137m-Ba	5.82E-02	4.79E+02	2.85E+02	1.94E+02	7.05E+00	1.37E+01	3.53E+02	8.52E+02
14-C	4.33E-07	3.56E-03	2.12E-03	1.44E-03	5.24E-05	1.02E-04	2.62E-03	6.34E-03
151-Sm	1.09E-01	8.95E+02	5.33E+02	3.62E+02	1.32E+01	2.55E+01	6.59E+02	1.59E+03
152-Eu	1.32E-05	1.09E-01	6.48E-02	4.40E-02	1.60E-03	3.10E-03	8.01E-02	1.94E-01
154-Eu	1.87E-04	1.54E+00	9.18E-01	6.24E-01	2.27E-02	4.40E-02	1.13E+00	2.74E+00
155-Eu	5.74E-05	4.72E-01	2.81E-01	1.91E-01	6.95E-03	1.35E-02	3.48E-01	8.40E-01
226-Ra	3.09E-09	2.54E-05	1.51E-05	1.03E-05	3.74E-07	7.24E-07	1.87E-05	4.52E-05
227-Ac	1.35E-08	1.11E-04	6.64E-05	4.51E-05	1.64E-06	3.18E-06	8.20E-05	1.98E-04
228-Ra	2.52E-08	2.07E-04	1.24E-04	8.39E-05	3.05E-06	5.92E-06	1.53E-04	3.69E-04
229-Th	1.15E-10	9.43E-07	5.61E-07	3.81E-07	1.39E-08	2.69E-08	6.94E-07	1.68E-06
231-Pa	1.63E-08	1.34E-04	7.99E-05	5.43E-05	1.97E-06	3.82E-06	9.87E-05	2.39E-04
232-Th	4.33E-08	3.57E-04	2.12E-04	1.44E-04	5.25E-06	1.02E-05	2.62E-04	6.35E-04
232-U	3.11E-07	2.56E-03	1.52E-03	1.04E-03	3.77E-05	7.30E-05	1.88E-03	4.56E-03
233-U	1.98E-05	1.63E-01	9.70E-02	6.59E-02	2.40E-03	4.64E-03	1.20E-01	2.90E-01
234-U	4.26E-05	3.51E-01	2.09E-01	1.42E-01	5.16E-03	1.00E-02	2.58E-01	6.24E-01
235-U	1.85E-06	1.53E-02	9.09E-03	6.18E-03	2.25E-04	4.35E-04	1.12E-02	2.72E-02
236-U	4.14E-07	3.41E-03	2.03E-03	1.38E-03	5.02E-05	9.72E-05	2.51E-03	6.07E-03
237-Np	4.17E-06	3.43E-02	2.04E-02	1.39E-02	5.05E-04	9.78E-04	2.52E-02	6.10E-02
238-Pu	1.31E-04	1.08E+00	6.42E-01	4.36E-01	1.59E-02	3.07E-02	7.93E-01	1.92E+00
238-U	4.29E-05	3.53E-01	2.10E-01	1.43E-01	5.19E-03	1.01E-02	2.60E-01	6.28E-01
239-Pu	3.96E-03	3.26E+01	1.94E+01	1.32E+01	4.80E-01	9.30E-01	2.40E+01	5.80E+01
240-Pu	8.23E-04	6.77E+00	4.03E+00	2.74E+00	9.97E-02	1.93E-01	4.98E+00	1.20E+01
241-Am	1.10E-03	9.05E+00	5.39E+00	3.66E+00	1.33E-01	2.58E-01	6.66E+00	1.61E+01
241-Pu	2.20E-03	1.81E+01	1.08E+01	7.34E+00	2.67E-01	5.17E-01	1.33E+01	3.23E+01
242-Cm	1.56E-05	1.29E-01	7.66E-02	5.21E-02	1.89E-03	3.67E-03	9.47E-02	2.29E-01
242-Pu	2.26E-07	1.86E-03	1.11E-03	7.54E-04	2.74E-05	5.31E-05	1.37E-03	3.31E-03
243-Am	2.42E-07	1.99E-03	1.19E-03	8.07E-04	2.93E-05	5.69E-05	1.47E-03	3.55E-03
243-Cm	9.19E-07	7.56E-03	4.50E-03	3.06E-03	1.11E-04	2.16E-04	5.56E-03	1.35E-02
244-Cm	1.49E-05	1.23E-01	7.32E-02	4.98E-02	1.81E-03	3.51E-03	9.05E-02	2.19E-01
3-H	7.43E-07	6.11E-03	3.64E-03	2.47E-03	9.00E-05	1.74E-04	4.50E-03	1.09E-02
59-Ni	6.58E-05	5.41E-01	3.22E-01	2.19E-01	7.97E-03	1.54E-02	3.98E-01	9.63E-01
60-Co	1.76E-05	1.45E-01	8.64E-02	5.87E-02	2.14E-03	4.14E-03	1.07E-01	2.58E-01
63-Ni	3.07E-03	2.53E+01	1.51E+01	1.02E+01	3.72E-01	7.21E-01	1.86E+01	4.50E+01
79-Se	1.29E-07	1.06E-03	6.33E-04	4.31E-04	1.57E-05	3.03E-05	7.83E-04	1.89E-03
90-Sr	8.18E-01	6.73E+03	4.01E+03	2.72E+03	9.90E+01	1.92E+02	4.95E+03	1.20E+04
90-Y	8.18E-01	6.73E+03	4.01E+03	2.72E+03	9.90E+01	1.92E+02	4.95E+03	1.20E+04
93m-Nb	5.21E-05	4.29E-01	2.55E-01	1.74E-01	6.31E-03	1.22E-02	3.16E-01	7.63E-01
93-Zr	6.54E-05	5.39E-01	3.21E-01	2.18E-01	7.93E-03	1.54E-02	3.96E-01	9.58E-01
99-Tc	9.96E-06	8.20E-02	4.88E-02	3.32E-02	1.21E-03	2.34E-03	6.03E-02	1.46E-01
SUM		1.55E+04	9.21E+03	6.26E+03	2.28E+02	4.41E+02	1.14E+04	2.75E+04

APPENDIX D

INVENTORY UNCERTAINTY ESTIMATES

This page intentionally left blank.

APPENDIX D

INVENTORY UNCERTAINTY ESTIMATES

D.1 WMA C Closure Inventories (See Excel®[3] files attached)

D.2 Calculation Detail Report (See Excel® files attached)

D.3 BBI Template Uncertainties (See Excel® files attached)

[3] Excel® is a registered trademark of Microsoft Corporation, Redmond, Washington.