⑤ Sta. 4

MAY 18 1995

ENGINEERING DATA TRANSMITTAL

Page 1 of 8

1. EDT № 612066

2. To: (Receiving Organization) Information Resource Management	3. From: (Originating Organization) Waste Treatment Systems Engineering	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: 74930	6. Cog. Engr.: E. Q. Le	7. Purchase Order No.: N/A

8. Originator Remarks:
This EDT ~~implements~~ the Process Control Plan, providing a general description of activities which will take place during 242-A Evaporator Campaign 95-1. The Process Control Plan is also written to certify that the wastes in tanks 106-AP, 107-AP, 102-AW and 106-AW are acceptable for processing through evaporator.

9. Equip./Component No.: N/A

10. System/Bldg./Facility: 242-A Evaporator

11. Receiver Remarks:

12. Major Assm. Dwg. No.: N/A

13. Permit/Permit Application No.:

14. Required Response Date:

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Desig-nator	(G) Reason for Trans-mittal	(H) Origi-nator Dispo-sition	(I) Receiv-er Dispo-sition
1	WHC-SD-WM-PCP-010		0	Process Control Plan for 242-A Evaporator Campaign 95-1	ESQ	1	1	

16. KEY

Approval Designator (F)	Reason for Transmittal (G)	Disposition (H) & (I)
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION
(See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.
1	1	Cog. Eng. E. Q. Le		5/16/95	R1-43	Lead Cog. Eng.: B. H. Von Bargen		5/17/95	R1-43	1	1
1	1	Cog. Mgr. R. J. Nicklas		5/16/95							
1	1	QA ~~H. K. Aponda~~ R. R.		5-16-95							
1	1	Safety S. U. Zaman		5/16/95							
1	1	Env. M. W. Bowman	M W Bowman	5-18-95							
1	1	Operations. J. E. Geary		5/17/95							
1	1	Co-author. M. D. Guthrie		5/16/95	R1-43						

18. 5/16/95 Signature of EDT Originator Date	19. Authorized Representative for Receiving Organization Date	20. 5/16/95 Cognizant Manager Date	21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments

BD-7400-172-2 (04/94) GEF097

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED NW

MASTER

BD-7400-172-1

INSTRUCTIONS FOR COMPLETION OF THE ENGINEERING DATA TRANSMITTAL

(USE BLACK INK OR TYPE)

BLOCK	TITLE	
(1)*	EDT	● Pre-assigned EDT number.
(2)	To: (Receiving Organization)	● Enter the individual's name, title of the organization, or entity (e.g., Distribution) that the EDT is being transmitted to.
(3)	From: (Originating Organization)	● Enter the title of the organization originating and transmitting the EDT.
(4)	Related EDT No.	● Enter EDT numbers which relate to the data being transmitted.
(5)*	Proj./Prog./Dept./Div.	● Enter the Project/Program/Department/Division title or Project/Program acronym or Project Number, Work Order Number or Organization Code.
(6)*	Cognizant Engineer	● Enter the name of the individual identified as being responsible for coordinating disposition of the EDT.
(7)	Purchase Order No.	● Enter related Purchase Order (P.O.) Number, if available.
(8)*	Originator Remarks	● Enter special or additional comments concerning transmittal, or "Key" retrieval words may be entered.
(9)	Equipment/Component No.	● Enter equipment/component number of affected item, if appropriate.
(10)	System/Bldg./Facility	● Enter applicable system, building or facility number, if appropriate.
(11)	Receiver Remarks	● Enter special or additional comments concerning transmittal.
(12)	Major Assm. Dwg. No.	● Enter applicable drawing number of major assembly, if appropriate.
(13)	Permit/Permit Application No.	● Enter applicable permit or permit application number, if appropriate.
(14)	Required Response Date	● Enter the date a response is required from individuals identified in Block 17 (Signature/Distribution).
(15)*	Data Transmitted	
	(A)* Item Number	● Enter sequential number, beginning with 1, of the information listed on EDT.
	(B)* Document/Drawing No.	● Enter the unique identification number assigned to the document or drawing being transmitted.
	(C)* Sheet No.	● Enter the sheet number of the information being transmitted. If no sheet number, leave blank.
	(D)* Rev. No.	● Enter the revision number of the information being transmitted. If no revision number, leave blank.
	(E) Title or Description of Data Transmitted	● Enter the title of the document or drawing or a brief description of the subject if no title is identified.
	(F)* Approval Designator	● Enter the appropriate Approval Designator (Block 15). Also, indicate the appropriate approvals for each item listed, i.e., SQ, ESQ, etc.
	(G) Reason for Transmittal	● Enter the appropriate code to identify the purpose of the data transmittal (see Block 16).
	(H) Originator Disposition	● Enter the appropriate disposition code (see Block 16).
	(I) Receiver Disposition	● Enter the appropriate disposition code (see Block 16).
(16)	Key	● Number codes used in completion of Blocks 15 (G), (H), and (I), and 17 (G), (H) (Signature/Distribution).
(17)	Signature/Distribution	
	(G) Reason	● Enter the code of the reason for transmittal (Block 16).
	(H) Disposition	● Enter the code for the disposition (Block 16).
	(J) Name	● Enter the signature of the individual completing the Disposition 17 (H) and the Transmittal.
	(K)* Signature	● Obtain appropriate signature(s).
	(L)* Date	● Enter date signature is obtained.
	(M)* MSIN	● Enter MSIN. Note: If Distribution Sheet is used, show entire distribution (including that indicated on Page 1 of the EDT) on the Distribution Sheet.
(18)	Signature of EDT Originator	● Enter the signature and date of the individual originating the EDT (entered prior to transmittal to Receiving Organization). If the EDT originator is the cognizant engineer, sign both Blocks 17 and 18.
(19)	Authorized Representative for Receiving Organization	● Enter the signature and date of the individual identified by the Receiving Organization as authorized to approve disposition of the EDT and acceptance of the data transmitted, as applicable.
(20)*	Cognizant Manager	● Enter the signature and date of the cognizant manager. (This signature is authorization for release.)
(21)*	DOE Approval	● Enter DOE approval (if required) by signature or control number that tracks the approval to a signature, and indicate DOE action.

*Asterisk denote the required minimum items check by Configuration Documentation prior to release; these are the minimum release requirements.

EDT 612066

UNREVIEWED SAFETY QUESTION EVALUATION FORM

(Per WHC-IP-0842, 15.9)

Pg 2 of 8
Page 1 of 7

USQ Tracking Number: TF-95-0043

AREA: [x] East [] West

Facility: [x] 242-A [] DST [] SST [x] LERF [] Aging Waste

EQUIPMENT DESCRIPTION:

REFERENCE DOCUMENT(S):

ECN No.

PCA No.

Work Pkg No.

Other (Specify) EDT 612066

TITLE: PROCESS CONTROL PLAN FOR 242-A EVAPORATOR 95-1, WHC-SD-WM-PCP-010, Rev. 0

1. Does the PROPOSED CHANGE or DISCOVERY increase the probability of occurrence of an accident previously evaluated in the AUTHORIZATION BASIS documentation?

[xx] No [] Yes/Maybe

Basis: EDT 612066 does not increase the probability of any accident evaluated in the WHC-SD-WM-SAR-023, "242-A Evaporator/Crystallizer Safety Analysis Report", Rev. 1-B, Chapter 9 or WHC-SD-W105-SAR-001, Final Safety Analysis Report 242-A Evaporator Liquid Effluent Retention Facility", Rev. 0-C. The EDT implements the Process Control Plan to provide a general description of activities which will take place during 242-A Evaporator Campaign 95-1. The process control plan is also written to certify that the wastes in tanks 106-AP, 107-AP, 102-AW, and 106-AW are acceptable for processing through evaporator. The activities have no effect on the accidents described in Table 9-1, "Summary of Radiological Consequences".

The attached pages identify incorrect statements which need to be updated in the SAR involving process control at the 242-A Evaporator. The discoveries listed on the attached pages have no effect on the probability of the accidents described in Table 9-1, "Summary of Radiological Consequences".

UNREVIEWED SAFETY QUESTION EVALUATION FORM
(Continued)

2. Does the PROPOSED CHANGE or DISCOVERY increase the consequences of an accident previously evaluated in the AUTHORIZATION BASIS documentation?

[xx] No [] Yes/Maybe

Basis: EDT 612066 does not increase the consequences of any accident evaluated in the WHC-SD-WM-SAR-023, "242-A Evaporator/Crytallizer Safety Analysis Report", Rev. 1-B, Chapter 9 or WHC-SD-W105-SAR-001, Final Safety Analysis Report 242-A Evaporator Liquid Effluent Retention Facility", Rev. 0-C. The EDT implements the Process Control Plan to provide a general description of activities which will take place during 242-A Evaporator Campaign 95-1. The process control plan is also written to certify that the wastes in tanks 106-AP, 107-AP, 102-AW, and 106-AW are acceptable for processing through evaporator. The consequences of an radiological source term accident previously evaluated in the 242-A SAR and LERF SAR do not increase since the evaluation in the Process Control Plan has set the Waste Volume Reduction Factor such that the radiological source term cannot exceed the 242-A Evaporator and LERF Radiological Source Terms. Activities as described in the Process Control Plan have no effect on the accidents described in Table 9-1, "Summary of Radiological Consequences".

The attached pages identify incorrect statements which need to be updated in the SAR involving process control at the 242-A Evaporator. The discoveries listed on the attached pages have no effect on maintaining the DBA feed composition. The consequences of the accidents described in Table 9-1, "Summary of Radiological Consequences" are not impacted by these discoveries.

3. Does the PROPOSED CHANGE or DISCOVERY increase the probability of occurrence of a malfunction of EQUIPMENT previously evaluated in the AUTHORIZATION BASIS documentation?

[xx] No [] Yes/Maybe

Basis: EDT 612066 has no effect on the probability of a malfunction of ITS EQUIPMENT as described in the WHC-SD-WM-SAR-023, "242-A Evaporator/Crytallizer Safety Analysis Report", Rev. 1-B, Chapter 9 or WHC-SD-W105-SAR-001, Final Safety Analysis Report 242-A Evaporator Liquid Effluent Retention Facility", Rev. 0-C. The EDT implements the Process Control Plan to provide a general description of activities which will take place during 242-A Evaporator Campaign 95-1. The process control plan is also written to certify that the wastes in tanks 106-AP, 107-AP, 102-AW, and 106-AW are acceptable for processing through evaporator. The activities do not effect ITS EQUIPMENT at the 242-A Evaporator or at the Liquid Effluent Retention Facility.

The attached pages identify incorrect statements which need to be updated in the SAR involving process control at the 242-A Evaporator. The discoveries are specific to process control, and have no effect on ITS EQUIPMENT at the 242-A Evaporator.

EDT 612066
Pg 4 of 8

UNREVIEWED SAFETY QUESTION EVALUATION FORM
(Continued)

4. Does the PROPOSED CHANGE or DISCOVERY increase the consequences of a malfunction of ITS EQUIPMENT previously evaluated in the AUTHORIZATION BASIS documentation?

   [xx] No [] Yes/Maybe

   Basis: EDT 612066 has no effect on the consequences of a malfunction of ITS EQUIPMENT as described in the WHC-SD-WM-SAR-023, "242-A Evaporator/Crytallizer Safety Analysis Report", Rev. 1-B, Chapter 9 or WHC-SD-W105-SAR-001, Final Safety Analysis Report 242-A Evaporator Liquid Effluent Retention Facility", Rev. 0-C. The EDT implements the Process Control Plan to provide a general description of activities which will take place during 242-A Evaporator Campaign 95-1. The process control plan is also written to certify that the wastes in tanks 106-AP, 107-AP, 102-AW, and 106-AW are acceptable for processing through evaporator. The activities have no effect on ITS EQUIPMENT at the 242-A Evaporator or at the Liquid Effluent Retention Facility.

   The attached pages identify incorrect statements which need to be updated in the SAR involving process control at the 242-A Evaporator. The discoveries are specific to process control, and have no effect on ITS EQUIPMENT at the 242-A Evaporator.

5. Does the PROPOSED CHANGE or DISCOVERY create the possibility of an accident of a different type than any previously evaluated in the AUTHORIZATION BASIS documentation?

   [xx] No [] Yes/Maybe

   Basis: EDT 612066 does not create the possibility of an accident of a different type than previously evaluated in the WHC-SD-WM-SAR-023, "242-A Evaporator/Crytallizer Safety Analysis Report", Rev. 1-B, Chapter 9 or WHC-SD-W105-SAR-001, Final Safety Analysis Report 242-A Evaporator Liquid Effluent Retention Facility", Rev. 0-C. The EDT implements the Process Control Plan to provide a general description of activities which will take place during 242-A Evaporator Campaign 95-1. The process control plan is also written to certify that the wastes in tanks 106-AP, 107-AP, 102-AW, and 106-AW are acceptable for processing through evaporator. The activities do not effect accidents at the 242-A Evaporator or the Liquid Effluent Retention Facility.

   The attached pages identify incorrect statements which need to be updated in the SAR involving process control at the 242-A Evaporator. The discoveries listed on the attached pages will not effect accidents at the 242-A Evaporator.

EDT 612066
pg 5 of 8

UNREVIEWED SAFETY QUESTION EVALUATION FORM
(Continued)

6. Does the PROPOSED CHANGE or DISCOVERY create the possibility of a malfunction of EQUIPMENT of a different type than any previously evaluated in the AUTHORIZATION BASIS documentation?

[xx] No [] Yes/Maybe

Basis: EDT 612066 does not create the possibility of a malfunction of ITS EQUIPMENT of a different type than previously evaluated in the WHC-SD-WM-SAR-023, "242-A Evaporator/Crytallizer Safety Analysis Report", Rev. 1-B, Chapter 9 or WHC-SD-W105-SAR-001, Final Safety Analysis Report 242-A Evaporator Liquid Effluent Retention Facility", Rev. 0-C. The EDT implements the Process Control Plan to provide a general description of activities which will take place during 242-A Evaporator Campaign 95-1. The process control plan is also written to certify that the wastes in tanks 106-AP, 107-AP, 102-AW, and 106-AW are acceptable for processing through evaporator. The activities do not effect on ITS EQUIPMENTS at the 242-A Evaporator or the Liquid Effluent Retention Facility.

The attached pages identify incorrect statements which need to be updated in the SAR involving process control at the 242-A Evaporator. The discoveries are specific to process control, and have no effect on ITS EQUIPMENT at the 242-A Evaporator.

7. Does the PROPOSED CHANGE or DISCOVERY reduce the margin of safety as defined in the basis for any Technical Specification/Operational Safety Requirement?

[xx] No [] Yes/Maybe

Basis: EDT 612066 does not reduce the margin of safety as defined in the WHC-SD-WM-SAR-023, "242-A Evaporator/Crytallizer Safety Analysis Report", Rev. 1-B, Chapter 9 or WHC-SD-W105-SAR-001, Final Safety Analysis Report 242-A Evaporator Liquid Effluent Retention Facility", Rev. 0-C. The EDT implements the Process Control Plan to provide a general description of activities which will take place during 242-A Evaporator Campaign 95-1. The process control plan is also written to certify that the wastes in tanks 106-AP, 107-AP, 102-AW, and 106-AW are acceptable for processing through evaporator. The activities do not effect on the margin of safety as described in Table 9-1, "Summary of Radiological Consequences"

The attached pages identify incorrect statements which need to be updated in the SAR involving process control at the 242-A Evaporator. The discoveries are specific to process control, and have no effect on the margin of safety as described in Table 9-1, "Summary of Radiological Consequences". No OSR, SL, or LCO are modified.

EDT 612066
pg 6 of 8

UNREVIEWED SAFETY QUESTION EVALUATION FORM
(Continued)

Page 5 of 7

8. Does the PROPOSED CHANGE or DISCOVERY require a new or revised Technical Safety Requirement/Operational Safety Requirement or a compensatory measure required by a Compliance Implementation Plan?

[xx] No [] Yes/Maybe

Basis: EDT 612066 does not require a new or revised WHC-SD-WM-SAR-023, "242-A Evaporator/Crytallizer Safety Analysis Report", Rev. 1-B, Chapter 9 or WHC-SD-W105-SAR-001, Final Safety Analysis Report 242-A Evaporator Liquid Effluent Retention Facility", Rev. 0-C. The EDT implements the Process Control Plan to provide a general description of activities which will take place during 242-A Evaporator Campaign 95-1. The process control plan is also written to certify that the wastes in tanks 106-AP, 107-AP, 102-AW, and 106-AW are acceptable for processing through evaporator. The activities do not required a new or revised Operational Safety Requirement and has no effect on bounding accidents specified in the SAR, Chapter 9.

The attached pages identify incorrect statements which need to be updated in the SAR involving process control at the 242-A Evaporator. The discoveries are specific to process control, and have no effect on the accidents described in Table 9-1, "Summary of Radiological Consequences". No OSR, SL, or LCO are modified.

USQE No. 1 E. Q. Le
Print Name

Signature
Date 05/03/95

USQE No. 2 M. D. Guthrie
Print Name

Mike Guth
Signature
Date 5/3/95

PRC REVIEW (If Required)

Meeting No.: ____________ Date ____________

PRC Chairman Concurrence: ____________ Signature ____________ Date

SUPPLEMENTAL INFORMATION

Purpose of Unreviewed Safety Question (USQ) Evaluation

The USQ addresses the proposed changes to the SAR resulting from EDT 612066 to the Process Control Plan for 242-A Evaporator Campaign 95-1. In preparing this USQ, numerous incorrect statements were discovered in the SAR relating to process control at the 242-A Evaporator. This USQ addresses both the proposed changes and discoveries.

242-A Evaporator SAR Process Control References

Section 4.1.1.2

Table 4-7 in the SAR references Table 3-20 of the 242-A Evaporator Dangerous Waste Permit Application which includes an exotherm limit of 450 °F and nitrate/nitrite limit of 40 weight percent. Presently, the Process Control Plan, WHC-SD-WM-PCP-010, Rev. 0, specifies only an exotherm limit of 335 °F (Wahlquist 1993). Table 4-7 in the SAR should be corrected to reflect the limits presented in the Process Control Plan.

Table 4-8 in the SAR references Tables 3-13 through 3-17 of the 242-A Evaporator Dangerous Waste Permit Application. The Process Control Plan, WHC-SD-WM-PCP-010, Rev. 0 removed the Land Disposal Restrictions limits for slurry product (Von Bargen 1995). Table 4-8 of the SAR should be deleted.

Table 4-9 in the SAR references Table 3-22 of the 242-A Evaporator Dangerous Waste Permit Application. The limits in Table 3-22 have been modified (Von Bargen 1995). The errors have been corrected in the Process Control Plan, WHC-SD-WM-PCP-010, Rev. 0. Table 4-9 should be revised to include the correct limits listed in the Process Control Plan.

Table 4-10 in the SAR references Table 3-23 of the 242-A Evaporator Dangerous Waste Permit Application. Table 3-23 contains several constituents which were removed as limits from the Process Control Plan, WHC-SD-WM-PCP-010, Rev. 0 (Von Bargen 1995). Table 4-10 should be revised to include the correct limits listed in the Process Control Plan.

Section 4.1.3.1

Table 4-13 in the SAR references Table 3-12 of the 242-A Evaporator Dangerous Waste Permit Application. The Process Control Plan, WHC-SD-WM-PCP-010, Rev. 0 removed the Land Disposal Restrictions limits for slurry product (Von Bargen 1995). Table 4-13 of the SAR should be deleted.

Table 4-14 in the SAR reference Table 3-18 of the 242-A Evaporator Dangerous Waste Permit Application. The limits in the Table 3-18 listed in the Process Control Plan, WHC-SD-WM-PCP-010, Rev. 0, have been modified (Von Bargen 1995). Table 4-14 should be revised to reflect the current limit.

Section 6.1.1.1

The SAR states "Complexed Wastes are not pumped into TK-AW-102." The Tank Farm Waste Compatibility Program defines waste as complex when the total organic carbon concentration exceeds 10 g/L when evaporated to the double shell slurry feed product composition. The

EDT 612066
pg 8 of 8

UNREVIEWED SAFETY QUESTION EVALUATION FORM
(Continued)

compatibility program requires segregation of complex waste but does not preclude processing complex waste by the 242-A Evaporator (Fowler 1995). The waste content in tank 106-AW presently meet this definition of complex waste. Post-campaign sampling and analysis will be used to determine whether complexants are present in the material. This SAR should be revised to meet the current definition of complex waste.

REFERENCES

Aguirre, H., 1994, Final Safety Analysis Report 242-A Evaporator Liquid Effluent Retention Facility, WHC-SD-W105-001, Rev. 0-C, Westinghouse Hanford Company, Richland, Washington.

DOE/RL, 1991, 242-A Evaporator Dangerous Waste Permit Application, DOE/RL-90-42, Rev. 0, U.S. Department of Energy-Richland Operations Office, Richland, Washington.

Fowler, K. D., 1995, Tank Farm Waste Comptibility Program, WHC-SD-WM-OCD-015, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Lavender, 1994, 242-A Evaporator/Crystallizer Safety Analysis Report, WHC-SD-WM-SAR-023, Rev. 1-B, Westinghouse Hanford Company, Richland, Washington.

Von Bargen, B. H., 1995, 242-A Evaporator/Liquid Effluent Retention Facility Data Quality Objectives, WHC-SD-WM-DQO-014, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Wahlquist, R. A., 1993, Operating Specifications for The 242-A Evaporator-Crystallizer, OSD-T-151-00012, Rev D-1, Westinghouse Hanford Company, Richland, Washington.

RELEASE AUTHORIZATION

Document Number:	WHC-SD-WM-PCP-010, REV 0
Document Title:	Process Control Plan for 242-A Evaporator Campaign 95-1
Release Date:	5/18/95

This document was reviewed following the procedures described in WHC-CM-3-4 and is:

APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

Kara M. Broz

May 18, 1995

This report has been reproduced from the best available copy. Available in paper copy and microfiche. Printed in the United States of America. Available to the U.S. Department of Energy and its contractors from:

U.S. Department of Energy
Office of Scientific and Technical Information (OSTI)
P.O. Box 62
Oak Ridge, TN 37831
Telephone: (615) 576-8401

Available to the public from:
U.S. Department of Commerce
National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
Telephone: (703) 487-4650

SUPPORTING DOCUMENT

1. Total Pages ~~133~~ 237 cm 5/18/95

2. Title
Process Control Plan for 242-A Evaporator Campaign 95-1

3. Number
WHC-SD-WM-PCP-010

4. Rev No.
0

5. Key Words
242-A Evaporator, Process Control Plan, Run Plan, Campaign 95-1, Radiological Source Term, Compatibility

KMB 5/18/95 **APPROVED FOR PUBLIC RELEASE**

6. Author
Name: E. Q. Le
5/2/95
Signature
Co-Author Name: M. D. Guthrie 5/2/95
Organization/Charge Code 74930/N1179

7. Abstract
242-A Evaporator Campaign 94-2 will process approximately 2.51 million gallons of wastes from tanks 106-AP, 107-AP, 102-AW, and 106-AW. The process control plan describes activities which will occur during Campaign 95-1. The waste processibility is evaluated and addressed in the process control plan to ensure that (1) candidate feed wastes and slurry product are compatible with respect to 102-AW feed tank, 106-AW slurry receiver tank and evaporator requirements; (2) operations will be performed within evaporator and storage tank safety boundaries; (3) environmental and regulatory compliance is maintained.

~~8. PURPOSE AND USE OF DOCUMENT - This document was prepared for use within the U.S. Department of Energy and its contractors. It is to be used only to perform, direct, or integrate work under U.S. Department of Energy contracts. This document is not approved for public release until reviewed.~~

~~PATENT STATUS - This document copy, since it is transmitted in advance of patent clearance, is made available in confidence solely for use in performance of work under contracts with the U.S. Department of Energy. This document is not to be published nor its contents otherwise disseminated or used for purposes other than specified above before patent approval for such release or use has been secured, upon request, from the Patent Counsel, U.S. Department of Energy Field Office, Richland, WA.~~

~~DISCLAIMER - This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. 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. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.~~

9. Impact Level ESQ

10. RELEASE STAMP

OFFICIAL RELEASE
BY WHC
DATE MAY 18 1995
Sta. 4

A-6400-073 (11/91) (EF) WEF124

DISCLAIMER

CONTENTS

Page

1.0 INTRODUCTION 1

2.0 CAMPAIGN OBJECTIVE 2

3.0 WASTE SAMPLE ACQUISITION 3

- 3.1 Subsurface Sample Number Selection 3
- 3.2 Subsurface Sample Location Selection 3
- 3.3 Sampling 4

4.0 SAMPLE CHARACTERIZATION and DATA EVALUATION 5

- 4.1 Characterization Requirements 5
- 4.2 Analytical Results 5
- 4.3 Data Evaluation 5
- 4.4 Tank Sample Number Reassessment 6

5.0 WASTE PROCESSABILITY EVALUATION 7

- 5.1 Process Control Evaluation 7
  - 5.1.1 Watch List Tanks 7
  - 5.1.2 New Waste Streams 7
  - 5.1.3 Energetics 7
  - 5.1.4 Mixing and Compatibility 7
  - 5.1.5 Corrosivity 8
  - 5.1.6 Flammable Gas 8
  - 5.1.7 High Phosphate Waste 9
  - 5.1.8 Organic Complexants 9
  - 5.1.9 Transfer Line Plugging 11
  - 5.1.10 Transuranic Waste Segregation 11
  - 5.1.11 Heat Generation 11
  - 5.1.12 Separable Organic Layers 12

- 5.2 Safety Evaluation 12
  - 5.2.1 Tank Criticality 12
  - 5.2.2 Evaporator Radiological Source Term 13
  - 5.2.3 LERF Radiological Limits 13
  - 5.2.4 LERF Ammonia Industrial Hazard Limit 14
  - 5.2.5 Shield Design Limit 15

- 5.3 Environmental Compliance Evaluation 15
  - 5.3.1 Vessel Vent Organic Discharge Limits 15
  - 5.3.2 Gaseous Ammonia Discharge limit 16
  - 5.3.3 LERF Liner Limits 17
  - 5.3.4 LERF Ammonia Extremely Hazardous Waste Limit 17

CONTENTS (cont.)

Page

5.4.1 Gaseous Radiological Limits 18
5.4.2 Waste Profile for Campaign 95-1 Slurry 18

6.0 CAMPAIGN DESCRIPTION 18

6.1 Feed Inventories 18

6.2 Processing Activity Description 19

6.2.1 Campaign Duration 19
6.2.2 Normal Operation 19
6.2.3 106-AP to 108-AP Transfer 20
6.2.4 Air Lift Circulator Operation 20
6.2.5 Campaign Operating Strategy 20
6.2.6 Evaporator Vessel Flushing 21
6.2.7 Post-campaign Sludge Measurements 21

6.3 Sampling and Monitoring Requirements 21

6.3.1 Compliance Samples 21
6.3.2 Process Control Samples 22
6.3.3 Gaseous Effluent Monitoring 24
6.3.4 Liquid Effluent Monitoring 24
6.3.5 Quality Assurance 24

6.4 Product/Waste Disposition 25

7.0 REFERENCES 26

APPENDICES

A. INDEX OF TECHNICAL OPERATING CONTROLS A-1

B. 242-A EVAPORATOR LIMITS B-1

C. SAMPLE IDENTIFICATION AND ANALYSIS REQUIREMETNS C-1

D. TANK 241-AP-106 ANALYTICAL RESULTS AND DATA EVALUATION D-1

E. TANK 241-AP-107 ANALYTICAL RESULTS AND DATA EVALUATION E-1

F. TANKS 102-AW AND 106-AW CHARACTERIZATION ANALYSES F-1

G. CAMPAIGN 95-1 FEED COMPOSITE DATA G-1

H. COMPARISON OF CAMPAIGN 95-1 TO 242-A EVAPORATOR LIMITS H-1

I. CALCULATIONS I-1

J. PREDICTS RUNS J-1

K. REFERENCE LETTERS K-1

TABLES

B-1. Miscellaneous 242-A Evaporator Feed Limits B-3
B-2. Evaporator Feed Limits for LERF Liner Compatibility B-4
B-3. Evaporator Feed Limits for Vessel Vent Organic Discharge B-5
B-4 Process Condensate Chemical Limits B-6
B-5. Process Condensate DCGs B-8
B-6. 242-A Evaporator Radiological Source Term B-9
B-7. Double-Shell Tank Waste Corrosion Specifications B-10
B-8. Steam Condensate and Cooling Water Radionuclide Limits B-11
B-9. Vessel Vent Radionuclide Limits B-12
C-1. Tank 106-AP Sampling Information C-3
C-2. Tank 242-AP-106 Samples and the Analytes Requested C-4
C-3. Tank 107-AP Sampling Information C-5
C-4. Tank 242-AP-107 Samples and the Analytes Requested C-6
C-5. Tank 106-AW Sampling Information C-7
D-1. Tank 241-AP Analytical Data: Aluminum D-3
D-2. Tank 241-AP Analytical Data: Sodium D-3
D-3. Tank 241-AP Analytical Data: Fluoride D-4
D-4. Tank 241-AP Analytical Data: Hydroxide D-4
D-5. Tank 241-AP Analytical Data: Phosphate D-5
D-6. Tank 241-AP Analytical Data: Sulfate D-5
D-7. Tank 241-AP Analytical Data: Nitrate D-6
D-8. Tank 241-AP Analytical Data: Nitrite D-6
D-9. Tank 241-AP Analytical Data: Uranium D-7
D-10. Tank 241-AP Analytical Data: Specific Gravity D-7
D-11. Tank 241-AP Analytical Data: pH D-8
D-12. Tank 241-AP Analytical Data: Ammonia D-8
D-13. Tank 241-AP Analytical Data: Total Organic Carbon D-8
D-14. Tank 241-AP Analytical Data: Surface Total Organic Carbon D-9
D-15. Tank 241-AP Analytical Data: Total Carbon D-9
D-16. Tank 241-AP Analytical Data: Total Inorganic Carbon D-9
D-17. Tank 241-AP Analytical Data: DSC-Exotherm D-10
D-18. Tank 241-AP Analytical Data: DSC-Endotherm D-10
D-19. Tank 241-AP Analytical Data: Water Weight Percent D-10
D-20 Tank 241-AP Analytical Data: Visual Appearance/Dose Rate D-11
D-21. Tank 241-AP Analytical Data: Total Alpha D-11
D-22. Tank 241-AP Analytical Data: Total Beta D-11
D-23. Tank 241-AP Analytical Data: Tritium D-12
D-24. Tank 241-AP Analytical Data: Carbon-14 . . . . D-12
D-25. Tank 241-AP Analytical Data: Cobalt-60 . . . . D-13
D-26. Tank 241-AP Analytical Data: Selenium-79 . . . . D-13
D-27. Tank 241-AP Analytical Data: Strontium-90 . . . . D-14
D-28. Tank 241-AP Analytical Data: Niobium-94 . . . . D-14
D-29. Tank 241-AP Analytical Data: Technetium-99 . . . . D-15
D-30. Tank 241-AP Analytical Data: Ruthenium-106 . . . . D-15
D-31. Tank 241-AP Analytical Data: Iodine-129 . . . . D-16
D-32. Tank 241-AP Analytical Data: Cesium-134 . . . . D-16
D-33. Tank 241-AP Analytical Data: Cesium-137 . . . . D-17
D-34. Tank 241-AP Analytical Data: Cerium-144 . . . . D-17
D-35. Tank 241-AP Analytical Data: Europium-154 . . . . D-18
D-36. Tank 241-AP Analytical Data: Europium-155 . . . . D-18
D-37. Tank 241-AP Analytical Data: Radium-226 . . . . D-18

TABLES (cont.)

D-38. Tank 241-AP Analytical Data: Neptunium-273 . . . . D-19
D-39. Tank 241-AP Analytical Data: Plutonium-238 . . . . D-19
D-40. Tank 241-AP Analytical Data: Plutonium-239/240 . . . . D-20
D-41. Tank 241-AP Analytical Data: Americium-241 . . . . D-20
D-42. Tank 241-AP Analytical Data: Curium-244 . . . . D-21
D-43. Tank 241-AP Analytical Data: Acetone D-21
D-44. Tank 241-AP Analytical Data: 1-Butanol D-22
D-45. Tank 241-AP Analytical Data: 2-Butoxyethanol D-22
D-46. Tank 241-AP Analytical Data: 2-Butanone D-23
D-47. Tank 241-AP Analytical Data: Tributylphosphate D-23
D-48. Tank 241-AP Analytical Data: 2-Hexanone D-24
D-49. Tank 241-AP Analytical Data: 2-Pentanone D-24
D-50. Tank 241-AP Analytical Data: MIBK D-24
D-51. Tank 241-AP Analytical Data: Tetrahydrofuran D-25
E-1. Tank 241-AP Analytical Data: Aluminum E-3
E-2. Tank 241-AP Analytical Data: Sodium E-3
E-3. Tank 241-AP Analytical Data: Fluoride E-3
E-4. Tank 241-AP Analytical Data: Hydroxide E-4
E-5. Tank 241-AP Analytical Data: Phosphate E-4
E-6. Tank 241-AP Analytical Data: Sulfate E-5
E-7. Tank 241-AP Analytical Data: Nitrate E-5
E-8. Tank 241-AP Analytical Data: Nitrite E-6
E-9. Tank 241-AP Analytical Data: Uranium E-6
E-10. Tank 241-AP Analytical Data: Specific Gravity E-7
E-11. Tank 241-AP Analytical Data: pH E-7
E-12. Tank 241-AP Analytical Data: Ammonia E-7
E-13. Tank 241-AP Analytical Data: Total Organic Carbon E-8
E-14. Tank 241-AP Analytical Data: Surface Total Organic Carbon E-8
E-15. Tank 241-AP Analytical Data: Total Carbon E-8
E-16. Tank 241-AP Analytical Data: Total Inorganic Carbon E-9
E-17. Tank 241-AP Analytical Data: DSC-Exotherm E-9
E-18. Tank 241-AP Analytical Data: DSC-Endotherm E-9
E-19. Tank 241-AP Analytical Data: Water Weight Percent E-10
E-20 Tank 241-AP Analytical Data: Visual Appearance/Dose Rate E-10
E-21. Tank 241-AP Analytical Data: Total Alpha E-10
E-22. Tank 241-AP Analytical Data: Total Beta E-11
E-23. Tank 241-AP Analytical Data: Tritium E-11
E-24. Tank 241-AP Analytical Data: Carbon-14 . . . . E-11
E-25. Tank 241-AP Analytical Data: Cobalt-60 . . . . E-12
E-26. Tank 241-AP Analytical Data: Selenium-79 . . . . E-12
E-27. Tank 241-AP Analytical Data: Strontium-90 . . . . E-12
E-28. Tank 241-AP Analytical Data: Niobium-94 . . . . E-13
E-29. Tank 241-AP Analytical Data: Technetium-99 . . . . E-13
E-30. Tank 241-AP Analytical Data: Ruthenium-106 . . . . E-13
E-31. Tank 241-AP Analytical Data: Iodine-129 . . . . E-14
E-32. Tank 241-AP Analytical Data: Cesium-134 . . . . E-14
E-33. Tank 241-AP Analytical Data: Cesium-137 . . . . E-14
E-34. Tank 241-AP Analytical Data: Cerium-144 . . . . E-15
E-35. Tank 241-AP Analytical Data: Europium-154 . . . . E-15
E-36. Tank 241-AP Analytical Data: Europium-155 . . . . E-15
E-37. Tank 241-AP Analytical Data: Radium-226 . . . . E-16

TABLES (cont.)

E-38. Tank 241-AP Analytical Data: Neptunium-273 . . . . E-16
E-39. Tank 241-AP Analytical Data: Plutonium-238 . . . . E-16
E-40. Tank 241-AP Analytical Data: Plutonium-239/240 . . . . E-17
E-41. Tank 241-AP Analytical Data: Americium-241 . . . . E-17
E-42. Tank 241-AP Analytical Data: Curium-244 . . . . E-17
E-43. Tank 241-AP Analytical Data: Acetone E-18
E-44. Tank 241-AP Analytical Data: 1-Butanol E-18
E-45. Tank 241-AP Analytical Data: 2-Butoxyethanol E-19
E-46. Tank 241-AP Analytical Data: 2-Butanone E-19
E-47. Tank 241-AP Analytical Data: Tributylphosphate E-20
E-48. Tank 241-AP Analytical Data: 2-Hexanone E-20
E-49. Tank 241-AP Analytical Data: 2-Pentanone E-20
E-50. Tank 241-AP Analytical Data: MIBK E-21
E-51. Tank 241-AP Analytical Data: Tetrahydrofuran E-21
F-1. Tanks 102-AW and 106-AW Inorganic Data F-1
F-2. Tanks 102-AW and 106-AW Radionuclide Data F-2
G-1. Campaign 95-1 Inorganic Feed Composite G-1
G-2. Campaign 95-1 Radionuclide Feed Composite G-2
G-3. Largest Organic Constituent in Campaign Feed Tanks G-3
H-1. Comparison of Miscellaneous 242-A Evaporator Feed Limits to Campaign 95-1 . . . . H-3
H-2. Comparison of Tank 106-AP Composition to Evaporator Feed Limits for Organic LERF Acceptance H-4
H-3. Comparison of Tank 107-AP Composition to Evaporator Feed Limits for Organic LERF Acceptance H-5
H-4. Comparison of Tank 106-AP Composition to Evaporator Feed Limits Based on Volatile Emissions H-6
H-5. Comparison of Tank 107-AP Composition to Evaporator Feed Limits Based on Volatile Emissions H-7
H-6. Comparison of Tank 106-AP Radionuclide Concentrations to Radiological Source Term H-8
H-7. Comparison of Tank 107-AP Radionuclide Concentrations to Radiological Source Term H-9
H-8. Comparison of Tank 102-AW Radionuclide Concentrations to Radiological Source Term H-10
H-9. Comparison of Tank 106-AW Radionuclide Concentrations to Radiological Source Term H-11
H-10. Comparison of Campaign Feed Radionuclide Concentrations to Radiological Source Term H-12
H-11. Comparison of Projected Slurry Concentrations to Radiological Source Term H-13
H-12. Comparison of Projected Process Condensate Concentrations to LERF Radiological Limits H-14
H-13. Comparison of Candidate tanks, Feed, and Projected Slurry Concentrations to DST Corrosion Specifications H-16
H-14. Comparison of Projected Vessel Vent Discharge to Vessel Vent Radionuclide Limits H-17

LIST OF TERMS

ACW	242-A cooling water
ALC	airlift circulator
APC	242-A process condensate
ASC	242-A steam condensate
CAM	continuous air monitor
DCG	derived concentration guide
DSC	differential scanning calorimetry
DDSSF	dilute double-shell slurry feed
DST	Double Shell Tank
EDMC	Environmental Data Management Center
EPA	Environmental Protection Agency
ETF	Effluent Treatment Facility
FD-A	242-A feed
ICP	inductively coupled plasma
LERF	Liquid Effluent Retention Facility
LIMS	Laboratory Information Management System
MCS	monitor and control system
NCRW	neutralized cladding removal waste
ND	not detectable
PM	preventive maintenance
PPM	part per million
SAR	safety analysis report
semi-VOA	semivolatile organic analysis
SLY-A	242-A slurry
SPG	specific gravity
TIC	total inorganic carbon
TOC	total organic carbon
TRU	transuranic
VOA	volatile organic analysis
WVRF	waste volume reduction factor

PROCESS CONTROL PLAN FOR 242-A EVAPORATOR CAMPAIGN 95-1

1.0 INTRODUCTION

The wastes from tanks 106-AP, 107-AP, and 106-AW have been selected to be candidate feed wastes for Evaporator Campaign 95-1. The wastes in tank 106-AP and 107-AP are primarily from B-Plant strontium processing and PUREX neutralized cladding removal, respectively. The waste in tank 106-AW originated primarily from the partially concentrated product from 242-A Evaporator Campaign 94-2. Approximately 8.67 million liters (2.29 Mgal) of waste from these tanks will be transferred to tank 102-AW during the campaign. Tank 102-AW is the dedicated waste feed tank for the evaporator and currently contains 647,000 liters (171 Kgal) of processable waste.

The purpose of the 242-A Evaporator Campaign 95-1 Process Control Plan (hereafter referred to as PCP) is to certify that the wastes in tanks 106-AP, 107-AP, 102-AW, and 106-AW are acceptable for processing through evaporator and provide a general description of process strategies and activities which will take place during Campaign 95-1. The PCP also summarizes and presents a comprehensive characterization of the wastes in these tanks.

The PCP is required to be prepared prior to the campaign according to the requirements and authority for preparing, reviewing, and releasing in *WHC-IP-0842, Section 8.12, Process Control Plans* (WHC 1993). The processibility of the candidate feed wastes is addressed in the PCP as directed by the *242-A Evaporator - Liquid Effluent Retention Data Quality Objectives, (DQO) WHC-SD-WM-DQO-014* (Von Bargen 1995). The processibility is evaluated to ensure that (1) candidate feed wastes and slurry product are compatible with respect to 102-AW feed tank, 106-AW slurry receiver tank and evaporator requirements; (2) operations will be performed within evaporator, LERF, and storage tank safety boundaries; (3) environmental and regulatory compliance is maintained.

Campaign 95-1 will be the third operating run of the 242-A Evaporator since the B-534 upgrade following the completion of two successful campaigns in 1994 and will also be the first operation of the 242-A evaporator since the completion of the process condensate recycle system. The recycle system was installed during precampaign 95-1 scheduled outage and is designed to minimize process condensate to be discharged to Liquid Effluent Retention Facility (LERF). This is accomplished by eliminating water addition and re-using process condensate for feed and slurry pump seal water and deentrainer pad spray systems. Therefore, a process condensate to waste volume reduction ratio is anticipated to be better (smaller) for this campaign than any past campaigns.

The LERF basin 42 will continue to be used for interim storage of process condensate from the evaporator campaign 95-1. LERF basin 44 will be maintained as emergency/contingency space. The LERF OSD (Johnson 1995) requires a total of 25.5 million liters (6.75 Mgal) of contingency volume in case of failure of a single LERF basin. The combined volume of the three basin is 76.6 million liters (20.25 Mgal), so a maximum volume of 51.1 million liters (13.5 Mgal) of process condensate can be stored in the three LERF basins. As of May 12, 1995, the LERF Basins contain a total of 30.7 million liters (8.1 Mgal) (Basin 42: 0.4 Mgal, Basin 43: 6.2 Mgal and Basin 44: 1.5 Mgal). Campaign 95-1 is expected to generate a maximum of 10.6 million liters (2.8 Mgal). Therefore, the total volume in the basins after the campaign will be at a maximum of 41.3 million liters (10.9 Mgal), which is less than the 51.1 million liters (13.5 Mgal) limit.

2.0 CAMPAIGN OBJECTIVE

Campaign 95-1 will process approximately 9.31 million liters (2.46 Mgal) of waste from tanks 106-AP, 107-AP, 106-AW and 102-AW with a minimum projected waste volume reduction factor (WVRF) of 85% WVRF and with a possible maximum WVRF of 90%.

Because campaign 95-1 feed exceeds the 10 g/L TOC definition of complexed waste, the WVRF will be limited to the saturation point of nitrite/nitrate salts, as required by the Tank Farm Waste Compatibility Program (Fowler 1995). The final WVR is estimated to range between 85% to 90% and will be determined by Predict analysis of process control samples taken during evaporator operation.

Based on current characterization data from campaign feed tanks and the assessment presented in Section 5 of this PCP, transfer of wastes from tank 106-AP, 107-AP, and 106-AW to evaporator feed tank 102-AW can be proceed with respect to compatibility of the wastes to be mixed. Since tank 106-AP is equipped with a flex and float pump, waste in tank 106-AP will be transferred to tank 108-AP, prior to the start of the campaign. This will allow blending capability necessary for evaporator process control. It should be noted that throughout this document, discussion of 106-AP to 102-AW transfers refers to 106-AP transfer via 108-AP to tank 102-AW.

The Predict computer model indicates that the waste in tanks 106-AP, 107-AP, and 102-AW are non-complexed and waste in tank 106-AW is complex. The segregation of complex waste is not a safety issue and would yield only a small WVR benefit for this campaign. Wastes in these tanks will be processed together to maximize operational efficiency and minimize activities such as additional sampling, jumper changes, flushing, extension of campaign duration, etc.

Based on characterization data for tank 107-AP, the waste has been identified to contain very high ammonia concentrations. To ensure the ammonia gas released out the vessel vent is maintained within specifications during initial start-up, the evaporator vessel will be initially filled with water or 102-AW waste prior to transferring 107-AP waste into tank 102-AW for feed staging.

The laboratory boildown studies for this campaign indicate severe foaming at 50% WVR. To prevent potential process fluid carry over into TK-C-100 and potential evaporator shutdowns caused by high deentrainment pad differential pressure, anti-foam chemicals will be continuously added throughout the campaign.

Throughput for this campaign is estimated to range from 16.2 to 17.1 million liters (4.27 to 4.52 Mgal). The processing time for the campaign is forecasted to range from 41 to 43 days, which includes downtime for final pass waste staging and maintenance.

The slurry product from this campaign will be complexed dilute double-shell slurry feed (DDSSF) waste based on the Predict computer model (Allision 1984). Slurry product at the completion of the campaign is estimated to be 0.931 to 1.40 million liters (246 to 369 Kgal) of DDSSF and will be stored in tank 106-AW. It is estimated that approximately 9.8 - 10.6 million liters (2.6 - 2.8 Mgal) of process condensate will be transferred to LERF. Both slurry product and process condensate radionuclide concentrations are predicted to be far below the safety limits. The calculations and assumptions used to arrive at the campaign WVRF, throughput, duration, and process condensate output are contained in Appendix I.

LERF Basin 42 currently contains 1.5 million liters (0.4 Mgal) and will be used for storage of Campaign 95-1 process condensate. Evaporator campaign 95-1 will run with the ion exchange column off-line and process condensate recycle system on-line.

3.0 WASTE SAMPLE ACQUISITION

3.1 Subsurface Sample Number Selection

The number of subsurface sampling locations for tanks 106-AP and 107-AP was determined by the results of the power curve analysis. With respect to the fill history and contents of tanks 106-AP and 107-AP, it was determined that three subsurface sampling locations from tank 106-AP and five from tank 107-AP would adequately represent the organic, inorganic and radionuclide character of these tanks (I.M #71330-94-001 and I.M #71330-94-002).

The waste in tank 106-AW is the partially processed waste from campaign 94-2. Most of volatile organic compounds were boiled off during the campaign. The logical assumption was made to neglect acetone concentration from determination of minimum number samples. The ammonia, hydroxide, nitrite, nitrate, strontium-90, cesium-137, and plutonium-239/240 concentrations from slurry sample T1648 were used to determined the minimum number samples required for 106-AW boildown study analysis. Based on power curves presented in appendix 7A of the Evaporator DQO (Von Bargen 1994), it was determined that two samples were required for Tank 106-AW Boildown.

3.2 Subsurface Sample Location Selection

The subsurface sampling locations from available risers of each tank were selected to get an estimate of the tank spatial variability. At each subsurface sampling location, four sample bottles were drawn: one for volatile analysis, one for semivolatile analysis, one for inorganic and radionuclide analyses, one for boildown and mixing study analyses.

A review of available tank riser details (Anderson 1991) and field verification indicated that three tank risers for tanks 106-AP, 107-AP, and two risers for tank 106-AW were available for subsurface sampling for tanks.

Two of three available risers from tank 106-AP were randomly selected using the random number generator from HEWLETT-PACKARD 15C (Hewlett-packard, 1987). These risers are at a radius of 20 feet from the tank's center and at a distance of 34.6 feet from each other. Within the 409.8 inches of supernatant liquid height, two subsurface sample elevations (height above tank bottom) from the first riser were randomly selected. One was at the middle of the upper half of the tank and the other was at the middle of the lower half. The third subsurface elevation from the second riser was selected randomly. The three subsurface sample point locations are identified in Table C-1.

The three available risers from tank 107-AP are equally spaced and situated 120 degrees apart at a radius of 20 feet from the tank's center. Within the 362.3 inches of supernatant liquid height, five subsurface sampling locations were randomly selected in such a way that one sample location was from the top half and the other from the bottom half for the first two risers. The five subsurface sample point locations are identified in Table C-3.

From the two available risers in tank 106-AW, the riser 16B was chosen since it is closest to the lowest sludge level in the tank. Sampling locations listed in Table C-5 were selected between 52 inches of sludge and 204.4 inches of supernatant liquid to maximize waste spacial variability for Tank 106-AW.

3.3 Sampling

Sampling from campaign 95-1 candidate feed tanks was performed as directed by Tank Characterization Plans (Schreiber 1994 & 1995) and Work Package ES-95-00088/W. Thirteen samples from tank 106-AP, seventeen from tank 107-AP, and two from tank 106-AW were sampled on November 14 through November 17, 1994, on January 30 through February 2, 1995, and on March 09, 1995, respectively. These tank samples were collected by the "bottle-on-a-string" method. For tanks 106-AP and 107-AP, three field blanks and two trip blanks were also collected to provide an indication of contamination from sample collection, transport, preparation or extraction, and analysis. Sample identifications for the campaign tanks are presented in Appendix C.

For ALARA purposes, adherence to SW-846 criteria such as refrigeration and no headspace was not possible during the sampling.

4.0 SAMPLE CHARACTERIZATION AND DATA EVALUATION

4.1 CHARACTERIZATION REQUIREMENTS

Waste in tank 106-AP was previously characterized for the Grout program (Giamberardini 1993). To minimize characterization cost for evaporator campaign 95-1, the 106-AP Grout data was assessed and data usable was utilized in the PCP (I.M #71330-94-003). The additional analyses of waste content in tank 106-AP required to be conducted is summarized in Table C-2.

No prior sampling had been conducted on 107-AP waste although compatibility analyses of contributions to this waste tank were on record (7CF10-042-094). A full characterization was required and is presented in Table C-4.

Except for the boildown analysis for tank 106-AW, no characterization was required since process analysis of this tank was available from the evaporator campaign 94-2 slurry sample T1648.

4.2 ANALYTICAL RESULTS

Analytical results for tanks 106-AP, 107-AP, 102-AW, and 106-AW are contained in Appendices D, E, and F. The data packages for the tanks 106-AP and 107-AP characterization may be obtained from the Environmental Data Management Center (EDMC). Analyses for the samples from tanks 102-AW and 106-AW may be obtained from the Laboratory Information Management System (LIMS).

When a sample analysis failed to detect a specific analyte, the detection limit was preceded by a less than (<) sign and recorded as the sample result. In cases where a duplicate analysis was performed on a sample, the sample data result was presented by calculating an average concentration value from the original and duplicate result. When an analyte was not detected by the original and duplicate sample, the highest detection limit was used to present the sample data result.

4.3 DATA EVALUATION

Representive tank concentrations are statistically determined and documented in Appendices D and E for tanks 106-AP and 107-AP, respectively. If tank sample results were all reported as "less than" values for a specific analyte, then the highest "less than" value was used as the tank concentration. If both detected and undetected sample results were reported for an analyte, the undetected results were not used in calculating the average for a representation tank concentration. For inorganic and radionuclide sample results reported above laboratory detection limits, the representive tank concentration of the corresponding analyte was obtained by calculating arithmetic means from sample results. For organic sample results reported above laboratory detection limits, the representive tank concentration is obtained by calculating an upper 90 percent confidence interval from sample results.

All analytical data results for 106-AP and 107-AP were reviewed against the requirements of data precision and accuracy defined in *WHC-SD-WM-QAPP-009, Rev. 1* (Tucker 1994). If a sample data result exceeded the criteria, it was not utilized to calculate means or corresponding standard errors. In addition, the analytical data results for 106-AP and 107-AP were also tested against Q rejection criteria (Day and Underwood, 1980). The Q-test with 90% confidence is a statistically acceptable method which allows the erroneous data to be discarded. If a sample data result was determined to be erroneous by Q-test, it was not utilized to calculate the mean.

The field blank contamination for tanks 106-AP and 107-AP was evaluated by comparison to the reagent blank or preparation blank run at the same time. Since the concentration of each contaminate analyte was less than 5% of the action level and of the feed tank average sample result, it was determined that the concentrations of contaminant analytes were negligible.

The inorganic and radionuclide composite concentrations for evaporator feed were based proportionally to the processable volumes in campaign 95-1 tanks. The inorganic and radionuclide compositions for evaporator feed listed in Tables G-1 and G-2 were estimated using volumetric ratios of 37.57% for 106-AP, 36.86% for 107-AP, 6.69% for 102-AW, and 18.88% for 106-AW.

4.4 TANK SAMPLE NUMBER REASSESSMENT

The reassessment of the number of samples for tanks 106-AP and 107-AP is necessary to determine whether adequate samples were actually collected. The minimum number of samples that should have been collected are statistically determined by the Decision Error Feasibility Trials (DEFT) computer model. The DEFT computer model (EPA, 1994) is designed to determine a minimum number of samples needed to represent concentrations in a waste tank. DEFT computer model computes the minimum required number of samples based on the mean concentration, sample variability, and constraint of each analyte of concern.

The power curve analysis was performed on 106-AP and 107-AP data using DEFT computer model. It was determined that the number of samples collected in these tanks met or exceeded the minimum number of samples required per Figure 7-2 of the DQO (Von Bargen 1995). Copies of the internal letters addressing the verification of sample numbers for tanks 106-AP and 107-AP can be found in Appendix K.

5.0 WASTE PROCESSABILITY EVALUATION

Evaluation of the processability of wastes from tanks 106-AP, 107-AP, 102-AW, 106-AW is addressed in this section. These tanks hereafter are referred to as campaign feed tanks. The evaluation also addresses waste compatibility with the feed tank, slurry tank, and Evaporator requirements. It also identifies concerns and resolves potential process control problems.

5.1 PROCESS CONTROL EVALUATION

5.1.1 Watch List Tanks

Waste contained in a Watch List Tank in the Double-Shell Tank (DST) systems shall be isolated to prevent inadvertent commingling with other wastes. The Watch List Tanks have an Unreviewed Safety Question (USQ) because of the potential consequences of radiological release resulting from uncontrolled increases in temperature and pressure. A review of The *Tank Farm Surveillance and Waste Status Summary Report for January 31, 1994*, WHC-EP-182-82 (Hanlon 1995), indicates the campaign feed tanks are not watch list tanks.

5.1.2 New Waste Streams

New waste streams sent to the tank farms from new or significantly modified chemical processes implemented at a facility shall be accepted only after issuing an approved tank farm flowsheet. No new waste types are generated within the 241-AP and 241-AW Double-Shell Tank (DST) systems or by the 242-A Evaporator facility. Slurry waste stream from the 242-A Evaporator is not a new waste source per the approved *Vacuum Evaporator-Crystallizer Flowsheet for Waste Liquors*, ARH-F-101 (Vandercook 1976).

5.1.3 Energetics

Wastes that exhibit exothermic reactions at less than 335 °F shall be segregated and/or mixed with waste that exhibit the same reactivity. An exotherm exists when a material stores a large quantity of energy in the form of chemical energy or physical strain which is released when the material is heated. Wastes that exhibit exotherms indicate the potential for self-heating and could enter into a propagating chemical reaction. The differential scanning calorimetry (DSC) analysis performed on wastes in campaign feed tanks and campaign composite detected no exotherms below the limit of 335 °F.

Wastes that exhibit energy releases from exotherms in excess of the energy absorption from endotherms shall be segregated from all other wastes. The net energy available for heating the waste from an exothermic chemical reaction is greatly diminished by endotherms. If the endotherms are greater, then a propagating reaction would be inhibited. Base on laboratory thermal analysis on campaign feed tanks and campaign composite sample conducted up to 932 °F, the absolute value of the exotherm/endotherm ratio is well below the ratio limit of 1.

The thermal analysis results for campaign feed tanks can be found in Appendices D, E and F. The thermal analysis results for the campaign composite can be found in Appendix K.

5.1.4 Mixing and Compatibility Study

A mixing and compatibility study was performed on a composite of the feed for this campaign to ensure the waste compatibility and provide data to establish processing controls. The samples were mixed with no apparent changes in color, temperature, clarity, or any visually determinable characteristic (Beck 1995). The letter containing the results from the mixing and compatibility study can be found in Appendix K.

5.1.5 Corrosivity

Waste that do not meet tank corrosivity limits should not be transferred to tank farms. The nitrate, nitrite and hydroxide concentrations are limited in order to inhibit uniform corrosion rates and stress corrosion cracking in the DST. The nitrate, nitrite and hydroxide concentrations for tanks 106-AP, 107-AP, 102-AW, and 106-AW are within in the tank corrosion boundary limits. The comparison of campaign feed tanks to DST waste corrosion specifications can be found in Appendix H, Table H-13.

The combined waste from campaign feed tanks was evaluated in regards to tank corrosion controls and limits. It is determined that the campaign feed composite will be in compliance with applicable OSD limits. An estimation of hydroxide concentration for campaign feed composite was derived from assuming conservatively that all of the carbonate and phosphate exists in the waste as bicarbonate and biphosphate. When a waste containing bicarbonate and biphosphate is mixed in the tank farms, some amount of hydroxide will be consumed to convert acidic ions such as bicarbonate and biphosphate to their conjugate base forms of carbonate and phosphate respectively. This results in a lower hydroxide concentration than would be predicted assuming simple mixing with no buffering. Calculation of hydroxide concentration for campaign feed composite can be found in Appendix I.

The nitrate, nitrite and hydroxide concentrations from slurry product at 90% WVR were compared against double shell tank waste corrosion specifications listed Table B-7. The nitrate molar concentration for the slurry product is estimated by Predict to be at 1.70 M. This concentration places condition 2 (table B-7) into effect. Under condition 2, the boundary condition for hydroxide concentrations (3.26 M) is within limits because it is greater than the lower limit of 0.1 x $[NO_3]$ or 0.170 M and less than the upper limit of 10M. The combined hydroxide and nitrite concentration (4.09 M) is within the limit since it is greater than the lower limit of 0.4 x $[NO_3]$ or 0.680 M. Comparison of projected slurry to DST waste corrosion specifications can be found in Appendix H, Table H-13.

The PREDICT program was also used to extrapolate the hydroxide, nitrate, and nitrite levels for the feed composite throughout the campaign. The nitrate, nitrite, and hydroxide levels will not violate the tank corrosion specifications at any point during the campaign. The printouts from the PREDICT program can be found in Appendix J.

5.1.6 Flammable Gas

Waste having a weighted mean specific gravity (SpG) greater than 1.41 should be segregated. Waste stored at a high SpG can yield significant amounts of solids which creates the potential for flammable gas accumulation. The SpG analysis performed on wastes in each campaign feed tank estimated that the highest SpG value of these tanks would be 1.097. The results from specific gravity analysis for campaign feed tanks can be found in Appendices D, E, and F.

Slurry SpG at 90% WVR is estimated to be 1.23 which is well below the SpG limit of 1.41 (see Appendix I for calculation). However, the preliminary boildown studies from the Laboratory indicated that slurry SpG may be as high as 1.39 at 85% and 1.79 at 90% WVR. The preliminary boildown SpG is much higher than the calculated slurry SpG mainly because it did not account for 0.405 million liters (107 Kgal) of water that will be added to tank 102-AW prior to the campaign from flushing and training run. The preliminary boildown SpG values are biased high due to the suspended solids in the boildown flask. Based on the past experience, actual SpG during the campaign will be much lower than the preliminary boildown SpG since the solid precipitation will be removed by settling in tank 106-AW prior to decanting back to tank 102-AW.

In order to ensure the SpG limit is not exceeded, the SpG will be closely monitored and controlled below 1.3 during the campaign. Prior to the final evaporator pass, a feed sample will be taken for SpG analysis to determine a final WVR. During the final pass, the SpG can be set at maximum of 1.35 - 1.40 if necessary. The specific gravity calculation for campaign slurry product at 90% WVR can be found in Appendix I.

5.1.7 High Phosphate Waste

Waste containing high phosphate concentrations (i.e., $[PO_4^{-3}] > 0.1$ M) should not be mixed with waste with a high salt content (i.e., $[Na^+] > 8$ M). Studies on sodium phosphate (Na_3PO_4) solutions have demonstrated the formation of needle-shaped crystals of $Na_3PO_4 \bullet 12H_2O$ which increase the viscosity of the waste and can cause the formation of a gel-like matrix (Fowler 1995). The phosphate and sodium concentrations listed in Appendix G, Table G-1 for tanks 106-AP, 107-AP, 102-AW, 106-AW and feed composite are well below 0.1 M and 8 M limits, respectively.

Using the assumption that all constituents concentrate at the same ratio, the phosphate and sodium concentrations in slurry can be estimated by using the formula, slurry = feed / (1-WVRF). It is estimated at 90% WVR that the slurry product will have $<4.79 \times 10^{-2}$ M phosphate and 6.18 M sodium which are well below 0.1 M and 8 M limits, respectively.

5.1.8 Organic Complexants

Waste streams that contain organic complexants are segregated in tank farms as complex waste. Because no analytical procedure is currently in place to routinely measure the complexants used on site, waste is classified as complex if the total organic carbon (TOC) concentration exceeds 10 g/L if evaporated to the composition where sodium aluminate in solution reaches saturation without exceeding receiver tank composition limits. The 10 g/L TOC concentration limit is to reduce the potential for hydrogen or flammable gas accumulation and prevent possible slurry-growth problems in receiver tanks if waste is concentrated beyond its nitrate/nitrite saturation level.

The PREDICT computer program was used to extrapolate the TOC for campaign feed tanks and campaign composite to the sodium aluminate solubility boundary (Allison 1984). The PREDICT computer model was developed primarily to simulate the effect the evaporation process has on the solubilities of aluminate, carbonate, nitrate, nitrite, phosphate, and sulphate. PREDICT uses the conservative assumption that all organic constituents remain in the slurry product during the evaporation process. The concentrations in Table G-1 were used in the PREDICT program.

The waste in tanks 106-AW and campaign composite exceed the 10 g/L definition of a complex waste. The wastes in tanks 106-AP, 107-AP, and 102-AW meet the criteria for a non-complex waste. The TOCs at the sodium aluminate boundary for tanks 106-AP, 107-AP, and 102-AW are predicted to have values of 8.78 g/L, 5.99 g/L, and 9.07 g/L respectively. The extrapolated TOC at the sodium aluminate boundary from the PREDICT program printouts can be found in Appendix J.

Tanks that contain waste greater than three weight percent TOC on a dry basis are also classified as complex. These tanks have organic chemicals which are potentially flammable. Mixtures of organic materials with nitrite and nitrate salts can deflagrate. There is no credible organic safety concern for these tanks if they contain mostly liquid. The safety concern is with tanks that primarily contain solids because they could dry out and heat up, and high organic concentrations in the tanks could support an exothermic reaction at high elevated temperatures.

The wastes in campaign feed tanks, feed composite, and slurry product at 90% WVR did not exceed the 3 wt% TOC definition of complex waste. They are estimated to have TOC values on a dry basis ranging from 0.75% to 1.28%. The weight percent TOC calculations can be found in Appendix I.

Tank 106-AP received mostly dilute non-complexed waste from B-Plant Vessel Clean-Out and B-Plant Strontium Processing wastes. Tank 107-AP received dilute non-complexed waste from the PUREX Ammonia Scrubber and Purex neutral cladding removal waste. Tank 102-AW contained mostly water and 0.208 million liters (55 Kgal) of 106-AP waste. The waste in tank 106-AW came primarily from the partially concentrated product from 242-A Evaporator Campaign 94-2, which processed neutralized cladding removal waste and miscellaneous dilute wastes. These tanks do not contain organic complexants.

The segregation of waste as complex waste when the TOC concentration is greater than 10 g carbon/L solution at DSSF composition is a programmatic issue only, and is not a safety issue. Segregation of complex and non-complex waste is an operational decision rule implemented to maximize use of tank space. Complex and non-complex wastes are not segregated to prevent chemical reactions between the different waste types. Complex waste is concentrated only to the saturation level of nitrate/nitrite in order to avoid formation of a gel-like solution due to its supersaturation when solids precipitate.

Wastes in tanks 106-AP, 107-AP, 106-AW and 102-AW will be processed together to maximize operational efficiency and minimize problems such as additional sampling, jumper changes, flushing, extended campaign duration etc. Segregation of 106-AW waste from 106-AP, 107-AP, and 102-AW wastes would yield only a small WVR benefit based on the 10 g/L definition of a complex waste. It is estimated by Predict that the nitrate precipitation for this campaign will occur at 93.6% WVR. The campaign will be terminated at a possible maximum of 90% WVR which is well before the nitrate saturation level. In regards to complex waste designation, the PREDICT computer model speculated that the campaign 95-1 slurry product will be considered as complexed with a TOC content of 12.0 g/L when extrapolated to Eight Molar caustic limit. A slurry sample will be taken near the end of the campaign to further evaluate whether the slurry product should be designated as complex waste.

5.1.9 Transfer Line Plugging

To prevent potential transfer line plugging, waste having a Reynolds number of less than 20,000 and greater than 30 percent volume solids should not be transferred without a technical evaluation. The Reynolds numbers for campaign feed tanks were estimated to be several times the minimum Reynolds number limit. Based on the visual volume percent solids analysis on campaign feed tank samples, it is indicated that the campaign tank wastes had less than one percent solids by volume.

The Reynolds number calculated for the slurry product was less than 20,000. To prevent the possiblility of transfer line plugging, slurry pump PB-2 will be operated when the specific gravity is greater than 1.3 (Nicholson 1991). Predict runs indicate that the campaign will be terminated well before the 30 percent solids volume at 90% WVR (Appendix J). The Reynolds number calculations can be found in Appendix I.

5.1.10 Transuranic (TRU) Waste Segregation

Waste containing a TRU concentration of equal or greater than 100 nCi/g is considered as TRU waste and should be segregated from non-TRU waste. Dissolving precipitated TRU constituents increases the mobility of the TRU and, therefore, increases the risks of interim storage. In addition, disposal cost of the TRU waste is much more expensive than non-TRU waste due to the requirement of additional waste pretreatment steps needed to prepare the wastes for final disposal processes. The predominate radionuclide activity of TRU wastes are from Plutonium-239 and Americium-241.

The campaign feed tanks and slurry product at 90% WVRF were estimated to have TRU values ranging 0.17 to 4.51 nCi/g. The TRU calculations can be found in Appendix I. The campaign feed tanks and slurry product are categorized as non-TRU waste since they do not meet the definition of TRU waste.

5.1.11 Heat Generation

Receiver tanks 102-AW and 106-AW shall not receive transfers of waste capable of generating heat at a rate greater than 70 kBtu/hr. Heat generation rate of waste transferred is limited to avoid causing an excess heat generation rate of waste in receiver tanks (102-AW & 106-AW). The heat content less than 70,000 Btu/hr will prevent a release of contamination due to internal boiling. The predominant heat load is from Cesium-137 (half life of 30 yrs) and Strontium-90 (half life of 28.1 years).

The sludge in tanks 102-AW and 106-AW has not been sampled before. For the purpose of calculating the tank heat load, it is assumed (worst case) the sludge radioactive heat generation from tanks 102-AW and 106-AW was equivalent to tank 106-C sludge. The combined heat generation of slurry product and sludge in tank 106-AW at the end of the campaign was estimated to be 46 kBtu/hr which is well below heat load limit of 70 kBtu/hr. The heat load calculations can be found in Appendix I.

5.1.12 Separable Organic Layers

Organic vapors can accumulate in the condensate collection tank C-100 during evaporator operations if separable organic in the feed tanks is processed. Organic liquid fire or vapor explosion could potentially result from the accumulations if the temperature is above 165 degree F and there is an ignition (spark etc...). During evaporator operations, the possibility exists for an immiscible organic layer to develop in the condensate collection tank C-100. In addition, the presence of an immiscible organic layer in the process condensate would cause operational difficulties if transferred to ETF.

Surface samples were taken from tanks 102-AW, 106-AP and 107-AP to determine if a separable organic layer was present. TOC analytical results for surface samples from tanks 102-AW, 106-AP, and 107-AP were 533 mg/L, 111 mg/L and 263 mg/L which are well below the 2600 mg/L definition of a separable organic layer (Von Bargen 1995). Because 106-AW waste is concentrated slurry from tank 102-AW, it is assumed that 106-AW has no surface organic layer. The minimum level in tank 102-AW will be set at 6 inches throughout the campaign.

5.2 SAFETY EVALUATION

5.2.1 Tank Criticality

The criticality prevention specification is cited in CPS-T-149-00010 (WHC 1994). The criticality prevention program limits the concentration of fissile material to 0.013 g/l for all transfers to and within the DST systems. More restrictive requirement limits the concentration of fissile material in the feed to the evaporator to be less than 0.005 g/l.

Fissile isotopes of primary concern are ^{239}Pu, ^{233}U and ^{235}U. Of these, ^{239}Pu is by far the most significant contributor to the criticality potential of tank waste. When calculating fissile material concentrations, a ^{235}U enrichment of less than one weight percent can be excluded in concentration and total mass calculations (WHC 1994). ^{239}Pu and ^{233}U are included in the fissile material concentration regardless of their enrichment. A copy of the internal letter addressing the predicted fissile uranium concentrations in tank waste can be found in Appendix K.

Fissile concentrations for campaign feed tanks, composite, and slurry product were estimated to have values ranging from 1.41×10^{-6} g/l to 2.73×10^{-5} g/l which are well below the Evaporator feed and DST systems limits of 0.005 g/l and 0.013 g/l, respectively. Additional calculations indicated that a WVRF of greater than 99.9% would be required to exceed the Evaporator feed fissile material concentration limit of 0.005 g/l for this campaign. The campaign will be terminated well before that point with a maximum possible WVRF of 90%. Fissile concentration calculations can be found in Appendix I.

5.2.2 Evaporator Radiological Source Term

The *242-A Evaporator OSR Compliance Strategy for Radiological Source Strengths*, WHC-SD-WM-OCD-016 (Tranbarger 1992), governs the operation of the 242-A Evaporator within its radiological source term. Prior to an evaporator campaign, WHC-SD-WM-OCD-016 requires a comparison of the feed waste and slurry product to the Evaporator radiological source term (RST) limits for each constituent. The most restrictive radionuclide is then evaluated against the campaign WVRF.

The campaign feed tanks and slurry product values at 90% WVR were compared against each of the constituents in the Evaporator RST limits in Table B-6. Using the assumption that all constituents concentrate at the same ratio, the radionuclide concentrations in slurry can be estimated by using the formula, slurry = feed / (1-WVRF). In general, the campaign feed tank radionuclide concentrations are several orders of magnitude below the Evaporator RST limits. Due to high laboratory detection levels for undetectable radionuclides such as ^{60}Co, ^{106}Ru, ^{129}I, ^{154}Eu, ^{155}Eu, ^{238}Pu, and ^{244}Cm, these radionuclides were predicted in the slurry product to have potential concentration of greater than 10% of their respective Evaporator RST limits with the ^{129}I concentration the highest at 53%. Using the assumption that all constituents concentrate at the same ratio, ^{137}Cs was predicted to be the most restrictive radionuclide for detected radionuclides. It is estimated that ^{137}Cs concentration will be approximately 0.8% of its RST limit after the campaign.

Isotopic plutonium analysis for ^{241}Pu cannot be performed at the 222-S Analytical Laboratories. WHC-SD-WM-OCD-016 contains formulas for ^{241}Pu which allow its calculation based upon the $^{239/240}$Pu concentration (Tranbarger 1992). When the formulas are applied, ^{241}Pu was found to be less than one percent of its RST limit.

For some constituents, the analytical method does not provide an accurate concentration because detection limits are altered due to interference from other radionuclides (Tranbarger 1992). In these cases, the analytical result is reported with a "less than" sign. The "less than" result for ^{94}Nb, ^{226}Ra and ^{238}Pu were reported to be greater than four percent of their respective RST limits. WHC-SD-WM-OCD-016 contains formulas for ^{94}Nb, ^{226}Ra and ^{238}Pu which provide more realistic concentrations. When the formulas were applied, the ^{94}Nb, ^{226}Ra and ^{238}Pu values were calculated to be less than three percent of RST limits.

The comparisons of feed wastes and slurry product radionuclide level to source term limit are contained in Tables H-6 through H-11.

5.2.3 LERF Radiological Limits

The LERF radiological limits are based upon maintaining the sum of the ratio of concentration to Derived Concentration Guide (DCG) value for twenty-two radionuclides at less than 5,000 (Lavender 1993a). Values for each of the constituents in the LERF radiological limit were entered into the process flowsheet for the 242-A Evaporator (Lavender 1993b). The process flowsheet was developed to model the partition of constituents during the evaporation process. The process condensate concentrations at 90% WVRF from the flowsheet were compared against the DCG for each of the twenty-two radionuclides in Table B-5.

Table H-12 lists the projected process condensate concentration to DCG ratios for each of the radionuclides in the LERF radiological limit. Due to high laboratory detection levels for undetectable radionuclides such as ^{129}I, ^{134}Cs, and ^{144}Ce, the sum of these concentrations in the process condensate was estimated to possibly be at 24% of the 5,000 DCG limit. However, the sum of the detected concentrations to DCG ratios were found to be less than two orders of magnitude below the 5,000 DCG limit.

Isotopic plutonium analysis for ^{241}Pu cannot be performed at the 222-S Analytical Laboratories. WHC-SD-WM-OCD-016 contains formulas for ^{241}Pu which allow its calculation based upon the $^{239/240}$Pu concentration. The calculated ^{241}Pu concentration was entered into the process flowsheet and the concentration to DCG ratio was found to be less than one DCG.

For some constituents, the analytical method does not provide an accurate concentration because detection limits are altered due to interference from other radionuclides. In these cases, the analytical result is reported with a "less than" sign (Tranbarger 1992). The "less than" result for ^{94}Nb, ^{226}Ra and ^{238}Pu were reported to be greater than four percent of their respective RST limits. WHC-SD-WM-OCD-016 contains formulas for ^{94}Nb, ^{226}Ra and ^{238}Pu which provide more realistic concentrations. The calculated ^{94}Nb, ^{226}Ra and ^{238}Pu to DCG ratios were found to be less than one DCG.

5.2.4 LERF Ammonia Industrial Hazard Limit

Ammonia concentration in the process condensate at the LERF must be maintained below the industrial hazard limit of 13,600 mg/L (Lavender 1993b). The ammonia concentration is limited to prevent toxicological exposure of nonfacility personnel to gaseous ammonia. A validated model for estimating ammonia release as a function of the feed concentration and other critical parameters (e.g., feed rate, operating pressures, temperatures, condenser efficiencies, etc.) does not exist. Based on sampling data from Evaporator campaign 94-2 and conservatively assuming that all of the ammonia in the feed is volatilized in the Evaporator, it was estimated that approximately 94 percent of the ammonia in the feed was released to the LERF (I.M 71730-95-004).

The ammonia concentrations for campaign feed tanks are summarized in Table G-1. The ammonia concentration in the tank 107-AP was found to be the largest and is selected to predict the largest ammonium concentrations which would be discharged to the LERF during campaign 95-1. Given a nominal feed rate at 378 L/min (100 gpm), 50% WVR per pass, and initial pot volume at 95,000 liters (25 kgal), the highest possible ammonia concentration released to the LERF during the campaign was estimated to be 1,950 mg/L which is well below the limit of 13,600 mg/L. The calculation of ammonia level in the process condensate can be found in Appendix I.

5.2.5 Shield Design Limits

The Cs-137 concentrations in the feed stream and slurry product must be maintained below 0.8 Ci/L to prevent potential radiation fields that exceed the parameters of shielding design criteria which could pose a hazard to workers in the personnel-occupied areas of the 242-A Evaporator Building (Lavender, 1993b).

Cs-137 concentrations from the campaign feed tanks were summarized in Table G-1 and were compared against the Evaporator shielding design limit. In general, the campaign feed tank Cs-137 concentrations are several orders of magnitude below the Evaporator shielding design limit. The Cs-137 concentration in tank 106-AW was the closest of any of the constituents to the limit and was four percent of the limit. Using the assumption that all constituents concentrate at the same ratio, the Cs-137 concentrations in slurry can be estimated by using the formula, slurry = feed / (1-WVRF). The Cs-137 concentration in slurry product at the end of campaign is estimated to be 0.0115 Ci/L which is well below the shielding design limit of 0.8 Ci/L.

5.3 ENVIRONMENTAL COMPLIANCE EVALUATION

5.3.1 Vessel Vent Organic Discharge Limits

The individual constituent limits for evaporator feed in Table B-3 were chosen to prevent the vessel vent from exceeding the volatile emission limit of 3 lbs/hr or 3.1 tons/yr (Von Bargen 1995). The vessel vent organic discharge limits are also based upon maintaining the sum of the ratio of concentration to limit value for five organic compounds at less than one. The upper 90% confidence interval for sample analyses in Appendices D and E were compared against the volatile emissions limits in Table B-3 for each constituent. The comparison of campaign feed tanks to evaporator feed limits based on volatile emissions is contained in Tables H-4 and H-5. The feed to product ratio (R) was assumed to be 2 for this comparison.

In general, the upper 90% confidence interval of the concentrations for 1-butanol, 2-butoxyethanol, 2-butanone and tributyl phosphate are several orders of magnitude below the vessel vent limits. The acetone concentration in tank 106-AP was the closest of any of the constituents to the vessel vent limits. The upper 90% confidence interval of acetone concentration in tank 107-AP was 29 percent of the volatile emission limit. The sum of the ratio of concentration to limit value for five organic compounds in each campaign feed tank was less than one.

Except for tetrahydrofuran in tank 106-AP, none of the organic analytes of concern such as 2-hexanone, 2-pentanone, methyl isobutyl ketone, and tetrahydrofuran were detected in the campaign feed wastes above 500 parts per billion (ppb). A total of three subsurface samples were collected from tank 107-AP for organic analysis. Tetrahydrofuran was only detected on one of these samples at 680 ppb. Since the detected level was insignificant, it is not necessary to establish an emission modeling for tetrahydrofuran.

The waste in tank 106-AW is the processed waste from campaign 94-2. Most of the volatile organic compounds were boiled off during the campaign. The waste in tank 102-AW comprised mostly water and small portion of 106-AP waste. The logical assumption was made to neglect volatile organic compounds from the comparison with the vessel vent discharge limits.

"TC-TIC" is the screening method which is used to determine whether or not additional organic species are unaccounted for in the analysis. The "TC-TIC" represents the total organic carbon (TOC) in a tank. If it were conservatively assumed that all the TOC is volatile and exists as acetone, then the limit would be 87 mg/L for the feed. The "TC-TIC" values for campaign feed tanks exceed the screen limit of 87 mg/L. However based on the volatile and semivolatile organic analyses, the highest volatile and semivolatile contents were found to be <28 mg/L and <41 mg/L for tank 106-AP and <32 mg/L and <33 mg/L for tank 107-AP, respectively. Thus, the sums of volatile and semivolatile organics are accounted for <21% and <27% of total organic compounds in tanks 106-AP and 107-AP, respectively. The remaining organic carbon in the wastes is attributed to the presence of water soluble organic compounds such as acetate, citrates, oxalates, EDTA, etc...which are commonly found in the tanks. These compounds are not volatilized during the 242-A evaporator process. Based on a review of the lab gas chromatogram data for volatitle and semivolatile organic analyses, no additional peaks were observed that would contribute significantly to the organic discharge rate.

The organic compounds released from the 242-A vessel vent would primarily consist of volatile organics plus a small percentage of semivolatile organics. If all volatile and semivolatile organics were conservatively assumed to be released, less than 65 mg/l from the feed would exit the stack. This is well below the "TC-TIC" limit of 87 mg/L.

5.3.2 Gaseous Ammonia Discharge Limit

Gaseous ammonia discharges from the vessel vent exhaust stack are required to be maintained below the CERCLA reportable quantity of 100 pounds in any 24 hour period (40CFR 302). A validated model for estimating ammonia release as a function of the feed concentration and other critical parameters (e.g., feed rate, operating pressures, temperatures, condenser efficiencies, etc.) does not exist. Based on sampling data from Evaporator campaign 94-2 and conservatively assuming that all of the ammonia in the feed is converted to ammonia gas in the Evaporator, it was estimated that approximately six percent of the ammonia in the feed was released to the vessel vent (I.M 71730-95-004).

The ammonia concentrations for campaign feed tanks are summarried in Table G-1. The ammonia concentration in the tank 107-AP was found to be the largest and is selected to predict the largest ammonium concentrations which would be discharged out the stack during campaign 95-1. Given nominal feed rate at 378 L/min (100 gpm), 50% WVR per pass, and initial pot volume at 95,000 liters (25 kgal), the highest possible ammonia concentration released to the vessel vent during the campaign was estimated to be 40.9 Kg/day (90 lbs/day) which is just below the limit of 45.5 Kg/day (100 lbs/day), assuming unblended 107-AP waste at maximum operating rate. The calculation of ammonia level discharged out to vessel vent stack can be found in Appendix I.

The processing strategy will be to control the ammonia through the vessel vent system in such the way that vessel vent ammonia alarm is not upset (setpoint = 1200 ppm or 22.7 Kg/day). To ensure the ammonia alarm is not upset, the pot will be initially filled with 102-AW waste or water. 107-AP waste will be blended with other campaign wastes in tank 102-AW to lower the feed ammonia concentration. Throughout the campaign, the ammonia totalizer will be monitored and processing adjustments will be made if necessary.

5.3.3 LERF Liner Limits

Table B-4 contains the chemical concentration limits for process condensate in the LERF. Table B-2 contains the feed limits for process condensate to meet the LERF composition limits. The chemical concentration in the feed is limited to prevent degradation of the HDPE liner used at the LERF. In addition, the process condensate organic discharge limit is based upon maintaining the sum of the ratio of concentration to limit value at less than one.

The upper 90% confidence interval of the organic sample analyses and the mean value of ammonia analyses in Appendices D and E were compared against the feed limits. The analytical results for 1-butanol, 2-butoxyethanol, 2-butanone, 2-hexanone, methyl isobutylketone, and tetrahydrofuran in campaign feed tanks were reported as not detectable. To allow comparison with the feed limits for LERF acceptance contained in Table B-2, their highest detection limits were conservatively utilized. In general, the upper 90% confidence interval of the organic concentrations and ammonia mean values are several orders of magnitude below the limits. The ammonia concentration in tank 107-AP was found to be the closest of any of the constituents to the feed limits for LERF acceptance. The ammonia concentration in tank 107-AP was less than one percent of the feed limit.

The sum of the ratio of concentration to limit value for target organic compounds in each campaign feed tank was less than one. The comparison of campaign feed wastes to evaporator feed limits for organic LERF acceptance can be found in Tables H-2 and H-3. The feed to product ratio (R) was assumed to be 2 for this comparison.

The residual wastes in tanks 102-AW and 106-AW from campaign 94-2 were previously evaluated for ammonia and volatile organic compounds with the feed limit for LERF acceptance (Le 1994). Because most of ammonia and volatile organic compounds were boiled off during the campaign, these analytes were not re-evaluated against the feed limits for LERF acceptance.

5.3.4 LERF Ammonia Extremely Hazardous Waste Limit

The feed limit for ammonia mentioned in Section 5.2.4 was to ensure toxicological exposure remains within the LERF FSAR accident analysis. However, a more restrictive limit of 10,000 mg/L ammonia concentration in the process condensate at the LERF is required to prevent forming extremely hazardous waste (EHW). A validated model for estimating ammonia concentration in process condensate released to LERF as a function of the feed concentration and other critical parameters (e.g., feed rate, operating pressures, temperatures, condenser efficiencies, etc.) does not exist. Based on sampling data from Evaporator campaign 94-2 and conservatively assuming that all of the ammonia in the feed is volatilized in the Evaporator, it was estimated that approximately 94 percent of the ammonia in the feed was released to the LERF (I.M 71730-95-004).

The ammonia concentrations for campaign feed tanks are summarized in Table G-1. The ammonia concentration in the tank 107-AP was found to be the largest and is selected to predict largest ammonium concentrations which would be discharged to the LERF during campaign 95-1. Given nominal feed rate at 378 L/min (100 gpm), 50% WVR per pass, and initial pot volume at 95,000 liters (25 kgal), the highest possible ammonia concentration released to the LERF during the campaign was estimated to be 1,950 mg/L which is well below the (EHW) limit of 10,000 mg/L. The calculation of ammonia level in the process condensate can be found in Appendix I.

5.3.5 Gaseous Radiological Limits

Gaseous effluent from 242-A Evaporator vessel ventilation system is expected to be radiologically contaminated. Continuous monitoring of exhaust air will be performed during the campaign to provide notification of excessive concentrations of radionuclides. Specification limits for radioactive gaseous releases are set to meet the requirements of WHC-CM-7-5 Environmental Compliance program.

The predominant total alpha and total beta activities are from Pu-239 and Sr-90, respectively. Pu-239 and Sr-90 values in the campaign feed were entered into the process flowsheet for the 242-A Evaporator (Lavender 1993b). The process flowsheet was developed to model the partition of constituents during the evaporation process. The Pu-238 and Sr-90 gaseous concentrations at 90% WVRF from the flowsheet were compared against the vessel vent radionuclide limits in Table B-9. The projected radionuclide levels for Pu-239 and Sr-90 in the gaseous effluent were several orders of magnitude below the vessel vent radionuclide limits. Comparison of projected vessel vent discharge to vessel vent radionuclide limits is contained in Table H-14.

5.3.6 Waste Profile for Campaign 95-1 Slurry

All waste transfers into the DST system must be pre-approved and must meet set waste acceptance criteria (Mulkey 1994). A copy of waste profile sheets can be found in Appendix K.

6.0 CAMPAIGN DESCRIPTION

6.1 FEED INVENTORIES

Tank 102-AW

Tank 102-AW will continue to be used as the evaporator feed tank for this campaign. The supernatant liquid in tank 102-AW is comprised primarily of water and 106-AP waste. The 106-AP waste transfer was necessary to maintain hydroxide and nitrate concentrations in tank 102-AW within corrosion control specification limits during the precampaign 95-1 training run.

As of May 8, 1995, the 102-AW liquid level was at 71 inches. The solids level in 102-AW as measured at the FIC was at 16 inches. However, a sludge level measurement on riser 22-A prior to campaign indicated a sludge level was 20 inches. Therefore tank 102-AW contains approximately 51 inches of processable waste.

Tank 106-AW

Tank 106-AW will continue to be used as the evaporator slurry receiver tank for this campaign. The supernatant liquid in tank 106-AW is primarily from the partially concentrated product from evaporator campaign 94-2, which processed dilute wastes from PUREX ammonium scrubber feed and B-Plant steam condensate.

As of May 8, 1995, the 106-AW liquid level was at 240 inches. The liquid level in tank 106-AW at the start of the campaign is expected to be the same. A sludge level measurement taken on five risers of tank 106-AW prior to campaign indicated solids level varied from 52 to 100 inches. Therefore tank 106-AW contains approximately 140 inches of processable waste.

Tank 106-AP

Tank 106-AP will be used as an evaporator feed tank for this campaign. Waste in tank 106-AP came mostly from B-Plant Vessel Clean-out and B-Plant Strontium processing. As of May 8, 1995, the 106-AP liquid level was at 39.3 inches. Approximately 340 inches of processable 106-AP waste was transfered to tank 108-AP on May 7, 1995 for feed tank waste staging. Prior to the 106-AP transfer, tank 108-AP contained a 10 inches heel.

Tank 107-AP

Tank 107-AP will be used as an evaporator feed tank for this campaign. Tank 107-AW consists of mostly PUREX neutralized cladding removal and Purex miscellaneous wastes. As of May 8, 1995, the 107-AP liquid level was at 362 inches. Approximately 352 inches of 107-AP waste will be transfered as evaporator feed.

6.2 PROCESSING ACTIVITY DESCRIPTION

6.2.1 Campaign Duration

Processing time for Campaign 94-2 is anticipated to be from 42 to 45 days. A one week outage is needed for final pass sample characterization and for preventive maintenance and instrument calibrations.

6.2.2 Normal Operation

Throughout the campaign, anti-foam should be continuously added and process condensate recycle system should be operating. The Ion exchange column shall remain off-line. The slurry flow must be maintained above 42 gpm to prevent auto flushing. Gravity slurrying to 106-AW should not be performed if the density exceeds 1.3. The 106-AW slurry distributor shall be rotate frequently to prevent plutonium accumulation in one spot in the tank.

Feed rates are expected to be 80-130 gpm and boiloff rates are expected to be 40-65 gpm to maintain a WVRF per pass of roughly 50%. To achieve an accuracy in monitoring organic layer in tank C-100, the tank liquid level shall be maintained at approximately 50% weight factor during normal evaporator operation and tank C-100 agitator shall not be used. LERF Basin 42 will be used to receive the process condensate from this campaign.

6.2.3 106-AP to 108-AP Transfer

Since tank 106-AP is equipped with a flex and float pump, waste in tank 106-AP was transferred to tank 108-AP to provide blending capability necessary for evaporator process control prior to the campaign.

6.2.4 Air Lift Circulator Operation

Two airlift circulators (ALCs) are installed in tank 102-AW. One ALC is 16 inches in diameter and the other is 24 inches in diameter. The ALCs are used to blend the supernatant liquid in tank 102-AW to provide a uniform feed for the evaporator. The ALC operating procedure states that the 16 inch ALC is to be used when the liquid level in tank 102-AW is between 190 and 240 inches. The 24 inch ALC is to be used when the liquid level is greater than 240 inches. The 102-AW ALCs shall be operated prior to and throughout the campaign, within their procedural limits. All ALCs will be shut down at the completion of the campaign. Due to known tank stratification in the candidate feed tanks, it will be desirable to operate both ALCs when possible to achieve maximum mixing potential.

6.2.5 Campaign Operating Strategy

Characterization data for tank 107-AP indicate very high ammonia concentrations. To ensure the ammonia gas released out the vessel vent is controlled within limits during initial start-up, the evaporator pot will be initially filled with water or 102-AW waste prior to transferring 106-AP and 107-AP waste into tank 102-AW for feed staging.

Waste will then be transferred from tank 106-AP via tank 108-AP to 102-AW and from tank 107-AP to 102-AW to a level of no greater than 380 inches prior to campaign 95-1 start. Transfers from 106-AP will be blended with transfers from 107-AP. Since 107-AP waste contains a high ammonia concentration, it is recommended that 107-AP waste be blended on an one-to-one ratio basis with 106-AP waste to lower the ammonia concentration prior to processing in the Evaporator. Prior to campaign 95-1 startup, the air-lift circulators will be started in tank 102-AW to provide a uniform feed for the evaporator and the 242-A ammonia monitor should be operating.

To prevent excessive foaming which may cause potential evaporator shutdowns, feed will be pumped initially to the evaporator with the simultaneous addition of anti-foam chemicals. To minimize the use of antifoam chemicals, a stepwise reduction of the addition of antifoam chemicals into the 242-A Evaporator will be implemented when the evaporator process reaches steady state condition.

The operating strategy during the first portion of this campaign is to concentrate at approximately 50% WVR from 106-AP and 107-AP tanks without slurry recycle. Because 106-AW specific gravity is slightly higher than the other feed tanks, the 106-AP and 107-AP wastes should be concentrated prior to mixing with 106-AW waste in order to prevent waste stratification. Waste transfers shall be planned to maintain an operating level of 50 - 380 inches in tank 102-AW. When the liquid level in tank 106-AW reaches approximately 400 inches, perform small volume batch recycle transfers from tank 106-AW while continuing the 106-AP and 107-AP to 102-AW transfers. Small volume recycle transfers will minimize waste stratification. A recent sludge level measurement taken on five risers of tank 106-AW prior to campaign indicated solids level varied from 52 to 100 inches. Therefore the minimum operating liquid level in tank 106-AW will be set at 100 inches during the campaign.

All campaign wastes must be staged into tank 102-AW prior to the evaporator final pass. In order to obtain a maximum operation goal of 90% WVR, the supernatant liquid in the tank must be well mixed to prevent waste stratification before a sample is taken. To facilitate good mixing, the feed pump will be used to recirculate waste in tank 102-AW for a few hours prior to transfer to the Evaporator for feed sampling.

Overflowing Tank C-100 must be performed prior to the completion of the campaign to remove any organic or foam that may be potentially collected in the tank during the campaign. At the completion of the campaign, waste inventories in 102-AW, 106-AP, and 107-AP are expected to be minimal. The final levels in tanks 102-AW, 106-AP, 107-AP, and 108-AP are estimated to be approximately 20, 39, 10, and 10 inches, respectively. Tank 106-AW is expected to contain approximately 95 - 144 inches of supernatant liquid with a slight increase in the amount of solids.

6.2.6 Evaporator Vessel Flushing

At the end of the campaign, the evaporator vessel, recirculation line, feed line, dump line and slurry line shall be adequately rinsed to reduce potential scale and residue buildup on pipe and vessel walls and to decrease radioactive dose rate in the pump room and evaporator room for future maintenance entries and processing campaigns.

6.2.7 Post-campaign Sludge Measurements

Sludge level measurements in tanks 102-AW and 106-AW must be obtained after the completion of the campaign to provide necessary information for future evaporator campaigns.

6.3 SAMPLING AND MONITORING REQUIREMENTS

6.3.1 Compliance Samples

Compliance samples on the evaporator steam condensate and cooling water streams will not be collected to demonstrate compliance under consent order No. DE 91NM-177 (DiLiberto, 1995). As of February 2, 1995, all the sampling and analysis requirements under this consent order have been met for interim compliance effluents. The process condensate compliance sampling has been integrated into the LERF and ETF sampling.

Compliance sampling of slurry products will not be conducted since the slurry will undergo further treatment before being required to meet Land Disposal Restriction treatment standards. No compliance vessel vent sampling will be collected because engineering calculations show that organic emissions are well below the limits. The organic emission calculations can be found in Appendix H.

To comply with DOE annual radionuclide discharge reporting requirements, cooling water samples will be taken daily and steam condensate samples will be taken each time a steam condensate basin is filled during the campaign.

6.3.2 Process Control Samples

In addition to the compliance samples, process control samples will be taken on the various evaporator streams throughout Campaign 95-1. Analyses to be performed on process control samples are included in the *242-A Evaporator Sample Schedule for Campaign 95-1* (Le 1995).

242-A Cooling Water (ACW) Samples

A portion of the cooling water stream is collected on a daily basis in the RC-2 carboy during evaporator operations. Two 1 liter cooling water sample bottles will be taken daily for annual discharge reporting requirements. One liter bottle will be taken per the Sample Schedule for process control and one additional 1 liter bottle shall be taken for composite analysis. The composite and process control bottles will be packaged separately sent to WSCF and 222-S, respectively.

ACW samples will be analyzed for total alpha, total beta, and pH. The sample analyses will be used to ensure compliance with limits listed in Table B-8 for discharge to 216-B-3 Pond. The used raw water stream has no diversion capabilities, thus, if excessive radiation levels are detected in verification samples, an immediate evaporator shut down is required.

242-A Process Condensate (APC) Samples

APC samples will be taken throughout the campaign to ensure compliance with the LERF composition limits listed in Tables B-4 and B-5 and to verify total volatile organics discharged out the vessel vent. APC samples will be analyzed for total alpha, total beta, ^{3}H and ^{129}I as a verification of the radionuclide concentration in the process condensate. These radionuclide concentrations were found to have the largest DCG ratios in the process condensate. These APC samples will also be analyzed for TC, TOC, TSS, and ammonia to verify the organic, ammonium, and solids content in the process condensate stream and determine vessel vent discharges. The APC samples will be taken simultaneously with feed and slurry samples. Individual sampling times will be specified by process memo.

The limits in Tables B-4 and B-5 apply only to the composition of process condensate in the LERF at any given time. APC samples which exceed the Table

B-4 or B-5 values would require an evaluation be made of whether continued transfer of process condensate would cause a violation of the LERF composition limits.

242-A Steam Condensate (ASC) Samples

A representative portion of the steam condensate stream is collected in the RC-1 carboy during the transfer of condensate to a retention basin. ASC samples will be taken each time a steam condensate basin is filled. One liter will be taken per the Sample Schedule and sent to 222-S. Two additional liters will be taken for composite analysis and sent to WSCF. ASC samples are analyzed for total alpha, total beta, and pH. The sample analyses will be used to ensure compliance with discharge limits listed in Table B-8. If sample results are found to have exceeded the discharge limits, a confirmatory ASC sample can be taken from the 207-A Pump Pit. The appropriate sample shall be analyzed and found to be within discharge limits listed in Table B-8 prior to discharge of a retention basin to 216-B-3 Pond. In the event that the discharge limits are exceeded, the retention basin shall be transferred to tank 102-AW.

242-A Feed (FD-A) Samples

Feed samples will be taken from the feed sampler SAMP-F-1 each time a new feed is introduced into the 242-A Evaporator. Feed samples will be taken simultaneously with slurry and process condensate samples. FD-A samples are analyzed for TC, TOC, ammonia, selected inorganics, and major radionuclides. The sample analyses will be used to verify the major inorganic and radiological constituents concentrations as expected during the campaign and total volatile organic and ammonia concentration discharged out the vessel vent. An additional feed sample will be taken near the end of campaign for evaluation of final evaporator process pass WVRF. In order to obtain a maximum operation goal of 90% WVR, the supernatant liquid in the tank must be well mixed to prevent waste stratifying before a sample is taken. To facilitate good mixing, the feed pump will be used to recirculate waste in tank 102-AW for a few hours prior to transfer to the Evaporator for feed sampling. Individual sampling times will be specified by process memo.

242-A Slurry (SLY-A) Samples

Slurry samples will be taken from the slurry sampler SAMP-F-2 each time a new feed is introduced into the 242-A Evaporator. Slurry samples will be taken simultaneously with feed and process condensate samples. The SLY-A samples are analyzed for TC, TOC, ammonia, selected inorganics, and major radionuclides. The sample analyses will primarily be used to verify that the major inorganic and radiological constituents concentrate as expected during the campaign and to estimate total volatile organic and ammonia concentration discharged out the vessel vent.

Additionally, slurry sample(s) will be taken on the final evaporator pass to measure concentrations in tank 106-AW and to verify compliance with the radiological source term listed in Table B-6. The evaporator process shall be shut down if any of the constituents in Table B-6 are found to have exceeded the radiological source term. Individual sampling times will be specified by process memo.

6.3.3 Gaseous Effluent Monitoring

The 242-A building ventilation exhaust stack (296-A-21) contains a generic stack monitoring system. One portion of the exhaust is diverted to a record sampler where radioactive particulates are collected on filter paper. The record sampler filter paper is collected weekly and analyzed. The filter paper is then maintained for monthly composite samples. The remaining portion of this stream is split between an alpha continuous air monitor (CAM) and a beta-gamma CAM.

The vessel vent exhaust stack (296-A-22) has a monitoring system similar in design to that of 296-A-21 except for the inclusion of a silver zeolite filter sampler. The silver zeolite filter is routinely collected and analyzed for gaseous radioisotopes of tritium, iodine, and ruthenium (WHC 1988).

The infrared gas analyzer continues to be used to continuously monitor ammonia levels in the vessel vent effluent stream. The ammonia monitor alarm is set at roughly half the level that would exceed the 100 lbs per 24 hours limit if maintained for 24 hours. If gaseous ammonia releases exceed 100 pounds in a 24 hour period, then the Environmental Compliance organization will be immediately notified and processing adjustments will be made to decrease the discharge level below the limit.

6.3.4 Liquid Effluent Monitoring

A portion of the used raw water stream is diverted through the RC-2 radiation monitoring cell. This stream has no diversion capabilities, thus, excessive radiation levels detected in verification samples will require an immediate evaporator shut down.

The steam condensate stream flows past an in-line radiation monitor RIAS-EA1-1 on the inlet to the C-103 weir. A portion of the steam condensate in the C-103 weir is diverted through the RC-1 radiation monitoring cell. On detection of high radiation in the steam condensate from either of the radiation monitors, an interlock will shut down steam to the evaporator process and divert the steam condensate stream to tank 102-AW.

The process condensate stream flows past an in-line radiation monitor RIAS-CA1-1 on the inlet to the C-100 tank. After passing through, a portion of the process condensate stream is diverted through the RC-3 radiation monitoring cell. On detection of high radiation from the in-line radiation monitor, an interlock will shut off feed to the evaporator process, shut down steam to the evaporator process, and terminate process condensate flow to LERF. On detection of high radiation from the RC-3 radiation monitor, an interlock will terminate process condensate flow to LERF.

6.3.5 Quality Assurance

During the campaign, surveillances may be performed by Quality Assurance for compliance to this process control plan.

6.4 PRODUCT/WASTE DISPOSITION

The slurry product from Campaign 95-1 will be transferred to tank 106-AW. Tank 106-AW is expected to contain approximately 0.931 - 1.40 million liters (246 - 369 Kgal) of DDSSF product at the completion of the campaign.

All process condensate from the campaign shall be transferred to LERF for active storage. Approximately 9.8 - 10.6 million liters (2.6 - 2.8 Mgal) of process condensate is anticipated to be transferred to LERF during the campaign.

Under normal conditions, steam condensate generated during the campaign will be discharged from the 207-A retention basins to 216-B-3 Pond. Steam condensate would be transferred to tank 102-AW in the unlikely event that radioactive contamination is detected in the steam condensate stream. All cooling water used during the campaign will be discharged to 216-B-3 Pond.

7.0 REFERENCES

Allison, J. M., 1984, *Computer Prediction of Evaporator Operations*, SD-WM-ADP-004, Rockwell Hanford Operations, Richland, Washington.

Anderson, 1991, *Double-Shell Underground Waste Storage Tanks-Riser Survey, WHC-SD-RE-TI-093*, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Basra, T. S., 1995, *242-A Evaporator Waste Analysis Plan*, WHC-SD-WM-EV-060, Rev. 5, Westinghouse Hanford Company, Richland, Washington.

Basra, 1995, *242-A Evaporator Quality Assurance Project Plan, WHC-SD-WM-QAPP-009*, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Beck, M. A., 1995, "Evaporator Campaign 95-1 Boildown Report", internal memo 8E110-PCD95-034, Westinghouse Hanford Company, Richland, Washington.

Fowler, K. D., 1995, *Tank Farm Waste Compatibility Program*, WHC-SD-WM-OCD-015, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Crummel, G. M., and R. D. Gustavson, 1995, *242-A Effluent Monitoring Plan*, WHC-EP-0466-2, Westinghouse Hanford Company, Richland, Washington.

Day and Underwood, 1980, *Quantitative analysis*, 4th edition, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

DiLiberto, A. J., 1995, "Completion of Sampling And Analysis Requirements Under Consent Order No. DE 91NM-177 (Project W-049H)", internal memo, Westinghouse Hanford Company, Richland, Washington.

DOE/RL, 1991, *242-A Evaporator Dangerous Waste Permit Application*, DOE/RL-90-42, Rev. 0, U.S. Department of Energy-Richland Operations Office, Richland, Washington.

EPA, 1994, *Decision Error Feasibility Trials*, Version 4.0, U.S. Environmental Protection Agency, Washington, DC.

Hanlon, B. M., 1995, *Tank Farm Surveillance and Waste Status Summary Report for January 31, 1995*, WHC-EP-0182-82, Westinghouse Hanford Company, Richland, Washington.

Harris, J. P., 1992, *Operating Specifications for the 241-AN, AP, AW, AY, AZ, & SY Tank Farms*, OSD-T-151-00007, Rev./Mod. H-5, Westinghouse Hanford Company, Richland, Washington.

Hewlett-Packard, 1987, *HP-15C Owner's Hanbook*, Hewlett-Packard Company, Canada.

I.M #65453-87-074, R. L. Weiss, May 28, 1987, "Additional Analyses on Core Samples from Tanks 241-C105 and 241-C-106," Rockwell Hanford Company, Richland, Washington.

I.M #7CFI0-042-094, R. A. Dodd, October 19, 1994, "242-A Evaporator Campaign 95-1 Waste Compatibility of Tank 241-AW-103 and Tank 241-AW-105 Waste with Tank 241-AP-107 Waste," Westinghouse Hanford Company, Richland, Washington.

I.M #71730-95-001, T. A. Campell, October 27, 1994, "Sampling Requirements for AP-106," Westinghouse Hanford Company, Richland, Washington.

I.M #71730-95-002, T. A. Campell, November 15, 1994, "Sampling Requirements for AP-107," Westinghouse Hanford Company, Richland, Washington.

I.M #71730-95-003, P. G. Johnson, November 15, 1994, "Recommendation for Deletion of Tank 106-AP Analytes," Westinghouse Hanford Company, Richland, Washington.

I.M #71730-95-004, T. A. Campell, March 28, 1995, "Correlation of 242-A Feed Ammonia Content to Ammonia Release During 94-2," Westinghouse Hanford Company, Richland, Washington.

I.M #71730-95-005, T. A. Campell, April 10, 1995, "Verification of Sample Number for Tank 241-AP-106, Campaign 95-1," Westinghouse Hanford Company, Richland, Washington.

I.M #71730-95-007, T. A. Campell, April 19, 1995, "Verification of Sample Number for Tank 241-AP-107, Campaign 95-1," Westinghouse Hanford Company, Richland, Washington.

Johnson, P. G., 1995, *Operating Specifications for the Liquid Effluent Retention Facility*, OSD-T-151-00029, Rev./Mod. B-0, Westinghouse Hanford Company, Richland, Washington.

Lavender, 1993a, *Final Safety Analysis Report, Project W-105, Liquid Effluent Retention Facility*, WHC-SD-W105-SAR-001, Rev. 0-C, Westinghouse Hanford Company, Richland, Washington.

Lavender, 1993b, *242-A Evaporator/Crystallizer Safety Analysis Report*, WHC-SD-WM-SAR-023, Rev. 1-B, Westinghouse Hanford Company, Richland, Washington.

Le, E. Q, 1995 *242-A Evaporator Sample Schedule For Campaign 95-1*, FSS-T-630-00001, Rev./Mod. B-5, Westinghouse Hanford Company, Richland, Washington.

Mulkey, C. H., 1994, *Double Shell Tank Waste Analysis Plan*, WHC-SD-WM-EV-053, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

Nicholson, R. S., 1991, *"Plugging Potential of 242-A Slurry Out Lines,"* Internal Memo #76420-91-029, August 28, 1991, Westinghouse Hanford Company, Richland, Washington.

Pitkoff, C. C., 1992, "Isotopic Uranium Analysis Composition", internal memo, Westinghouse Hanford Company, Richland, Washington.

Reynolds, D. A., 1988, "Viscosity of Evaporator Slurries" internal memo, Westinghouse Hanford Company, Richland, Washington.

Schreiber, 1994, *Tank 241-AP-106 Tank Characterization Plan*, *WHC-SD-WM-TP-277*, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Schreiber, 1995, *Tank 241-AP-107 Tank Characterization Plan*, *WHC-SD-WM-TP-286*, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Tranbarger, R. K., 1992, WHC-SD-WM-OCD-016, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Wahlquist, R. A., 1993, *Operating Specifications for the 242-A Evaporator-Crystallizer*, OSD-T-151-00012, Rev./Mod. D-1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1988, *Environmental Compliance*, WHC-CM-7-5, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1989, *Waste Storage Tank Status and Leak Detection Criteria*, WHC-SD-WM-TI-357, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993, *Waste Tank Administration*, WHC-IP-0842, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994, *Criticality Prevention Specification for Waste Storage Tanks and Associated Equipment*, CPS-T-149-00010, Rev./Mod. E-0, Westinghouse Hanford Company, Richland, Washington.

Vandercook, R. E., 1976, *Vacuum Evaporator-Crystallizer Flowsheet for Waste Liquors*, ARH-F-101, Westinghouse Hanford Company, Richland, Washington.

Von Bargen, B. H., 1994, *242-A Evaporator/Liquid Effluent Retention Facility Data Quality objectives, WHC-SD-WM-DQO-014*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Von Bargen, B. H., 1995, *242-A Evaporator/Liquid Effluent Retention Facility Data Quality objectives, WHC-SD-WM-DQO-014*, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

INDEX OF TECHNICAL OPERATING CONTROLS

This page intentionally left blank.

APPENDIX A

INDEX OF TECHNICAL OPERATING CONTROLS

DOE/RL-90-42, Rev. 0, *242-A Evaporator Dangerous Waste Permit Application.*

FSS-T-630-00001, Rev. B-5, *242-A Evaporator Sample Schedule for Campaign 95-1.*

OSD-T-151-00007, Rev./Mod. H-5, *Operating Specifications for the 241-AN, AP, AW, AY, AZ, & SY Tank Farms.*

OSD-T-151-00012, Rev./Mod. D-1, *Operating Specifications for the 242-A Evaporator-Crystallizer.*

OSD-T-151-00029, Rev./Mod. B-0, *Operating Specifications for the Liquid Effluent Retention Facility.*

WHC-EP-0466-2, *Facility Effluent Monitoring Plan for 242-A Evaporator Facility.*

WHC-SD-WM-DQO-014, Rev. 1, *242-A Evaporator/Liquid Effluent Retention Facility Data Quality Objectives.*

WHC-SD-WM-EV-060, Rev. 5, *242-A Evaporator Waste Analysis Plan.*

WHC-SD-WM-SAR-023, Rev. 1, *242-A Evaporator/Crystallizer Safety Analysis Report.*

WHC-SD-WM-TI-357, Rev. 1, *Waste Storage Tank Status and Leak Detection Criteria.*

This page intentionally left blank.

APPENDIX B

242-A EVAPORATOR LIMITS

This page intentionally left blank.

Table B-1. Miscellaneous 242-A Evaporator Feed Limits[1]

Constituent	Limit
Exotherm	= 0 J/g if T < 335°F
Exotherm/Endotherm	< 1 if T < 932°F
Complexed Waste	Do not concentrate exceeding the $NaNO_3/NaNO_2$ precipitation boundary
Shielding Design (^{137}Cs)	< 0.8 Ci/L
Fissile Material Concentration	<0.005 g/L

[1] From *242-A Evaporator - Liquid Effluent Retention Data Quality Objectives* (Von Bargen 1995).

Table B-2. Evaporator Feed Limits for LERF Liner Compatibility[1]

Chemical Family/Parameter	**Current Taget Compounds**	**Limit** (mg/L)[2,3,6]
Alcohol/Glycol	1-butanol	500,000 × (R-1)/R
Alkanone[4]	Sum of acetone, 2-butanone, 2-hexanone, methyl isobutyl ketone, 2-Pentanone	200,000 × (R-1)/R
Alkenone[5]	none targeted	2000 × (R-1)/R
Aromatic/Cyclic Hydrocarbon	tetrahydrofuran	2000 × (R-1)/R
Halogenated Hydrocarbon	none targeted	2000 × (R-1)/R
Aliphatic Hydrocarbon	none targeted	500,000 × (R-1)/R
Ether	Butoxyethanol	2000 × (R-1)/R
Other Hydrocarbons	Tri-butyl Phosphate	2000 × (R-1)/R
Oxidizers	none targeted	1000 × (R-1)/R
Acids, Bases, Salts	Ammonia	100,000 × (R-1)/R
TC, TIC	N/A	(TC-TIC) < 1240 × (R-1)/R

[1] From Table 4A.2 in *242-A Evaporator - Liquid Effluent Retention Data Quality Objectives* (Von Bargen 1995).

[2] R is the ratio of feed flow rate to boil off rate (typically R = 2).

[3] The limits are applied using the sum of the fraction technique:

$$\sum_{n=1}^{i}\left(\frac{Conc_n}{LIMIT_n}\right)\leq 1$$

where i is the number of organic constituents detected in analysis of the waste fee tank. TC-TIC is not part of this summation.

[4] Ketone containing saturated alkyl group(s)

[5] Ketone containing unsaturated alkyl group(s)

[6] If a chemical fits in more than one chemical family, the more restrrictive limit applies.

Table B-3. Evaporator Feed Limits For Vessel Vent Organic Discharge[1]

Constituent	**Limit (mg/L)[2,3,4]**
Acetone	174.4 × (R-1)/R
1-Butanol	452 × (R-1)/R
2-Butoxyethanol	190.4 × (R-1)/R
2-Butanone	116 × (R-1)/R
Tri-Butyl Phosphate	2.030 E+4 x (R-1)/R
2-Hexanone	N/A
2-Pentanone	NA
Methyl Isobutyl Ketone	NA
Tetrahydrofuran	NA
TC, TIC	(TC - TIC) <174.4 × (R-1)/R (as acetone)

[1] From Table 4A.1 in *242-A Evaporator - Liquid Effluent Retention Data Quality Objectives* (Von Bargen 1995).

[2] Limits in this table are based on a maximum continuous operating time equivalent to six months per year. If total operating time is expected to exceed six months per year, the limits must be evaluated.

[3] The limits are applied using the sum of the fraction technique

$$\sum_{n=1}^{i}\left(\frac{Conc_n}{LIMIT_n}\right)\leq 1$$

where i is the number of organic constituents detected in analysis of the waste feed tank. TC-TIC is not part of this summation.

[4] R is the ratio of feed flow rate to slurry flow rate (typically =2).

PROCESS CONDENSATE DISCHARGE LIMITS

Table B-4. Process Condensate Limits for LERF liner Compatibility[1]

Chemical Family/Parameter	**Current Taget Compounds**	**Limit (mg/L)[2,6]**
Alcohol/Glycol	1-butanol	500,000
Alkanone[3]	Sum of acetone, 2-butanone, 2-hexanone, methyl isobutyl ketone	200,000
Alkenone[4]	none targeted	2000
Aromatic/Cyclic Hydrocarbon	tetrahydrofuran	2000
alogenated Hydrocarbon	none targeted	2000
Aliphatic Hydrocarbon	none targeted	500,000
Ether	Butoxyethanol	2000
Other Hydrocarbons	Tri-butyl Phosphate	2000
Oxidizers	none targeted	1000
Acids, Bases, Salts	Ammonia	100,000
pH	N/A	$2.0 < pH < 12.5$
TC, TIC	N/A	(TC-TIC) <1240

[1] From Table 4A.3 in *242-A Evaporator - Liquid Effluent Retention Data Quality Objectives* (Von Bargen 1995).

[2] The limits are applied using the sum of the fraction technique:

$$\sum_{n=1}^{i}\left(\frac{Conc_n}{LIMIT_n}\right)\leq 1$$

where i is the number of organic constituents detected in analysis of the waste fee tank. TC-TIC and pH are not part of this summation.

[3] Ketone containing saturated alkyl group(s)

[4] Ketone containing unsaturated alkyl group(s)

[5] If a chemical fits in more than one chemical family, the more restrictive limit applies

[6] Based on the definition of non-characteristically corrosive waste per *WAC 173-303-090*. Liner compatibility in the vendor's literature allows a pH range of 0.5 - 13.0.

Table B-5. Process Condensate DCGs[1]

Radionuclide	DCG (water) (μCi/mL)[2]
^{3}H	2.0×10^{-3}
^{14}C	7.0×10^{-5}
^{60}Co	5.0×10^{-6}
^{79}Se	2.0×10^{-5}
^{90}Sr	1.0×10^{-6}
^{94}Nb	3.0×10^{-5}
^{99}Tc	1.0×10^{-4}
^{106}Ru	6.0×10^{-6}
^{129}I	5.0×10^{-7}
^{134}Cs	2.0×10^{-6}
^{137}Cs	3.0×10^{-6}
^{144}Ce	7.0×10^{-6}
^{154}Eu	2.0×10^{-5}
^{155}Eu	1.0×10^{-4}
^{226}Ra	1.0×10^{-7}
^{237}Np	3.0×10^{-8}
^{238}Pu	4.0×10^{-8}
$^{239/240}Pu$	3.0×10^{-8}
^{241}Pu	2.0×10^{-6}
^{241}Am	3.0×10^{-8}
^{244}Cm	6.0×10^{-8}
U_{Gross}[3]	5.0×10^{-7}

[1] From *Final Safety Analysis Report, 242-A Evaporator Liquid Effluent Retention Facility* (Lavender 1993a)

[2] The DCGs are applied using the Unity Rule, modified as follows:

$$\sum_{n=1}^{N}\left(\frac{Conc_n}{DCG_n}\right) \leq 5000$$

[3] The DCG for ^{234}U was used for that of U_{Gross} for conservatism.

SLURRY DISCHARGE LIMITS

Table B-6. 242-A Evaporator Radiological Source Term[1]

Radionuclide	Limit (μCi/mL)
^{14}C	0.26
^{60}Co	1.2
^{79}Se	7.8×10^{-2}
^{90}Sr	220
^{94}Nb	9.8×10^{-2}
^{99}Tc	2.0
^{106}Ru	53
^{129}I	2.6×10^{-3}
^{134}Cs	15
^{137}Cs	1,500
^{154}Eu	5.0
^{155}Eu	7.0
^{226}Ra	3.3×10^{-2}
^{238}Pu	1.3×10^{-3}
$^{239/240}Pu$	0.16
^{241}Pu	15
^{241}Am	1.0
^{244}Cm	1.3×10^{-2}

[1] From *242-A Evaporator/Crystallizer Safety Analysis Report* (Lavender 1993b).

Table B-7. Double-Shell Tank Waste Corrosion Specifications[1]

Constituent	Limit (M)
$[NO_3] \le 1.0$ M	
Hydroxide	$0.01 \le [OH] \le 5.0$
Nitrite	$0.011 \le [NO_2] \le 5.5$
1.0 M $< [NO_3] \le 3.0$ M	
Hydroxide	$0.1 \times [NO_3] \le [OH] \le 10$
Nitrite	$[OH] + [NO_2] \ge 0.4 \times [NO_3]$
3.0 M $< [NO_3] \le 5.5$ M	
Hydroxide	$0.3 \le [OH] \le 10$
Nitrite	$[OH] + [NO_2] \ge 1.2$

---

[1] From *Operating Specifications for the 241-AN, AP, AW, AY, AZ, & SY Tank Farms* (Harris 1992).

Table B-8. Steam Condensate and Cooling Water Radionuclide Limits[1]

Radionuclide	Limit (μCi/mL)
Annual Average Concentration (any consecutive 12 month period)	
^{239}Pu (Total Alpha)	6.0×10^{-8}
^{137}Cs	3.0×10^{-5}
^{90}Sr (Total Beta)	2.0×10^{-5}
U^{Gross}	2.0×10^{-8}
Monthly Average Concentration	
^{239}Pu (Total Alpha)	1.2×10^{-7}
^{137}Cs	6.0×10^{-5}
^{90}Sr (Total Beta)	4.0×10^{-5}
U^{Gross}	4.0×10^{-8}

[1] From *Operating Specifications for the 242-A Evaporator-Crystallizer* (Wahlquist 1993).

VESSEL VENT EMISSION LIMITS

Table B-9. Vessel Vent Radionuclide Limits[1]

Radionuclide	Limit (μCi/mL)
Annual Average Concentration (any consecutive 12 month period)	
^{239}Pu (Total Alpha)	2.0×10^{-14}
^{90}Sr (Total Beta)	9.0×10^{-12}
Weekly Average Concentration (any consecutive 7 day period)	
^{239}Pu (Total Alpha)	2.0×10^{-13}
^{90}Sr (Total Beta)	9.0×10^{-11}
Maximum Instantaneous Concentration (average over a 4 hour period)	
^{239}Pu (Total Alpha)	1.0×10^{-10}
^{90}Sr (Total Beta)	4.5×10^{-8}

[1] From *Operating Specifications from the 242-A Evaporator-Crystallizer* (Wahlquist 1993).

This page intentionally left blank.

APPENDIX C

SAMPLE IDENTIFICATION AND ANALYSIS REQUIREMENTS

This page intentionally left blank.

Table C-1. Tank 106-AP Sampling Information

Sample Number	LAB ID Number	ANALYSES	Sample Type	Sample Location[1]	Sample Elevation[2]
106-AP-1a	V146	Organic/sVOA	Supernate	Riser 1 (30°)	307 in
106-AP-1b	V150	Organic/VOA	Supernate	Riser 1 (30°)	307 in
106-AP-1c	V153	Inorganic/Rad	Supernate	Riser 1 (30°)	307 in
106-AP-1d	V164	Mixing/Boildown	Supernate	Riser 1 (30°)	307 in
106-AP-2a	V159	Organic/sVOA	Supernate	Riser 1 (30°)	103 in
106-AP-2b	V162	Organic/VOA	Supernate	Riser 1 (30°)	103 in
106-AP-2c	V156	Inorganic/Rad	Supernate	Riser 1 (30°)	103 in
106-AP-2d	V166	Mixing/Boildown	Supernate	Riser 1 (30°)	103 in
106-AP-3a	V160	Organic/sVOA	Supernate	Riser 1 (150°)	60 in
106-AP-3b	V163	Organic/VOA	Supernate	Riser 1 (150°)	60 in
106-AP-3c	V157	Inorganic/Rad	Supernate	Riser 1 (150°)	60 in
106-AP-3d	V165	Mixing/Boildown	Supernate	Riser 1 (150°)	60 in
106-AP-4	V169	TOC	Surface	----	408 in
106-AP-IB	V142	Inorganic/Rad	Field Blank	----	----
106-AP-OB1	V144	Organic/sVOA	Field Blank	----	----
106-AP-OB2	V148	Organic/VOA	Field Blank	----	----
106-AP-TB1	----	Organic/sVOA	Trip Blank	----	----
106-AP-TB2	----	Organic/VOA	Trip Blank	----	----

[1] Risers 1 (30°) and 1 (150°) are located at 30 and 150 degress from North direction of AP-106 central pump pit, respectively.

[2] Sample elevation is defined as the distance from tank bottom.

Table C-2. Tank 241-AP-106 Samples and the Analytes Requested

SAMPLE NUMBER	LAB SAMPLE NUMBER	ANALYTES REQUESTED
106-AP-1a	V146	2-Butoxyethanol and n-Tributylphosphate.
106-AP-2a	V159	
106-AP-3a	V160	
106-AP-0B1	V144	
106-AP-1b	V150	Acetone, 1-Butanol, 2-Butanone, 2-Hexanone, 4-Methyl-2-Pentanone, 2-Pentanone, and Tetradydrofuran.
106-AP-2b	V162	
106-AP-3b	V163	
106-AP-0B2	V148	
106-AP-1c	V153	Visual appearance, DSC, TGA, pH, NH3, OH, TC, TIC, TOC, U_{gross}, AT, TB, ^{154}Eu, ^{155}Eu, ^{226}Ra, ^{3}H, ^{79}Se, ^{129}I, ^{237}Np, ^{241}Am, and ^{244}Cm.
106-AP-2c	V156	
106-AP-3c	V157	
106-AP-IB	V142	
106-AP-1d	V164	Mixing/boildown.
106-AP-2d	V166	
106-AP-3d	V165	
106-AP-4	V169	TOC.

Table C-3. Tank 107-AP Sampling Information

Sample Number	LAB ID Number	ANALYSES	Sample Type	Sample Location[1]	Sample Elevation[2]
107-AP-1a	S95V000001	Organic/VOA	Supernate	Riser 1 (90°)	132 in
107-AP-1b	S95V000007	Organic/sVOA	Supernate	Riser 1 (90°)	132 in
107-AP-1c	S95V000011	Inorganic/Rad	Supernate	Riser 1 (90°)	132 in
107-AP-1d	S95V000017	Mixing/Boildown	Supernate	Riser 1 (90°)	132 in
107-AP-2a	S95V000002	Organic/VOA	Supernate	Riser 1 (90°)	228 in
107-AP-2b	S95V000008	Organic/sVOA	Supernate	Riser 1 (90°)	228 in
107-AP-2c	S95V000012	Inorganic/Rad	Supernate	Riser 1 (90°)	228 in
107-AP-2d	S95V000018	Mixing/Boildown	Supernate	Riser 1 (90°)	228 in
107-AP-3a	S95V000003	Organic/VOA	Supernate	Riser 1 (210°)	156 in
107-AP-3b	S95V000009	Organic/sVOA	Supernate	Riser 1 (210°)	156 in
107-AP-3c	S95V000013	Inorganic/Rad	Supernate	Riser 1 (210°)	156 in
107-AP-3d	S95V000019	Mixing/Boildown	Supernate	Riser 1 (210°)	156 in
107-AP-4a	S95V000004	Organic	Supernate	Riser 1 (210°)	324 in
107-AP-4b	S95V000020	Inorganic	Supernate	Riser 1 (210°)	324 in
107-AP-5a	S95V000005	Organic	Supernate	Riser 1 (330°)	120 in
107-AP-5b	S95V000021	Inorganic	Supernate	Riser 1 (330°)	120 in
107-AP-6	S95V000022	TOC	Surface	Riser 1 (330°)	360 in
107-AP-IB	S95V000024	Inorganic/Rad	Field Blank	----	----
107-AP-OB1	S95V000006	Organic/VOA	Field Blank	----	----
107-AP-OB2	S95V000010	Organic/sVOA	Field Blank	----	----
107-AP-TB1	----	Organic/VOA	Trip Blank	----	----
107-AP-TB2	----	Organic/sVOA	Trip Blank	----	----

[1] Risers 1 (90°), 1 (210°), and 1 (330°) are located at 90 , 210, and 330 degrees from North direction of AP-106 central pump pit, respectively.

[2] Sample elevation is defined as the distance from tank bottom.

Table C-4. Tank 241-AP-107 Samples and the Analytes Requested

SAMPLE NUMBER	LAB SAMPLE NUMBER	ANALYTES REQUESTED
107-AP-1a	S95V00001	2-Butoxyethanol and n-Tributylphosphate.
107-AP-2a	S95V00002	
107-AP-3a	S95V00003	
107-AP-0B1	S95V00006	
107-AP-1b	S95V00007	Acetone, 1-Butanol, 2-Butanone, 2-Hexanone, 4-Methyl-2-Pentanone, 2-Pentanone, and Tetradydrofuran.
107-AP-2b	S95V00008	
107-AP-3b	S95V00009	
107-AP-0B2	S95V00010	
107-AP-1c	S95V000011	Visual appearance, DSC, TGA, pH, Al, Na, F, OH, PO_4, SO_4, NO_3, NO_2, U_{gross}, Sp.G, NH_3, TC, TIC, TOC, AT, TB, ^{3}H, ^{14}C, ^{60}Co, ^{79}Se, ^{90}Sr, ^{94}Nb, ^{99}Tc, ^{106}Ru, ^{129}I, ^{134}Cs, ^{137}Cs, ^{144}Ce, ^{154}Eu, ^{155}Eu, ^{226}Ra, ^{237}Np, ^{238}Pu, $^{239/240}Pu$, ^{241}Am, and ^{244}Cm.
107-AP-2c	S95V000012	
107-AP-3c	S95V000013	
107-AP-IB	S95V000024	
107-AP-1d	S95V000017	Mixing/Boidown
107-AP-2d	S95V000018	
107-AP-3d	S95V000019	
107-AP-4a	S95V000004	Acetone & Mixing/Boildown.
107-AP-5a	S95V000005	
107-AP-4b	S95V000020	NH_3, OH, and NO_3.
107-AP-5b	S95V000021	
107-AP-6	S95V000022	TOC

Table C-5. Tank 106-AW Sampling Information

SAMPLE NUMBER	ANALYSES	SAMPLE TYPE	SAMPLE LOCATION	SAMPLE ELEVATION[1]
106-AW-1	Mixing/Boildown	Supernate	Riser 16B	192 in
106-AW-2	Mixing/Boildown	Supernate	Riser 16B	52 in

[1] Sample elevation is defined as the distance from tank bottom.

This page intentionally left blank.

APPENDIX D

TANK 241-AP-106 ANALYTICAL RESULTS AND DATA EVALUATION

This page intentionally left blank.

Table D-1. Tank 241-AP-106 Analytical Data[1]: Aluminum

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	Mean (ug/l)	Std. Dev. (ug/l)
G386	2.28E+05	3.6%	na	2.13E+05	1.59E+04
G423	2.02E+05	1.1%	na		
G427	1.88E+05	8.9%	na		
G428	2.35E+05	4.6%	na		
G432	1.97E+05	4.6%	na		
G433	2.19E+05	0.8%	na		
G437	2.17E+05	1.3%	na		
G438	2.15E+05	1.6%	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

Table D-2. Tank 241-AP-106 Analytical Data[1]: Sodium

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	Mean (ug/l)	Std. Dev. (ug/l)
G423	5.26E+06	1.6%	na	4.72E+06	2.17E+06
G427	4.94E+06	1.0%	na		
G428[2]	6.81E+06	1.5%	na		
G432	5.14E+06	2.3%	na		
G433	5.47E+06	0.7%	na		
G437	5.44E+06	0.3%	na		
G438	5.42E+06	0.3%	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

[2] Data is discarded by Q test ($Q_{G428} = 0.716 > Q_{0.90} = 0.51$)

Table D-3. Tank 241-AP-106 Analytical Data[1]: Flouride

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
G386	1.83E+02	1.1%	87.5%	1.49E+02	2.07E+01
G423[2]	3.25E+02	1.9%	na		
G427	1.33E+02	2.3%	na		
G428	1.69E+02	0.6%	na		
G432	1.55E+02	0.0%	na		
G433	1.37E+02	2.2%	na		
G437	1.33E+02	4.5%	na		
G438	1.31E+03	0.8%	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

[2] Data is discarded by Q test ($Q_{G423} = 0.732 > Q_{0.90} = 0.47$)

Table D-4. Tank 241-AP-106 Analytical Data[1]: Hydroxide

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
106-AP-1C	9.71E+02	2.7%	na	6.62E+03	6.96E+03
106-AP-2C	4.49E+03	na	na		
106-AP-3C	1.44E+04	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-5. Tank 241-AP-106 Analytical Data[1]: Phosphate

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
G386	2.24E+02	1.3%	89.4%	2.13E+02	1.07E+01
G423	2.13E+02	0.5%	na		
G427	2.16E+02	1.9%	na		
G428	2.15E+02	0.5%	na		
G432	1.92E+02	2.0%	na		
G433	2.25E+02	1.8%	na		
G437	2.11E+02	2.4%	na		
G438	2.04E+02	2.0%	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

Table D-6. Tank 241-AP-106 Analytical Data[1]: Sulfate

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
G386[2]	1.81E+02	1.7%	95.5%	1.45E+02	1.54E+01
G423	1.36E+02	0.7%	na		
G427	1.40E+02	1.4%	na		
G428	1.52E+02	0.0%	na		
G432	1.37E+02	1.5%	na		
G433	1.42E+02	0.7%	na		
G437	1.37E+02	2.2%	na		
G438	1.36E+02	0.7%	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

[2] Data is discarded by Q test ($Q_{G386} = 0.644 > Q_{0.90} = 0.47$)

Table D-7. Tank 241-AP-106 Analytical Data[1]: Nitrate

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
G386	4.89E+03	1.2%	77.7%	4.31E+03	3.39E+02
G423	4.15E+03	1.0%	na		
G427	3.99E+03	2.8%	na		
G428[2]	9.48E+03	0.1%	na		
G432	4.33E+03	0.5%	na		
G433	4.03E+03	2.7%	na		
G437	4.13E+03	1.2%	na		
G438	4.65E+03	4.0%	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

[2] Data is discarded by Q test ($Q_{G428} = 0.836 > Q_{0.90} = 0.47$)

Table D-8. Tank 241-AP-106 Analytical Data[1]: Nitrite

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev (ug/ml)
G386	1.15E+03	0.9%	93.4%	1.09E+03	1.35E+02
G423	1.17E+03	1.7%	na		
G427	1.02E+03	1.0%	na		
G428	1.33E+03	1.5%	na		
G432	9.80E+02	1.3%	na		
G433[2]	1.02E+02	2.0%	na		
G437	9.85E+02	3.1%	na		
G438	9.70E+02	2.0%	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

[2] Data is discarded by Q test ($Q_{G433} = 0.707 > Q_{0.90} = 0.47$)

Table D-9. Tank 241-AP-106 Analytical Data[1]: Uranium

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
106-AP-1C	3.10E-01	1.7%	119%	4.44E-01	1.97E-01
106-AP-2C	3.52E-01	na	na		
106-AP-3C	6.71E-01	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-10. Tank 241-AP-106 Analytical Data[1]: Specific Gravity

Sample I.D	Data Result	Precision RPD	Accuracy % Rec.	Mean	Std. Dev.
G386	0.997	0.1%	na	0.997	0.00220
G423	0.997	0.5%	na		
G427	0.998	0.1%	na		
G428	1.000	0.1%	na		
G432	0.996	0.2%	na		
G433	0.997	0.0%	na		
G437	0.993	0.3%	na		
G438	0.994	0.4%	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

Table D-11. Tank 241-AP-106 Analytical Data[1]: pH

Sample I.D	Data Result	Precision RPD	Accuracy % Rec.	Mean	Std. Dev.
106-AP-1C	12.54	0.1%	na	12.84	0.29
106-AP-2C	12.87	na	na		
106-AP-3C	13.11	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-12. Tank 241-AP-106 Analytical Data[1]: Ammonia

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
106-AP-1C	6.40E+00	0.3	101.4%	1.77E+01	1.44E+01
106-AP-2C	1.28E+01	na	na		
106-AP-3C	3.40E+01	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-13. Tank 241-AP-106 Analytical Data[1]: Total Organic Carbon

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. ug/ml)
106-AP-1C	8.56E+01	na	98.6%	4.27E+02	5.57E+02
106-AP-2C	1.26E+02	na	na		
106-AP-3C	1.07E+03	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-14. Tank 241-AP-106 Analytical Data[1]: Surface Total Organic Carbon

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.
106-AP-4	1.11E+02	0.7%	96.3%

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-15. Tank 241-AP-106 Analytical Data[1]: Total Carbon

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
106-AP-1C	5.55E+02	4.6%	98.2%	1.23E+03	1.25E+03
106-AP-2C	4.66E+02	na	na		
106-AP-3C	2.67E+03	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-16. Tank 241-AP-106 Analytical Data[1]: Total Inorganic Carbon

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
106-AP-1C	4.77E+02	3.2%	99.3%	9.06E+02	8.27E+02
106-AP-2C	3.82E+02	na	na		
106-AP-3C	1.86E+03	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-17. Tank 241-AP-106 Analytical Data[1]: DSC-Exotherm

Sample I.D	Data Result (J/g)	Precision RPD	Accuracy % Rec.	Mean (J/g)	Std. Dev. (J/g)
106-AP-1C	0	0.0%	na	0	0
106-AP-2C	0	0.0%	na		
106-AP-3C	0	0.0%	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-18. Tank 241-AP-106 Analytical Data[1]: DSC-Endotherm

Sample I.D	Data Result (J/g)	Precision RPD	Accuracy % Rec.	Mean (J/g)	Std. Dev. (J/g)
106-AP-1C[2]	1483.4	32.9%	na	1496.3	44.1
106-AP-2C	1527.4	3.0%	na		
106-AP-3C	1465.1	2.4%	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

[2] Data is discarded due to its poor precision (≥ 20%)

Table D-19. Tank 241-AP-106 Analytical Data[1]: Water Weight Percent

Sample I.D	Data Result (H_2O wt%)	Precision RPD	Accuracy % Rec.	Mean (H_2O wt%)	Std. Dev. (H_2O wt%)
106-AP-1C	95.08	6.6%	na	91.57	6.79
106-AP-2C	95.88	0.2%	na		
106-AP-3C	83.74	0.02%	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-20. Tank 241-AP-106 Analytical Data[1]: Visual Appearance/Dose Rate

Sample I.D	Dose Rate (mR/hr)	Visual Observations
106-AP-1C	100	Yellow color, clear, no solids, single phase
106-AP-2C	350	Yellow color, clear, no solids, single phase
106-AP-3C	1400	Yellow color, clear, no solids, single phase

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-21. Tank 241-AP-106 Analytical Data[1]: Total Alpha

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
106-AP-1C	<5.30E-04	1.9%	92.0%	<5.28E-03	na
106-AP-2C	<5.23E-04	na	na		
106-AP-3C	<5.28E-03	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-22. Tank 241-AP-106 Analytical Data[1]: Total Beta

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
106-AP-1C	6.04E+00	3.9%	92.4%	4.04E+01	4.46E+01
106-AP-2C	2.44E+01	na	na		
106-AP-3C	9.09E+01	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-23. Tank 241-AP-106 Analytical Data[1]: Tritium

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
106-AP-1C	9.02E-03	6.1%	125.9%	1.01E-02	2.37E-03
106-AP-2C	1.28E-02	na	na		
106-AP-3C	8.43E-03	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-24. Tank 241-AP-106 Analytical Data[1]: Carbon-14

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
G423	1.26E-05	1.60%	81.6%	7.41E-06	2.93E-06
G427[2]	5.98E-06	26.1%	89.5%		
G428	6.77E-06	0.6%	71.3%		
G432[2]	1.36E-05	46.3%	89.0%		
G433	5.97E-06	24.0%	87.2%		
G437	5.80E-06	4.9%	88.0%		
G438	5.92E-06	20.7%	88.9%		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

[2] Data is discarded due to its poor precision (≥ 25%)

Table D-25. Tank 241-AP-106 Analytical Data[1]: Cobalt-60

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
G423	<1.33E-03	na	na	<1.92E-03	na
G427	<2.19E-04	na	na		
G428	<6.30E-04	na	na		
G432	<1.92E-03	na	na		
G433	<1.25E-03	na	na		
G437	<4.55E-04	na	na		
G438	<5.57E-04	na	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

Table D-26. Tank 241-AP-106 Analytical Data[1]: Selenium-79

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
106-AP-1C[2]	<2.50E-06	na	na	8.62E-06	na
106-AP-2C[2]	<2.49E-06	na	na		
106-AP-3C	8.62E-06	na	na		

---

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

[2] Since the sample analyses failed to detect the analyte, the detection limit values which were less than a detected analyte sample result are discarded from calculating the mean.

Table D-27. Tank 241-AP-106 Analytical Data[1]: Strontium-90

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
G386	5.57E-05	0.4%	na	1.18E-04	6.73E-05
G423	1.48E-04	18.5%	na		
G427	8.10E-05	1.0%	na		
G428	7.39E-05	2.0%	na		
G432[2]	4.27E-05	53.6%	na		
G433	2.24E-04	4.3%	na		
G437	1.83E-04	4.2%	na		
G438	5.79E-05	12.6%	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

[2] Data is discarded due to its poor precision (≥ 20%)

Table D-28. Tank 241-AP-106 Analytical Data[1]: Niobium-94

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
G386	<1.10E-03	na	na	<1.39E-03	na
G423	<1.16E-03	na	na		
G427	<4.21E-04	na	na		
G428	<9.63E-04	na	na		
G432	<1.39E-03	na	na		
G433	<1.15E-03	na	na		
G437	<6.86E-04	na	na		
G438	<6.48E-04	na	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

Table D-29. Tank 241-AP-106 Analytical Data[1]: Technetium-99

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
G386	1.40E-03	3.6%	na	1.33E-03	1.66E-04
G423[2]	<1.35E-03	na	na		
G427[3]	1.18E-03	21.2%	na		
G428	1.61E-03	8.7%	na		
G432	1.26E-03	17.5%	na		
G433	1.13E-03	0.9%	na		
G437[3]	1.49E-03	22.8%	na		
G438	1.23E-03	0.8%	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

[2] Since the sample analysis failed to detect the analyte, the detection limit value which was less than detected analyte sample results is discarded from calculating the mean.

[3] Data is discarded due to its poor precision ($\geq$ 20%)

Table D-30. Tank 241-AP-106 Analytical Data[1]: Ruthenium-106

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
G386	<5.52E-02	na	na	<3.36E-02	na
G423	<4.80E-02	na	na		
G427	<1.95E-02	na	na		
G428	<5.08E-02	na	na		
G432	<6.36E-02	na	na		
G433	<4.97E-02	na	na		
G437	<3.56E-02	na	na		
G438	<3.53E-02	na	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

Table D-31. Tank 241-AP-106 Analytical Data[1]: Iodine-129

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
106-AP-1C[2]	<1.10E-04	1.4%	86.8%	<2.01E-04	na
106-AP-2C[2]	<2.01E-04	na	na		
106-AP-3C	1.02E-04	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

[2] Since the sample analyses failed to detect the analyte, the highest detection limit value which is greater than a detected analyte sample result is conservatively used to represent the tank concentration.

Table D-32. Tank 241-AP-106 Analytical Data[1]: Cesium-134

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
G386	1.74E-02	1.1%	na	1.35E-02	1.82E-03
G423	1.26E-02	14.3%	na		
G427	1.24E-02	5.6%	na		
G428	2.40E-02	0.8%	na		
G432	1.29E-02	8.5%	na		
G433[2]	1.32E-03	15%	na		
G437	1.24E-02	0%	na		
G438	1.26E-02	9.5%	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

[2] Data is discarded by Q test ($Q_{G433} = 0.884 > Q_{0.90} = 0.47$)

Table D-33. Tank 241-AP-106 Analytical Data[1]: Cesium-137

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
G386	5.99	0.8	na	4.77	0.57
G423	4.29	0.5	na		
G427	4.74	3.6	na		
G428[2]	9.30	0.4	na		
G432	4.36	0.2	na		
G433	4.64	0.2	na		
G437	4.70	0.2	na		
G438	4.64	2.6	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

[2] Data is discarded by Q test ($Q_{G428} = 0.661 > Q_{0.90} = 0.47$)

Table D-34. Tank 241-AP-106 Analytical Data[1]: Cerium-144

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
G386	2.81E-02	na	na	<4.72E-02	na
G423	<2.45E-02	na	na		
G427	<1.44E-02	na	na		
G428	<4.56E-02	na	na		
G432	<4.72E-02	na	na		
G433	<2.53E-02	na	na		
G437	<1.94E-02	na	na		
G438	<1.93E-02	na	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

Table D-35. Tank 241-AP-106 Analytical Data[1]: Europium-154

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
106-AP-1C	<7.64E-03	na	na	<1.48E-02	na
106-AP-2C	<7.13E-03	na	na		
106-AP-3C	<1.48E-02	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-36. Tank 241-AP-106 Analytical Data[1]: Europium-155

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
106-AP-1C	<2.57E-02	na	na	<6.76E-02	na
106-AP-2C	<3.50E-02	na	na		
106-AP-3C	<6.76E-02	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-37. Tank 241-AP-106 Analytical Data[1]: Radium-226

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
106-AP-1C	<2.10E-01	na	na	<6.17E-01	na
106-AP-2C	<3.23E-01	na	na		
106-AP-3C	<6.17E-01	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-38. Tank 241-AP-106 Analytical Data[1]: Neptunium-237

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
106-AP-1C[2]	<2.06E-05	8.6%	81.3%	3.03E-05	na
106-AP-2C[2]	<1.84E-05	na	na		
106-AP-3C	3.03E-05	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

[2] Since the sample analyses failed to detect the analyte, the detection limit values which were less than a detected analyte sample result are discarded from calculating the mean.

Table D-39. Tank 241-AP-106 Analytical Data[1]: Plutonium-238

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
G386	<2.07E-05	na	na	<2.32E-04	na
G423	<2.32E-04	na	na		
G427	<2.01E-04	na	na		
G428	<2.01E-04	na	na		
G432	<1.05E-04	na	na		
G433	<2.06E-04	na	na		
G437	<1.99E-04	na	na		
G438	<1.93E-04	na	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

Table D-40. Tank 241-AP-106 Analytical Data[1]: Plutonium-239/240

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
G386	<1.32E-05	na	na	<1.36E-04	na
G423	<1.32E-04	na	na		
G427	<1.31E-04	na	na		
G428	<1.33E-04	na	na		
G432	<1.05E-04	na	na		
G433	<1.35E-04	na	na		
G437	<1.36E-04	na	na		
G438	<1.31E-04	na	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

Table D-41. Tank 241-AP-106 Analytical Data[1]: Americium-241

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
G386[2]	<2.55E-05	na	na	2.16E-04	1.78E-04
G423[3]	8.58E-05	33.1	na		
G427[2]	<6.37E-05	na	na		
G428[3]	1.24E-04	22.5	na		
G432	9.07E-05	na	na		
G433	4.20E-04	4.0	na		
G437	1.37E-04	10.9	na		
G438[2]	<1.24E-04	na	na		

[1] Data is obtained from Grout (Feed Tank) 106-AP, WHC-SD-WM-DP-049, Rev. 0.

[2] Since the sample analyses failed to detect the analyte, the detection limit values which were less than a detected analyte sample result are discarded from calculating the mean.

[3] Data is discarded due to its poor precision (≥ 20%)

Table D-42. Tank 241-AP-106 Analytical Data[1]: Curium-244

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
106-AP-1C	<2.51E-04	na	na	<2.79E-04	na
106-AP-2C	<2.68E-04	na	na		
106-AP-3C	<2.79E-04	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-43. Tank 241-AP-106 Analytical Data[1]: Acetone

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	90% C.I[3] (ug/l)	Mean (Std Dev)
106-AP-1B	4.10E+02	1%	106%	2.56E+04	3.86E+03 (4.87E+03)
106-AP-2B[2]	<5.00E+02	na	na		
106-AP-3B	7.30E+03	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

[2] Since the sample analysis failed to detect the analyte, the detection limit values which was less than a detected analyte sample result is discarded from calculating the mean.

[3] Upper 90 percent confidence interval is determined by using formula: mean + 6.314*standard deviation/sqrt(2)

Table D-44. Tank 241-AP-106 Analytical Data[1]: 1-Butanol

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	Largest (ug/l)	Std. Dev (ug/l)
106-AP-1B[2]	<2.50E+04	4%	89%	<2.50E+04	na
106-AP-2B[2]	<2.50E+04	na	na		
106-AP-3B	1.50E+03	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

[2] Since the sample analyses failed to detect the analyte, the highest detection limit value which was greater than a detected analyte sample is used to represent a tank concentration.

Table C-45. Tank 241-AP-106 Analytical Data[1]: 2-Butoxyethanol

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	90% C.I[2] (ug/l)	Mean (Std Dev)
106-AP-1A	2.20E+02	16	91%	2.44E+02	1.73E+02 (4.16E+01)
106-AP-2A	1.60E+02	na	na		
106-AP-3A	1.40E+02	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

[2] Upper 90 percent confidence interval is determined by using formula: mean + 2.920*standard deviation/sqrt(3)

Table D-46. Tank 241-AP-106 Analytical Data[1]: 2-Butanone

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	Largest (ug/l)	Std. Dev. (ug/l)
106-AP-1B	4.90E+01	1%	105%	<5.00E+02	na
106-AP-2B[2]	<5.00E+02	na	na		
106-AP-3B[2]	<5.00E+02	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

[2] Since the sample analyses failed to detect the analyte, the highest detection limit value which was greater than a detected analyte sample result is used to represent a tank concentration.

Table D-47. Tank 241-AP-106 Analytical Data[1]: Tributylphosphate

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	90% C.I[2] (ug/l)	Mean (Std Dev)
106-AP-1A	1.10E+02	20%	108%	1.39E+03	5.07E+02 (5.23E+02)
106-AP-2A	3.10E+02	na	na		
106-AP-3A	1.10E+03	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

[2] Upper 90 percent confidence interval is determined by using formula: mean + 2.920*standard deviation/sqrt(3)

Table D-48. Tank 241-AP-106 Analytical Data[1]: 2-Hexanone

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	Mean (ug/l)	Std. Dev. (ug/l)
106-AP-1B	<5.00E+02	6%	121%	<5.00E+02	na
106-AP-2B	<5.00E+02	na	na		
106-AP-3B	<5.00E+02	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-49. Tank 241-AP-106 Analytical Data[1]: 2-Pentanone

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	Mean (ug/l)	Std. Dev. (ug/l)
106-AP-1B	<5.00E+02	6%	116%	<5.00E+02	na
106-AP-2B	<5.00E+02	na	na		
106-AP-3B	<5.00E+02	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-50. Tank 241-AP-106 Analytical Data[1]: MIBK

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	Mean (ug/l)	Std. Dev. (ug/l)
106-AP-1B	<5.00E+02	7%	97%	<5.00E+02	na
106-AP-2B	<5.00E+02	na	na		
106-AP-3B	<5.00E+02	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

Table D-51. Tank 241-AP-106 Analytical Data[1]: Tetrahydrofuran

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	Mean (ug/l)	Std. Dev.
106-AP-1B[2]	<5.00E+02	3%	102%	6.80E+02	na
106-AP-2B[2]	<5.00E+02	na	na		
106-AP-3B	6.80E+02	na	na		

[1] Data is obtained from Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106, WHC-SD-WM-DP-078, Rev. 0B.

[2] Since the sample analyses failed to detect the analyte, the detection limit values which were less than a detected analyte sample result are discarded from calculating the mean.

This page intentionally left blank.

APPENDIX E

TANK 241-AP-107 ANALYTICAL RESULTS AND DATA EVALUATION

This page intentionally left blank.

Table E-1. Tank 241-AP-107 Analytical Data[1]: Aluminum

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
107-AP-1C	2.75E+02	na	na	2.73E+02	5.60E+00
107-AP-2C	2.67E+02	0.2%	100.9%		
107-AP-3C	2.78E+02	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-2. Tank 241-AP-107 Analytical Data[1]: Sodium

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
107-AP-1C	1.14E+04	na	na	1.14E+04	0
107-AP-2C	1.14E+04	na	122%		
107-AP-3C[2]	1.17E+04	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Data is discarded by Q test ($Q_{107\text{-}AP\text{-}3C} = 1 > Q_{0.90} = 0.94$)

Table E-3. Tank 241-AP-107 Analytical Data[1]: Fluoride

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
107-AP-1C	4.63E+03	na	na	4.60E+03	4.95E+01
107-AP-2C	4.56E+03	28.2%	79.2%		
107-AP-3C[2]	2.34E+03	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Data is discarded by Q test ($Q_{107\text{-}AP\text{-}3C} = 0.969 > Q_{0.90} = 0.94$)

Table E-4. Tank 241-AP-107 Analytical Data[1]: Hydroxide

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
107-AP-1C	5.53E+03	na	na	5.43E+03	1.40E+02
107-AP-2C	5.61E+03	0.71%	na		
107-AP-3C	5.25E+03	na	na		
107-AP-4B	5.39E+03	na	na		
107-AP-5B	5.39E+03	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-5. Tank 241-AP-107 Analytical Data[1]: Phosphate

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Largest (ug/ml)	Std. Dev. (ug/ml)
107-AP-1C	1.75E+02	na	na	<6.06E+02	na
107-AP-2C[2]	<6.06E+02	0.6%	90.8%		
107-AP-3C[2]	<6.06E+02	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Since the sample analyses failed to detect the analyte, the highest detection limit value which was greater than a detected analyte sample result is used to present a tank concentration.

Table E-6. Tank 241-AP-107 Analytical Data[1]: Sulfate

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
107-AP-1C	3.36E+02	na	na	<6.06E+02	na
107-AP-2C[2]	<6.06E+02	1.0%	92.6%		
107-AP-3C[2]	<6.06E+02	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Since the sample analyses failed to detect the analyte, the highest detection limit value which was greater than a detected analyte sample result is used to present a tank concentration.

Table E-7. Tank 241-AP-107 Analytical Data[1]: Nitrate

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
107-AP-1C	6.78E+03	na	na	6.81E+03	4.24E+01
107-AP-2C	6.84E+03	2.2%	92.6%		
107-AP-3C[2]	3.59E+03	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Data is discarded by Q test ($Q_{107\text{-}AP\text{-}3C} = 0.982 > Q_{0.90} = 0.94$)

Table E-8. Tank 241-AP-107 Analytical Data[1]: Nitrite

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
107-AP-1C	1.59E+03	na	na	1.59E+03	1.91E+01
107-AP-2C	1.61E+03	0.6%	78.0%		
107-AP-3C	1.57E+03	na	na		
107-AP-4B[2]	6.05E+03	na	na		
107-AP-5B	1.57E+03	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Data is discarded by Q test ($Q_{107\text{-AP-4B}} = 0.991 > Q_{0.90} = 0.64$)

Table E-9. Tank 241-AP-107 Analytical Data[1]: Uranium

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
107-AP-1C	5.54E+00	na	na	5.82E+00	4.20E-01
107-AP-2C	5.63E+00	na	na		
107-AP-3C	6.30E+00	7.16%	115.8%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-10. Tank 241-AP-107 Analytical Data[1]: Specific Gravity

Sample I.D	Data Result	Precision RPD	Accuracy % Rec.	Mean	Std. Dev.
107-AP-1C	1.01	0.1%	na	1.01	0
107-AP-2C[2]	1.02	na	na		
107-AP-3C	1.01	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Data is discarded by Q test ($Q_{107\text{-AP-2C}} = 1.000 > Q_{0.90} = 0.94$)

Table E-11. Tank 241-AP-107 Analytical Data[1]: pH

Sample I.D	Data Result	Precision RPD	Accuracy % Rec.	Mean	Std. Dev.
107-AP-1C[2]	13.40	0.15	na	13.42	0
107-AP-2C	13.42	na	na		
107-AP-3C	13.42	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Data is discarded by Q test ($Q_{107\text{-AP-1C}} = 1.000 > Q_{0.90} = 0.94$)

Table E-12. Tank 241-AP-107 Analytical Data[1]: Ammonia

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
107-AP-1C	1.06E+03	na	na	1.04E+03	2.28E+01
107-AP-2C	1.02E+03	5.4%	92.5%		
107-AP-3C	1.01E+03	na	na		
107-AP-4B	1.04E+03	na	na		
107-AP-5B	1.06E+03	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-13. Tank 241-AP-107 Analytical Data[1]: Total Organic Carbon

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
107-AP-1C	2.39E+02	na	na	2.39E+02	0
107-AP-2C	2.39E+02	3.9%	100.9%		
107-AP-3C[2]	2.50E+02	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Data is discarded by Q test ($Q_{107\text{-AP-3C}} = 1.000 > Q_{0.90} = 0.94$)

Table E-14. Tank 241-AP-107 Analytical Data[1]: Surface Total Organic Carbon

Sample I.D	Data Result (ug/ml)	Precision	Accuracy
107-AP-6	2.63E+02	na	na

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-15. Tank 241-AP-107 Analytical Data[1]: Total Carbon

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
107-AP-1C	5.86E+02	na	na	5.75E+02	1.27E+01
107-AP-2C	5.77E+02	7.7%	95.5%		
107-AP-3C	5.61E+02	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-16. Tank 241-AP-107 Analytical Data[1]: Total Inorganic Carbon

Sample I.D	Data Result (ug/ml)	Precision RPD	Accuracy % Rec.	Mean (ug/ml)	Std. Dev. (ug/ml)
107-AP-1C	3.39E+02	na	na	3.36E+02	5.51E+00
107-AP-2C	3.40E+02	0.7%	99.5%		
107-AP-3C	3.30E+02	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-17. Tank 241-AP-107 Analytical Data[1]: DSC-Exotherm

Sample I.D	Data Result (J/g)	Precision RPD	Accuracy % Rec.	Mean (J/g)	Std. Dev. (J/g)
107-AP-1C	0	0.0%	na	0	0
107-AP-2C	0	0.0%	na		
107-AP-3C	0	0.0%	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-18. Tank 241-AP-107 Analytical Data[1]: DSC-Endotherm

Sample I.D	Data Result (J/g)	Precision RPD	Accuracy % Rec.	Mean (J/g)	Std. Dev. (J/g)
107-AP-1C	1409.4	15.9%	na	1397.7	82.03
107-AP-2C	1473.2	7.3%	na		
107-AP-3C	1347.0	5.4%	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-19. Tank 241-AP-107 Analytical Data[1]: Water Weight Percent

Sample I.D	Data Result (H2O wt%)	Precision RPD	Accuracy % Rec.	Mean (H2O wt%)	Std. Dev. (H2O wt%)
107-AP-1C	94.49	0.38%	na	94.58	0.814
107-AP-2C	93.82	2.77%	na		
107-AP-3C	95.44	0.81%	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-20. Tank 241-AP-107 Analytical Data[1]: Visual Appearance/Dose Rate

Sample I.D	Dose Rate (mR/hr)	Visual Observations
107-AP-1C	175	Yellow color, clear, no solids, single phase
107-AP-2C	500	Yellow color, clear, no solids, single phase
107-AP-3C	300	Yellow color, clear, no solids, single phase

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-21. Tank 241-AP-107 Analytical Data[1]: Total Alpha

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	<5.90E-04	na	na	<9.31E-04	na
107-AP-2C	<9.31E-04	na	na		
107-AP-3C	<5.05E-04	10.2%	102.9%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-22. Tank 241-AP-107 Analytical Data[1]: Total Beta

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	9.61E+00	na	na	9.87E+00	3.01E-01
107-AP-2C	9.80E+00	na	na		
107-AP-3C	1.02E+01	7.7%	107.7%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-23. Tank 241-AP-107 Analytical Data[1]: Tritium

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C[2]	7.57E-02	na	na	3.53E-03	6.36E-04
107-AP-2C	3.98E-03	na	na		
107-AP-3C	3.08E-03	2.3%	98.1%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Data is discarded by Q test ($Q_{107\text{-AP-1C}} = 0.988 > Q_{0.90} = 0.94$)

Table E-24. Tank 241-AP-107 Analytical Data[1]: Carbon-14

Sample I.D	Data Result (ug/l)	Precision	Accuracy	Mean (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	1.88E-05	na	na	1.78E-05	5.66E-07
107-AP-2C	1.74E-05	na	na		
107-AP-3C	1.82E-05	0.2%	91.3%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-25. Tank 241-AP-107 Analytical Data[1]: Cobalt-60

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	<3.62E-02	na	105.1%	<3.62E-02	na
107-AP-2C	<3.54E-02	na	101.0%		
107-AP-3C	<3.44E-02	na	101.0%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-26. Tank 241-AP-107 Analytical Data[1]: Selenium-79

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	<5.17E-07	na	na	<5.73E-07	na
107-AP-2C	<5.47E-07	na	na		
107-AP-3C	<5.73E-07	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-27. Tank 241-AP-107 Analytical Data[1]: Strontium-90

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	3.38E-01	na	na	2.18E-01	1.70E-01
107-AP-2C[2]	<1.34E-02	na	na		
107-AP-3C	9.78E-02	0.3%	93.4%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Since the sample analysis failed to detect the analyte, the detection limit value which was less than a detected analyte sample result is discarded from calculating the mean.

Table E-28. Tank 241-AP-107 Analytical Data[1]: Niobium-94

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy %Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	<2.23E-02	na	na	<3.17E-02	na
107-AP-2C	<3.09E-02	na	na		
107-AP-3C	<3.17E-02	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-29. Tank 241-AP-107 Analytical Data[1]: Technetium-99

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	1.87E-03	na	na	2.20E-03	5.18E-04
107-AP-2C	1.94E-03	na	na		
107-AP-3C	2.80E-03	0.9%	101.9%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-30. Tank 241-AP-107 Analytical Data[1]: Ruthenium-106

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	<1.20E+00	na	103.9	<1.20E+00	na
107-AP-2C	<9.12E-01	na	96.3%		
107-AP-3C	<9.47E-01	na	96.3%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-31. Tank 241-AP-107 Analytical Data[1]: Iodine-129

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	<1.24E-04	na	na	<1.40E-04	na
107-AP-2C	<1.40E-04	na	na		
107-AP-3C	<8.35E-05	2.5%	96.8%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-32. Tank 241-AP-107 Analytical Data[1]: Cesium-134

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	1.31E-01	na	102.7%	9.54E-02	5.04E-02
107-AP-2C[2]	<5.55E-02	na	91.5%		
107-AP-3C	5.97E-02	na	91.5%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Since the sample analysis failed to detect the analyte, the detection limit value which was less than detected analyte sample result is discarded from calculating the mean.

Table E-33. Tank 241-AP-107 Analytical Data[1]: Cesium-137

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C[2]	2.34E+01	3.4%	102.7%	9.70E+00	2.19E-01
107-AP-2C	9.54E+00	2.0%	91.5%		
107-AP-3C	9.85E+00	0.3%	91.5%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Data is discarded by Q test ($Q_{107\text{-AP-1C}} = 0.978 > Q_{0.90} = 0.94$).

Table E-34. Tank 241-AP-107 Analytical Data[1]: Cerium-144

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	<2.46E-01	na	na	<5.62E-01	na
107-AP-2C	<5.62E-01	na	na		
107-AP-3C	<5.60E-01	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-35. Tank 241-AP-107 Analytical Data[1]: Europium-154

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	<7.58E-02	na	103.9%	<9.17E-02	na
107-AP-2C	<7.16E-02	na	96.3%		
107-AP-3C	<9.17E-02	na	96.3%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-36. Tank 241-AP-107 Analytical Data[1]: Europium-155

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	<1.85E-01	na	103.9%	<1.85E-01	na
107-AP-2C	<1.44E-01	na	96.3%		
107-AP-3C	<1.40E-01	na	96.3%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-37. Tank 241-AP-107 Analytical Data[1]: Radium-226

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	<1.50E+00	na	103.9%	<1.50E+00	na
107-AP-2C	<1.06E+00	na	96.3%		
107-AP-3C	<1.15E+00	na	96.3%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-38. Tank 241-AP-107 Analytical Data[1]: Neptunium-237

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	2.59E-05	na	na	<2.93E-05	na
107-AP-2C[2]	<2.93E-05	na	na		
107-AP-3C	2.52E-05	36.4%	26.9%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Since the sample analysis failed to detect the analyte, the highest detection limit value which was greater than a detected analyte sample result is used to represent a tank concentration.

Table E-39. Tank 241-AP-107 Analytical Data[1]: Plutonium-238

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	<3.13E-05	na	na	<3.89E-05	na
107-AP-2C	<3.89E-05	na	na		
107-AP-3C	<3.12E-05	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-40. Tank 241-AP-107 Analytical Data[1]: Plutonium-239

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Mean (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	8.79E-05	na	na	8.77E-05	4.25E-06
107-AP-2C	8.34E-05	na	na		
107-AP-3C	9.19E-05	4.2%	102.5%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-41. Tank 241-AP-107 Analytical Data[1]: Americium-241

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	<2.56E-04	na	na	<3.11E-04	na
107-AP-2C	<2.57E-04	na	na		
107-AP-3C	<3.11E-04	1.9%	83.1%		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-42. Tank 241-AP-107 Analytical Data[1]: Curium-244

Sample I.D	Data Result (uCi/ml)	Precision RPD	Accuracy % Rec.	Largest (uCi/ml)	Std. Dev. (uCi/ml)
107-AP-1C	<2.56E-04	na	na	<3.11E-04	na
107-AP-2C	<2.57E-04	na	na		
107-AP-3C	<3.11E-04	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-43. Tank 241-AP-107 Analytical Data[1]: Acetone

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	90% C.I[2] (ug/l)	Mean (Std Dev)
107-AP-1A	4.10E+03	5%	74%	4.23E+03	4.04E+03 (1.14E+02)
107-AP-2A	3.90E+03	na	na		
107-AP-3A	4.00E+03	na	na		
107-AP-4A	4.20E+03	na	na		
107-AP-5A	4.00E+03	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Upper 90 percent confidence interval is determined by using formula: mean + 2.920*standard deviation/sqrt(3)

Table E-44. Tank 241-AP-107 Analytical Data[1]: 1-Butanol

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	90% C.I[2] (ug/l)	Mean (Std Dev)
107-AP-1A	2.20E+04	0%	98	2.26E+04	2.17E+04 (5.77E+02)
107-AP-2A	2.10E+04	na	na		
107-AP-3A	2.20E+04	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Upper 90 percent confidence interval is determined by using formula: mean + 2.920*standard deviation/sqrt(3)

Table E-45. Tank 241-AP-107 Analytical Data[1]: 2-Butoxyethanol

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	Mean (ug/l)	Std. Dev. (ug/l)
107-AP-1B	<2.00E+03	5%	74%	<2.00E+03	na
107-AP-2B	<2.00E+03	na	na		
107-AP-3B	<2.00E+03	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-46. Tank 241-AP-107 Analytical Data[1]: 2-Butanone

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	Mean (ug/l)	Std. Dev. (ug/l)
107-AP-1A	<5.00E+02	9%	92%	<5.00E+02	na
107-AP-2A	<5.00E+02	na	na		
107-AP-3A	<5.00E+02	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-47. Tank 241-AP-107 Analytical Data[1]: Tributylphosphate

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	90% C.I[2] (ug/l)	Mean (Std Dev)
107-AP-1B	1.40E+03	10%	114%	2.06E+03	1.63E+03 (2.52E+02)
107-AP-2B	1.90E+03	na	na		
107-AP-3B	1.60E+03	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

[2] Upper 90 percent confidence interval is determined by using formula: mean + 2.920*standard deviation/sqrt(3)

Table E-48. Tank 241-AP-107 Analytical Data[1]: 2-Hexanone

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	Mean (ug/l)	Std. Dev. (ug/l)
107-AP-1A	<5.00E+02	5%	86%	<5.00E+02	na
107-AP-2A	<5.00E+02	na	na		
107-AP-3A	<5.00E+02	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-49. Tank 241-AP-107 Analytical Data[1]: 2-Pentanone

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	Mean (ug/l)	Std. Dev. (ug/l)
107-AP-1A	<5.00E+02	0%	92%	<5.00E+02	na
107-AP-2A	<5.00E+02	na	na		
107-AP-3A	<5.00E+02	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-50. Tank 241-AP-107 Analytical Data[1]: MIBK

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	Mean (ug/l)	Std. Dev. (ug/l)
107-AP-1A	<5.00E+02	9%	92%	<5.00E+02	na
107-AP-2A	<5.00E+02	na	na		
107-AP-3A	<5.00E+02	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

Table E-51. Tank 241-AP-107 Analytical Data[1]: Tetrahydrofuran

Sample I.D	Data Result (ug/l)	Precision RPD	Accuracy % Rec.	Mean (ug/l)	Std. Dev. (ug/l)
107-AP-1A	<5.00E+02	0%	100%	<5.00E+02	na
107-AP-2A	<5.00E+02	na	na		
107-AP-3A	<5.00E+02	na	na		

[1] Data is obtained from Analysis and Characterization of Double Shell Tank 241-AP-107 for 242-A Evaporator Campaign 95-1, WHC-SD-WM-DP-098, Rev. 0-A.

This page intentionally left blank.

APPENDIX F

TANKS 102-AW AND 106-AW CHARACTERIZATION ANALYSES

This page intentionally left blank.

Table F-1. Tanks 102-AW and 106-AW Inorganic Data

Constitutent	Unit	Tank 102-AW[1]	Tank 106-AW[2]
Al	M	1.99E-02	4.12E-02
Na	M	8.96E-01	1.86E+00
F	M	1.18E-01	2.51E-01
OH	M	9.58E-02	2.38E-01
PO_4	M	3.62E-03	8.07E-03
SO_4	M	1.60E-02	2.78E-02
NO_3	M	2.20E-01	5.19E-01
NO_2	M	1.78E-01	3.34E-01
U	g/l	1.75E-02	1.28E-04
Sp.G	N/A	1.030	1.097
NH_3	M	2.95E-03	5.56E-04
TOC	g/l	5.61E-01	1.15E+00
TIC	M	1.73E-01	3.21E-01
Exotherms	J/g	0	0

[1] Raw Data (LCSS), 222-S Laboratory, "Sample Status Report for T-1512 FD-A," dated November 09, 1994.

[2] Raw Data (LCSS), 222-S Laboratory, "Sample Status Report for T-1648 SLY-A," dated November 14, 1994.

Table F-2. Tanks 102-AW and 106-AW Radionuclide Data

Constitutent	Unit	Tank 102-AW[1]	Tank 106-AW[2]
Tritium	uCi/L	1.22E+01	1.24E+01
Carbon-14	uCi/L	1.74E-02	5.26E-02
Cobalt-60	uCi/L	<5.80E-01	<2.81E+01
Selenium-79	uCi/L	1.12E-02	2.98E-02
Strontium-90	uCi/L	3.99E+02	5.49E+01
Niobium-94	uCi/L	<1.76E+00	<2.30E+01
Technetium-99	uCi/L	3.73E+00	6.39E+00
Ruthenium-106	uCi/L	<7.61E+01	1.40E+03
Iodine-129	uCi/L	<3.63E-02	2.16E-02
Cesium-134	uCi/L	3.04E+01	<7.92E+01
Cesium-137	uCi/L	1.58E+04	3.17E+04
Cerium-144	uCi/L	<2.46E+01	<4.61E+02
Europium-154	uCi/L	<3.11E+00	<1.15E+02
Europium-155	uCi/L	<1.11E+01	<2.17E+02
Neptunium-237	uCi/L	<2.36E-02	<2.06E-02
Plutonium-239/240	uCi/L	1.07E-01	4.31E-01
Americium-241	uCi/mL	3.77E-04	9.51E-04
Curium-244	uCi/mL	<5.27E-05	<2.80E-05

[1] Raw Data (LCSS), 222-S Laboratory, "Sample Status Report for T-1512 FD-A," dated November 09, 1994.

[2] Raw Data (LCSS), 222-S Laboratory, "Sample Status Report for T-1648 SLY-A," dated November 14, 1994.

APPENDIX G

CAMPAIGN 95-1 FEED COMPOSITE DATA

This page intentionally left blank.

Table G-1. Campaign 95-1 Inorganic Feed Composite

Constitutent	106-AP	107-AP	102-AW[1]	106-AW	COMPOSITE[2]
Al (M)	7.89E-03	1.01E-02	4.05E-03	4.12E-02	1.49E-02
Na (M)	2.05E-01	4.96E-01	1.11E-01	1.86E+00	6.27E-01
F (M)	7.84E-03	2.42E-01	5.56E-03	2.51E-01	1.43E-01
OH (M)	3.89E-01	3.19E-01	1.86E-01	2.38E-01	3.20E-01
PO_4 (M)	2.24E-03	<6.38E-03	1.12E-03	8.07E-03	<4.84E-03
SO_4 (M)	1.51E-03	<6.31E-03	9.66E-04	2.78E-02	<8.34E-03
NO_3 (M)	6.95E-02	1.10E-01	3.64E-02	5.19E-01	1.69E-01
NO_2 (M)	2.37E-02	3.46E-02	1.40E-02	3.34E-01	8.69E-02
CO_3 (M)	1.51E-01	5.60E-03	9.86E-03	3.21E-01	7.01E-02
TOC (g/L)	4.72E-01	2.39E-01	2.11E-01	1.15E+00	4.81E-01
NH_3 (ppm)	1.77E+01	1.04E+03	9.18E+00	9.45E+00	4.00E+02
SpG	0.997	1.01	0.999	1.097	1.02

[1] Tank 102-AW inorganic concentration is calculated based on 1 inch of waste in tank 102-AW, 30.4 inches of waste from tank 106-AP, and 32.7 inches of water from flushing and cold run training.

[2] The feed composite is calculated using 36.27% for tank 106-AP, 37.62% for tank 107-AP, 6.84% for tank 102-AW, and 19.26% for tank 106-AW.

Table G-2. Campaign 95-1 Radionuclide Feed Composite

Radionuclide	**106-AP** (uCi/mL)	**107-AP** (uCi/mL)	**102-AW**[1] (uCi/mL)	**106-AW** (uCi/mL)	**Composite**[2] (uCi/mL)
^{3}H	1.01E-02	3.53E-03	4.98E-03	1.24E-02	7.72E-03
^{14}C	7.41E-06	1.78E-05	3.79E-06	5.26E-05	1.98E-05
^{60}Co	<1.92E-03	<3.54E-02	<9.20E-04	<2.81E-02	<1.95E-02
^{79}Se	8.62E-06	<5.73E-07	4.26E-06	2.98E-05	<9.37E-06
^{90}Sr	1.18E-04	2.18E-02	6.28E-03	5.49E-02	1.92E-02
^{94}Nb	<1.39E-03	<3.17E-02	<6.87E-04	<2.30E-02	<1.69E-02
^{99}Tc	1.33E-03	2.20E-03	6.89E-04	6.29E-03	2.57E-03
^{106}Ru	<3.36E-02	<9.47E-01	<1.71E-02	1.40E+00	<6.39E-01
^{129}I	<2.01E-04	<1.40E-04	<9.59E-05	2.16E-05	<1.36E-04
^{134}Cs	1.35E-02	9.54E-02	6.88E-03	<7.92E-02	<5.65E-02
^{137}Cs	4.77E+00	9.70E+00	2.51E+00	3.17E+01	1.17E+01
^{144}Ce	<4.72E-02	<5.62E-01	<2.28E-02	<4.61E-01	<3.19E-01
^{154}Eu	<1.48E-02	<9.17E-02	<7.07E-03	<1.15E-01	<6.25E-02
^{155}Eu	<6.76E-02	<1.44E-01	<3.22E-02	<2.17E-01	<1.23E-01
^{226}Ra	<6.17E-01	<1.15E+00	<2.93E-02	5.49E-06[3]	<4.57E-01
^{237}Np	3.03E-05	<2.93E-05	<1.47E-05	<2.06E-05	<2.70E-05
^{238}Pu	<2.32E-04	<3.89E-05	<1.10E-04	1.08E-04[4]	<1.27E-04
^{239}Pu	<1.36E-04	8.77E-05	<6.62E-05	4.31E-04	<1.70E-04
^{241}Am	2.16E-04	<3.11E-04	1.08E-04	9.51E-04	<3.86E-04
^{244}Cm	<2.79E-04	<3.11E-04	<1.33E-04	<2.80E-05	<2.33E-04
U_{gross} (g/L)	4.44E-04	5.63E-03	4.84E-04	1.28E-04	2.34E-03

[1] Tank 102-AW inorganic concentration is calculated based on 1 inch of waste in tank 102-AW, 30.4 inches of waste from tank 106-AP, and 32.7 inches of water from flushing and cold run training.

[2] The feed composite is calculated using 36.27% for tank 106-AP, 37.62% for tank 107-AP, 6.84% for tank 102-AW, and 19.26% for tank 106-AW.

[3] Due to lack of this analysis, the ^{226}Ra concentration was calculated using the formula, ^{90}Sr x 1.0E-04, taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[4] Due to lack of this analysis, the ^{238}Pu concentration was calculated using the formula, ^{239}Pu x 0.25, taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

Table G-3. Largest Organic Constituents in Campaign Feed Tanks

Constitutents	TK-106-AP[1] (ug/L)	TK-107-AP[2] (ug/L)	Highest Concentration (ug/L)
Acetone	2.56E+04	4.23E+03	2.56E+04
1-Butanol	<2.50E+04	2.26E+04	<2.50E+04
2-Butoxyethanol	2.44E+02	<2.00E+03	<2.00E+03
2-Butanone	<5.00E+02	<5.00E+02	<5.00E+02
Tributylphosphate	1.39E+03	2.06E+03	2.06E+03
2-Hexanone	<5.00E+02	<5.00E+02	<5.00E+02
2-Pentanone	<5.00E+02	<5.00E+02	<5.00E+02
Methyl-isobutyl-ketone	<5.00E+02	<5.00E+02	<5.00E+02
Tetrahydrofuran	6.80E+02	<5.00E+02	6.80E+02

[1] Upper 90 percent confidence interval mean value for tank 106-AP organic constituents from Appendix D.

[2] Upper 90 percent confidence interval mean value for tank 107-AP organic constituents from Appendix E.

Note: The waste in tank 106-AW is the processed waste from campaign 94-2. Most of volatile organic compounds were boiled off during the campaign. The logical assumption was made to neglect volatile organic compounds in tank 106-AW.

This page intentionally left blank.

APPENDIX H

COMPARISON OF CAMPAIGN 95-1 TO 242-A EVAPORATOR LIMITS

This page intentionally left blank.

Table H-1. Comparison of Miscellaneous 242-A Evaporator Feed Limits to Campaign 94-2 Feed

CONSTITUENT	**FEED**	**LIMIT**[1]	**COMMENT**
Differential Scanning Calorimetry	No exotherm was detected	No exotherm at a temperature below 335°F	IN COMPLIANCE
Exother/Endotherm	0	< 1	IN COMPLIANCE
Complexed Waste	Stop concentrating at one pass before reach nitrate saturation level	Do not concentrate exceeding the $NaNO_3/NaNO_2$ precipitation boundary	IN COMPLIANCE
Shielding Design (^{137}Cs)	< 0.03 Ci/L	< 0.8 Ci/L	IN COMPLIANCE
Fissile Material Concentration	< 2.73E-05 g/L	< 0.005 g/L	IN COMPLIANCE

[1] From 242-A Evaporator - Liquid Effluent Retention Data quality Objectives (Von Bargen 1995)

Table H-2. Comparision of Tank 106-AP Composition to Evaporator Feed Limits for Organic LERF Acceptance

CHEMICAL FAMILY/PARAMETER	CURRENT TARGET COMPOUNDS	LIMIT[1] (mg/L)	TANK 106-AP[2] (mg/L)	106-AP/LIMIT RATIO	COMMENT
Alcohol/Glycol	1-butanol	2.50E+05	<2.50E+01	<1.00E-04	In Compliance
Alkanone	Sum of acetone, 2-butanone, 2-hexanone, methyl isobutyl ketone, 2-Pentanone	1.00E+05	<2.76E+01	<2.76E-04	In Compliance
Alkenone	none targeted	1.00E+03	NA	NA	In Compliance
Aromatic/Cyclic Hydrocarbon	tetrahydrofuran	1.00E+03	6.80E-01	6.80E-04	In Compliance
Halogenated Hydrocarbon	none targeted	1.00E+03	NA	NA	In Compliance
Aliphatic Hydrocarbon	none targeted	2.50E+05	NA	NA	In Compliance
Ether	Butoxyethanol	1.00E+03	2.44E-01	2.44E-04	In Compliance
Other Hydrocarbons	Tributylphosphate	1.00E+03	1.39E+00	1.39E-03	In Compliance
Oxidizers	none targeted	5.00E+02	NA	NA	In Compliance
Acids, Bases, Salts	Ammonia	5.00E+04	1.77E+01	3.54E-04	In Compliance
TC, TIC	TC-TIC	6.20E+02	3.24E+02	5.23E-01	In Compliance
Unity Rule	Sum of Concentration to Limit ratios[3]	1.00E+00	NA	<2.69E-03	In Compliance

[1] From 242-A Evaporator - Liquid Effluent Retention Data Quality Objectives (Von Bargen 1995). The ratio of feed flow rate to boil off rate is assumed to be equal 2.

[2] Upper 90 percent confidence interval mean value for organic constituents from Appendix D are used for comparision to the limits.

[3] TC-TIC and ammonia are not part of this summation

Table H-3. Comparision of Tank 107-AP Composition to Evaporator Feed Limits for Organic LERF Acceptance

CHEMICAL FAMILY/PARAMETER	CURRENT TARGET COMPOUNDS	LIMIT[1] (mg/L)	TANK 107-AP (mg/L)	107-AP/LIMIT RATIO	COMMENT
Alcohol/Glycol	1-butanol	2.50E+05	2.26E+01	9.04E-05	In Compliance
Alkanone[6]	Sum of acetone, 2-butanone, 2-hexanone, methyl isobutyl ketone, 2-Pentanone	1.00E+05	<6.23E+00	<6.23E-05	In Compliance
Alkenone[7]	none targeted	1.00E+03	NA	NA	In Compliance
Aromatic/Cyclic Hydrocarbon	tetrahydrofuran	1.00E+03	<5.00E-01	<5.00E-04	In Compliance
Halogenated Hydrocarbon	none targeted	1.00E+03	NA	NA	In Compliance
Aliphatic Hydrocarbon	none targeted	2.50E+05	NA	NA	In Compliance
Ether	Butoxyethanol	1.00E+03	<2.00E+00	<2.00E-03	In Compliance
Other Hydrocarbons	Tributylphosphate	1.00E+03	2.06E+00	2.06E-03	In Compliance
Oxidizers	none targeted	5.00E+02	NA	NA	In Compliance
Acids, Bases, Salts	Ammonia	5.00E+04	1.04E+03	2.08E-02	In Compliance
TC, TIC	TC-TIC	6.20E+02	2.39E+02	3.85E-01	In Compliance
Unity Rule	Sum of Concentration to Limit Ratios[3]	1.00E+00	NA	<4.71E-03	In Compliance

[1] *From 242-A Evaporator - Liquid Effluent Retention Data Quality Objectives (Von Bargen 1995). The ratio of feed flow rate to boil off rate* is assumed to be equal 2.

[2] Upper 90 percent confidence interval mean value for organic constituents from Appendix E are used for comparision to the limits.

[3] TC-TIC and ammonia are not part of this summation

Table H-4. Comparision of Tank 106-AP Composition to Evaporator Feed Limits Based on Volatile Emissions

Constituent	Limit[1] (mg/L)	TANK 106-AP[2] (mg/L)	Ratio (106AP/Limit)	COMMENT
Acetone	8.72E+01	2.56E+01	2.94E-01	In Compliance
1-Butanol	2.26E+02	<2.50E+01	<1.11E-01	In Compliance
2-Butoxyethanol	9.52E+01	2.44E-01	2.56E-03	In Compliance
2-Butanone	5.80E+01	<5.00E-01	8.62E-03	In Compliance
Tributyl Phosphate	1.02E+04	1.39E+00	1.36E-04	
2-Hexanone	NA	<5.00E-01	NA	In Compliance
2-Pentanone	NA	<5.00E-01	NA	In Compliance
Methyl Isobutyl Ketone	NA	<5.00E-01	NA	In Compliance
Tetrahydrofuran	NA	6.80E-01	NA	In Compliance
TC-TIC	8.72E+01	3.24E+02	3.72E+00	In Compliance[3]
Sum of Concentration to Limit Ratios[4]	1.00E+00	NA	<4.16E-01	In Compliance

[1] From 242-A Evaporator - Liquid Effluent Retention Data Quality Objectives (Von Bargen 1995). The ratio of feed flow rate to boil off rate is assumed to be equal 2.

[2] Upper 90 percent confidence interval mean value for organic constituents from Appendix D are used for comparision to the limits.

[3] The highest volatile and semivolatile contents from tank 106-AP samples were found to be <28 ppm and <41 ppm, respectively. The organic compounds released from the 242-A vessel vent would primarily consist of volatile organics plus a small percentage of semivolatile organics. If all volatile and semivolatile organics are released <68 ppm would exit the stack. This is well below the 87 ppm limit set by the DQO. The "TC-TIC" value exceeds the DQO limit of 87. However based on the volatile and semivolatile organic data, the additional organics comprising the "TC-TIC" are expected to consist of water soluble organic compounds such as acetate, citrates, oxalates, EDTA, etc...which are commonly found in the tanks. These compounds are not volatilized during the 242-A evaporator process. Based on a review of the lab gas chromatogram data for volatile and semivolatile analyses, no additional peaks were observed that would contribute significantly to the organic discharge rate.

[4] TC-TIC is not part of this summation.

Table H-5. Comparision of Tank 107-AP Composition to Evaporator Feed Limits Based on Volatile Emissions[1]

Constituent	Limit[1] (mg/L)	TANK 107-AP[2] (mg/L)	Ratio (106AP/Limit)	COMMENT
Acetone	8.72E+01	4.23E+00	4.85E-02	In Compliance
1-Butanol	2.26E+02	2.26E+01	1.00E-01	In Compliance
2-Butoxyethanol	9.52E+01	<2.00E+00	<2.10E-02	In Compliance
2-Butanone	5.80E+01	<5.00E-01	8.62E-03	In Compliance
Tributyl Phosphate	1.02E+04	2.06E+00	2.02E-04	
2-Hexanone	NA	<5.00E-01	NA	In Compliance
2-Pentanone	NA	<5.00E-01	NA	In Compliance
Methyl Isobutyl Ketone	NA	<5.00E-01	NA	In Compliance
Tetrahydrofuran	NA	<5.00E-01	NA	In Compliance
TC-TIC	8.72E+01	2.39E+02	2.74E+00	In Compliance[3]
Sum of Concentration to Limit Ratios[4]	1.00E+00	NA	<1.78E-01	In Compliance

[1] From 242-A Evaporator - Liquid Effluent Retention Data Quality Objectives (Von Bargen 1995). The ratio of feed flow rate to boil off rate is assumed to be equal 2.

[2] Upper 90 percent confidence interval mean value for organic constituents from Appendix E are used for comparision to the limits.

[3] The highest volatile and semivolatile contents from tank 107-AP samples were found to be <32 ppm and <33 ppm, respectively. The organic compounds released from the 242-A vessel vent would primarily consist of volatile organics plus a small percentage of semivolatile organics. If all volatile and semivolatile organics are released <65 ppm would exit the stack. This is well below the 87 ppm limit set by the DQO. The "TC-TIC" value exceeds the DQO limit of 87. However based on the volatile and semivolatile organic data, the additional organics comprising the "TC-TIC" are expected to consist of water soluble organic compounds such as acetate, citrates, oxalates, EDTA, etc...which are commonly found in the tanks. These compounds are not volatilized during the 242-A evaporator process. Based on a review of the lab gas chromatogram data for volatile and semivolatile analyses, no additional peaks were observed that would contribute significantly to the organic discharge rate.

[4] TC-TIC is not part of this summation.

Table H-6. Comparision of 106-AP Radionuclide Concentrations to Radiological Source Term

RADIONUCLIDE	TK-106-AP (μCi/mL)	LIMIT[1] (μCi/mL)	106-AP/LIMIT Ratio	COMMENT
^{14}C	7.41E-06	2.6E-01	2.9E-05	IN COMPLIANCE
^{60}Co	<1.92E-03	1.2E+00	<1.6E-03	IN COMPLIANCE
^{79}Se	8.62E-06	7.8E-02	1.1E-04	IN COMPLIANCE
^{90}Sr	1.18E-04	2.2E+02	5.4E-07	IN COMPLIANCE
^{94}Nb	<1.39E-03	9.8E-02	<1.4E-02	IN COMPLIANCE
^{99}Tc	1.33E-03	2.0E+00	6.7E-04	IN COMPLIANCE
^{106}Ru	<6.36E-02	5.3E+01	<1.2E-03	IN COMPLIANCE
^{129}I	<2.01E-04	2.6E-03	<7.7E-02	IN COMPLIANCE
^{134}Cs	1.35E-02	1.5E+01	9.0E-04	IN COMPLIANCE
^{137}Cs	4.77E+00	1.5E+03	3.2E-03	IN COMPLIANCE
^{154}Eu	<1.48E-02	5.0E+00	<3.0E-03	IN COMPLIANCE
^{155}Eu	<6.76E-02	7.0E+00	<9.7E-03	IN COMPLIANCE
^{226}Ra[2]	1.18E-08	3.3E-02	3.6E-07	IN COMPLIANCE
^{238}Pu[3]	<3.40E-05	1.3E-03	<2.6E-02	IN COMPLIANCE
$^{239/240}$Pu	<1.36E-04	1.6E-01	<8.5E-04	IN COMPLIANCE
^{241}Pu[4]	<5.58E-03	1.5E+01	<3.7E-04	IN COMPLIANCE
^{241}Am	2.16E-04	1.0E+00	2.2E-04	IN COMPLIANCE
^{244}Cm	<2.79E-04	1.3E-02	<2.1E-02	IN COMPLIANCE

[1] From *242-A Evaporator/Crystallizer Safety Analysis Report* (Lavender 1992).

[2] The ^{226}Ra analytical result was reported as not detectable and its detection limit was greater than four percent of the ^{226}Ra limit, the ^{226}Ra concentration was calculated using the formula, ^{90}Sr x 1.0E-04 taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[3] The ^{238}Pu analytical result was reported as not detectable and its detection limit was greater than four percent of the ^{238}Pu limit, the ^{238}Pu concentration was calculated using the formula, $^{239/240}$Pu x 2.5E-01, taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[4] Due to the difficulties associated with its analysis, the ^{241}Pu concentration was calculated using the formula, $^{239/240}$Pu x 4.1E+01, taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

Table H-7. Comparision of 107-AP Radionuclide Concentrations to Radiological Source Term

RADIONUCLIDE	TK-107-AP (μCi/mL)	LIMIT[1] (μCi/mL)	107-AP/LIMIT Ratio	COMMENT
^{14}C	1.78E-05	2.6E-01	6.8E-05	IN COMPLIANCE
^{60}Co	<3.54E-02	1.2E+00	<3.0E-02	IN COMPLIANCE
^{79}Se	<6.73E-07	7.8E-02	<8.6E-06	IN COMPLIANCE
^{90}Sr	2.18E-02	2.2E+02	9.9E-05	IN COMPLIANCE
^{94}Nb[2]	5.00E-05	9.8E-02	5.1E-04	IN COMPLIANCE
^{99}Tc	2.20E-03	2.0E+00	1.1E-03	IN COMPLIANCE
^{106}Ru	<9.47E-01	5.3E+01	<1.8E-02	IN COMPLIANCE
^{129}I	<1.40E-04	2.6E-03	<5.4E-02	IN COMPLIANCE
^{134}Cs	9.54E-02	1.5E+01	6.4E-03	IN COMPLIANCE
^{137}Cs	9.70E+00	1.5E+03	6.5E-03	IN COMPLIANCE
^{154}Eu	<9.17E-02	5.0E+00	<1.8E-02	IN COMPLIANCE
^{155}Eu	<1.44E-01	7.0E+00	<2.1E-02	IN COMPLIANCE
^{226}Ra[3]	2.18E-06	3.3E-02	6.6E-05	IN COMPLIANCE
^{238}Pu	<3.89E-05	1.3E-03	<3.0E-02	IN COMPLIANCE
$^{239/240}$Pu	8.77E-05	1.6E-01	5.5E-04	IN COMPLIANCE
^{241}Pu[4]	3.60E-03	1.5E+01	2.4E-04	IN COMPLIANCE
^{241}Am	<3.11E-04	1.0E+00	<3.1E-04	IN COMPLIANCE
^{244}Cm	<3.11E-04	1.3E-02	<2.4E-02	IN COMPLIANCE

[1] From *242-A Evaporator/Crystallizer Safety Analysis Report* (Lavender 1992).

[2] The ^{94}Nb analytical result was reported as not detectable and its detection limit was greater than four percent of the ^{94}Nb limit, the ^{94}Nb concentration was calculated using the formula, ^{94}Nb = 5.0E-05 uCi/ml taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[3] The ^{226}Ra analytical result was reported as not detectable and its detection limit was greater than four percent of the ^{226}Ra limit, the ^{226}Ra concentration was calculated using the formula, ^{90}Sr x 1.0E-04 taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[4] Due to the difficulties associated with its analysis, the ^{241}Pu concentration was calculated using the formula, $^{239/240}$Pu x 4.1E+01, taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

Table H-8. Comparision of 102-AW Radionuclide Concentrations to Radiological Source Term

RADIONUCLIDE	TK-102-AW[1] (μCi/mL)	LIMIT[2] (μCi/mL)	102-AW/LIMIT Ratio	COMMENT
^{14}C	3.79E-06	2.6E-01	1.5E-05	IN COMPLIANCE
^{60}Co	<9.20E-04	1.2E+00	<7.7E-04	IN COMPLIANCE
^{79}Se	4.26E-06	7.8E-02	5.5E-05	IN COMPLIANCE
^{90}Sr	6.28E-03	2.2E+02	2.9E-05	IN COMPLIANCE
^{94}Nb	<6.87E-04	9.8E-02	<7.0E-03	IN COMPLIANCE
^{99}Tc	6.89E-04	2.0E+00	3.4E-04	IN COMPLIANCE
^{106}Ru	<3.14E-02	5.3E+01	<5.9E-04	IN COMPLIANCE
^{129}I	<9.59E-05	2.6E-03	<3.7E-02	IN COMPLIANCE
^{134}Cs	6.88E-03	1.5E+01	4.6E-04	IN COMPLIANCE
^{137}Cs	2.51E+00	1.5E+03	1.7E-03	IN COMPLIANCE
^{154}Eu	<7.07E-03	5.0E+00	<1.4E-03	IN COMPLIANCE
^{155}Eu	<3.22E-02	7.0E+00	<4.6E-03	IN COMPLIANCE
^{226}Ra[3]	6.28E-07	3.3E-02	1.9E-05	IN COMPLIANCE
^{238}Pu[4]	1.65E-05	1.3E-03	1.3E-02	IN COMPLIANCE
$^{239/240}$Pu	<6.62E-05	1.6E-01	<4.1E-04	IN COMPLIANCE
^{241}Pu[5]	<2.71E-03	1.5E+01	<1.8E-04	IN COMPLIANCE
^{241}Am	1.08E-04	1.0E+00	1.1E-04	IN COMPLIANCE
^{244}Cm	<1.33E-04	1.3E-02	<1.0E-02	IN COMPLIANCE

---

[1] The 102-AW radionuclide values were calculated based on 1 inch of waste in tank 102-AW, 30.4 inches of waste from tank 106-AP, and 32.7 inches of water from flushing and cold run training.

[2] From *242-A Evaporator/Crystallizer Safety Analysis Report* (Lavender 1992).

[3] The ^{226}Ra analytical result was reported as not detectable and its detection limit was greater than four percent of the ^{226}Ra limit, the ^{226}Ra concentration was calculated using the formula, ^{90}Sr x 1.0E-04 taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[4] Due to the difficulties associated with its analysis, the ^{238}Pu concentration was calculated using the formula, $^{239/240}$Pu x 2.5E-01, taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[5] Due to the difficulties associated with its analysis, the ^{241}Pu concentration was calculated using the formula, $^{239/240}$Pu x 4.1E+01, taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

Table H-9. Comparision of 106-AW Radionuclide Concentrations to Radiological Source Term

RADIONUCLIDE	TK-106-AW (μCi/mL)	LIMIT[1] (μCi/mL)	106-AW/LIMIT Ratio	COMMENT
^{14}C	5.26E-05	2.6E-01	2.0E-04	IN COMPLIANCE
^{60}Co	<2.81E-02	1.2E+00	<2.3E-02	IN COMPLIANCE
^{79}Se	2.98E-05	7.8E-02	3.8E-04	IN COMPLIANCE
^{90}Sr	5.49E-02	2.2E+02	2.5E-04	IN COMPLIANCE
^{94}Nb[2]	5.00E-05	9.8E-02	5.1E-04	IN COMPLIANCE
^{99}Tc	6.29E-03	2.0E+00	3.1E-03	IN COMPLIANCE
^{106}Ru	1.40E+00	5.3E+01	2.6E-02	IN COMPLIANCE
^{129}I	2.16E-05	2.6E-03	8.3E-03	IN COMPLIANCE
^{134}Cs	<7.92E-02	1.5E+01	<5.3E-03	IN COMPLIANCE
^{137}Cs	3.17E+01	1.5E+03	2.1E-02	IN COMPLIANCE
^{154}Eu	<1.15E-01	5.0E+00	<2.3E-02	IN COMPLIANCE
^{155}Eu	<2.17E-01	7.0E+00	<3.1E-02	IN COMPLIANCE
^{226}Ra[3]	5.49E-06	3.3E-02	1.7E-04	IN COMPLIANCE
^{238}Pu[4]	1.08E-04	1.3E-03	8.3E-02	IN COMPLIANCE
$^{239/240}Pu$	4.31E-04	1.6E-01	2.7E-03	IN COMPLIANCE
^{241}Pu[5]	1.77E-02	1.5E+01	1.2E-03	IN COMPLIANCE
^{241}Am	9.51E-04	1.0E+00	9.5E-04	IN COMPLIANCE
^{244}Cm	<2.80E-05	1.3E-02	<2.2E-03	IN COMPLIANCE

[1] From *242-A Evaporator/Crystallizer Safety Analysis Report* (Lavender 1992).

[2] The ^{94}Nb analytical result was reported as not detectable and its detection limit was greater than four percent of the ^{94}Nb limit, the ^{94}Nb concentration was calculated using the formula, ^{94}Nb = 5.0E-05 uCi/ml taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[3] Due to the lack of this analysis, the ^{226}Ra concentration was calculated using the formula, ^{90}Sr x 1.0E-04 taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[4] Due to the lack of this analysis, the ^{238}Pu concentration was calculated using the formula, $^{239/240}Pu$ x 2.5E-01, taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[5] Due to the lack of this analysis, the ^{241}Pu concentration was calculated using the formula, $^{239/240}Pu$ x 4.1E+01, taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

Table H-10. Comparision of Campaign Feed Radionuclide Concentrations to Radiological Source Term

RADIONUCLIDE	FEED[1] (μCi/mL)	LIMIT[2] (μCi/mL)	FEED/LIMIT Ratio	COMMENT
^{14}C	1.98E-05	2.6E-01	7.6E-05	IN COMPLIANCE
^{60}Co	<1.95E-02	1.2E+00	<1.6E-02	IN COMPLIANCE
^{79}Se	<9.41E-06	7.8E-02	<1.2E-04	IN COMPLIANCE
^{90}Sr	1.92E-02	2.2E+02	8.7E-05	IN COMPLIANCE
^{94}Nb[3]	5.00E-05	9.8E-02	5.1E-04	IN COMPLIANCE
^{99}Tc	2.57E-03	2.0E+00	1.3E-03	IN COMPLIANCE
^{106}Ru	<6.51E-01	5.3E+01	<1.2E-02	IN COMPLIANCE
^{129}I	<1.36E-04	2.6E-03	<5.2E-02	IN COMPLIANCE
^{134}Cs	<5.65E-02	1.5E+01	<3.8E-03	IN COMPLIANCE
^{137}Cs	1.17E+01	1.5E+03	7.8E-03	IN COMPLIANCE
^{154}Eu	<6.25E-02	5.0E+00	<1.3E-02	IN COMPLIANCE
^{155}Eu	<1.23E-01	7.0E+00	<1.8E-02	IN COMPLIANCE
^{226}Ra[4]	1.92E-06	3.3E-02	5.8E-05	IN COMPLIANCE
^{238}Pu[5]	<4.25E-05	1.3E-03	<3.3E-02	IN COMPLIANCE
$^{239/240}$Pu	<1.70E-04	1.6E-01	<1.1E-03	IN COMPLIANCE
^{241}Pu[6]	<6.96E-03	1.5E+01	<4.6E-04	IN COMPLIANCE
^{241}Am	<3.86E-04	1.0E+00	<3.9E-04	IN COMPLIANCE
^{244}Cm	<2.33E-04	1.3E-02	<1.8E-02	IN COMPLIANCE

[1] Composite data from Appendix G, table G-2.

[2] From *242-A Evaporator/Crystallizer Safety Analysis Report* (Lavender 1992).

[3] The ^{94}Nb composite value was greater than four percent of the ^{94}Nb limit, the ^{94}Nb concentration was calculated using the formula, ^{94}Nb = 5.0E-05 uCi/ml taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[4] The ^{226}Ra composite value was greater than four percent of the ^{226}Ra limit, the ^{226}Ra concentration was calculated using the formula, ^{90}Sr x 1.0E-04 taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[5] The ^{238}Pu composite value was greater than four percent of the ^{238}Pu limit, the ^{238}Pu concentration was calculated using the formula, $^{239/240}$Pu x 2.5E-01, taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[6] Due to the lack of this analysis, the ^{241}Pu concentration was calculated using the formula, $^{239/240}$Pu x 4.1E+01, taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

Table H-11. Comparision of Projected Slurry Concentrations to Radiological Source Term

RADIONUCLIDE	SLURRY[1] (μCi/mL)	LIMIT[2] (μCi/mL)	FEED/LIMIT Ratio	COMMENT
^{14}C	1.98E-04	2.6E-01	7.6E-04	IN COMPLIANCE
^{60}Co	<1.95E-01	1.2E+00	<1.6E-01	IN COMPLIANCE
^{79}Se	<9.41E-05	7.8E-02	<1.2E-03	IN COMPLIANCE
^{90}Sr	1.92E-01	2.2E+02	8.7E-04	IN COMPLIANCE
^{94}Nb[3]	5.00E-04	9.8E-02	5.1E-03	IN COMPLIANCE
^{99}Tc	2.57E-02	2.0E+00	1.3E-02	IN COMPLIANCE
^{106}Ru	<6.51E+00	5.3E+01	<1.2E-01	IN COMPLIANCE
^{129}I	<1.36E-03	2.6E-03	<5.2E-01	IN COMPLIANCE
^{134}Cs	<5.65E-01	1.5E+01	<3.8E-02	IN COMPLIANCE
^{137}Cs	1.17E+02	1.5E+03	7.8E-02	IN COMPLIANCE
^{154}Eu	<6.25E-01	5.0E+00	<1.3E-01	IN COMPLIANCE
^{155}Eu	<1.23E+00	7.0E+00	<1.8E-01	IN COMPLIANCE
^{226}Ra[4]	1.92E-05	3.3E-02	5.8E-04	IN COMPLIANCE
^{238}Pu[5]	<4.25E-04	1.3E-03	<3.3E-01	IN COMPLIANCE
$^{239/240}$Pu	<1.70E-03	1.6E-01	<1.1E-02	IN COMPLIANCE
^{241}Pu[6]	<6.96E-02	1.5E+01	<4.6E-03	IN COMPLIANCE
^{241}Am	<3.86E-03	1.0E+00	<3.9E-03	IN COMPLIANCE
^{244}Cm	<2.33E-03	1.3E-02	<1.8E-01	IN COMPLIANCE

[1] Using assumption that all constituents concentrate at the same ratio, slurry values were calculated at 90% WVR by using the formula, slurry = feed / (1-WVRF).

[2] From *242-A Evaporator/Crystallizer Safety Analysis Report* (Lavender 1992).

[3] The ^{94}Nb composite value was greater than four percent of the ^{94}Nb limit, the ^{94}Nb concentration was calculated using the formula, ^{94}Nb = 5.0E-05 uCi/ml taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[4] The ^{226}Ra composite value was greater than four percent of the ^{226}Ra limit, the ^{226}Ra concentration was calculated using the formula, ^{90}Sr x 1.0E-04 taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[5] The ^{238}Pu composite value was greater than four percent of the ^{238}Pu limit, the ^{238}Pu concentration was calculated using the formula, $^{239/240}$Pu x 2.5E-01, taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[6] Due to the lack of this analysis, the ^{241}Pu concentration was calculated using the formula, $^{239/240}$Pu x 4.1E+01, taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

Table H-12. Comparison of Projected Process Condensate Concentrations to LERF Radiological Limits

RADIONUCLIDE	PROCESS CONDENSATE[1] (μCi/mL)	DCG[2] (μCi/mL)	P.C CONC./DCG Ratio
^{3}H	7.75E-03	2.0E-03	3.9E+01
^{14}C	3.50E-07	7.0E-05	5.0E-03
^{60}Co	<3.44E-04	5.0E-06	<6.9E+01
^{79}Se	<1.66E-07	2.0E-05	<8.3E-03
^{90}Sr	1.50E-06	1.0E-06	1.5E+00
^{94}Nb[3]	8.83E-07	3.0E-05	2.9E-02
^{99}Tc	4.54E-05	1.0E-04	4.5E-01
^{106}Ru	<1.50E-05	6.0E-06	<2.5E+00
^{129}I	<1.24E-04	5.0E-07	<2.5E+02
^{134}Cs	<2.89E-04	2.0E-06	<1.4E+02
^{137}Cs	2.27E-06	3.0E-06	7.6E-01
^{144}Ce	<5.64E-03	7.0E-06	<8.1E+02
^{154}Eu	<1.10E-03	2.0E-05	<5.5E+01
^{155}Eu	<2.17E-03	1.0E-04	<2.2E+01
^{226}Ra[4]	3.39E-08	1.0E-07	3.4E-01
^{237}Np	<4.77E-07	3.0E-08	<1.6E+01
^{238}Pu[5]	<2.06E-10	4.0E-08	<5.2E-03
$^{239/240}Pu$	<8.26E-10	3.0E-08	<2.7E-02
^{241}Pu[6]	<3.38E-08	2.0E-06	<1.8E-02
^{241}Am	<4.96E-09	3.0E-08	<1.6E-01
^{244}Cm	<4.12E-06	6.0E-08	<6.9E+01
U_{Gross}[7]	1.46E-08	5.0E-07	2.9E-02
TOTAL	1.75E-02	5.0E+03 DCG LIMIT	<1.4E+03 DCG IN COMPLIANCE

[1] The process condensate values were obtained by entering the feed composite from table G-2 into the 242-A Evaporator process flowsheet.

[2] From Final Safety Analysis Report, Project W-105, Liquid Effluent Retention Facility (Lavender 1993).

[3] The ^{94}Nb composite value was greater than four percent of the ^{94}Nb limit, the ^{94}Nb concentration was calculated using the formula, ^{94}Nb = 5.0E-05 uCi/ml taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[4] The ^{226}Ra composite value was greater than four percent of the ^{226}Ra limit, the ^{226}Ra concentration was calculated using the formula, ^{90}Sr x 1.0E-04 taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[5] The ^{238}Pu composite value was greater than four percent of the ^{238}Pu limit, the ^{238}Pu concentration was calculated using the formula, $^{239/240}$Pu x 2.5E-01, taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[6] Due to the lack of this analysis, the ^{241}Pu concentration was calculated using the formula, $^{239/240}$Pu x 4.1E+01, taken from WHC-SD-WM-OCD-016 (Tranbarger 1992).

[5] The uranium value was obtained by entering uranium concentration from feed composite from Table G-2 into 242-A Evaporator process flowsheet. The corresponding process condensate value for uranium was then converted to µCi/mL by using the specific activity of one percent enriched uranium.

Table H-13: Comparison of Candidate Tanks, Feed, and Projected Slurry Concentrations to Double-Shell Tank Waste Corrosion Specifications[1]

PARAMETER	CONDITION 1 $[NO_3] \leq 1.0$ M	CONDITION 2 $1.0 M < [NO_3] \leq 3.0 M$	CONDITION 3 $3.0 M < [NO_3] \leq 5.5 M$
LIMIT[1]	$0.01M \leq [OH] \leq 5.0M$ $0.011M \leq [NO_2] \leq 5.5M$	$0.1 x [NO_3] \leq [OH] \leq 10M$ $[OH] + [NO_2] \geq 0.4 x [NO_3]$	$0.3 \leq [OH] < 10M$ $[OH] + [NO2] \geq 1.2$
241-AP-106	$[NO_3] = 0.0695$ M $[OH] = 0.389$ M $[NO_2] = 0.0237$ M	na	na
241-AP-107	$[NO_3] = 0.110$ M $[OH] = 0.319$ M $[NO_2] = 0.0346$ M	na	na
241-AW-102	$[NO_3] = 0.0364$ M $[OH] = 0.186$ M $[NO_2] = 0.0140$ M	na	na
241-AW-106	$[NO_3] =0.519$ M $[OH] = 0.238$ M $[NO_2] = 0.334$ M	na	na
FEED COMPOSITE[2]	$[NO_3] =0.169$ M $[OH] = 0.245M$ $[NO_2] = 0.0869M$	na	na
PROJECTED SLURRY[3]	na	$[NO_3] =1.70$ M $[OH] = 3.26$ M $[NO_2] = 0.869$ M	na
COMMENT	In Compliance	In Compliance $0.1 x [NO_3] = 0.170$ M $[OH] + [NO_2] = 4.09$ M $0.4 x [NO_3] = 0.680M$	na

[1] From *Operating Specifications for the 241-AN, AP, AW, AY, AZ, & SY Tank Farms* (Harris 1992).

[2] Final theoretical free hydroxide concentration after mixing, assuming total hydroxide consumed by the phosphate and carbonnate buffers has been accounted for (see Appendix I for OH calculation).

[3] The slurry values were obtained at 90% WVR by entering the feed value into the Predict

Table H-14. Comparision of Projected Vessel Vent Discharge To Vessel Vent Radionuclide Limits[1]

RADIONUCLIDE	**VESSEL VENT**[2] (uCi/ml)	**LIMIT** (uCi/ml)	**V.V/LIMIT** Ratio	**COMMENT**
Annual Average Concentration (any consecutive 12 month period)				
^{239}Pu	NA	2.0E-14	NA	NA
^{90}Sr	NA	9.0E-12	NA	NA
Weekly Average Concentration (any consecutive 7 day period)				
^{239}Pu	1.29E-17	2.0E-13	6.4E-05	IN COMPLIANCE
^{90}Sr	6.24E-15	9.0E-11	6.9E-05	IN COMPLIANCE
Maximum Instantaneous Concentration (average over a 4 hour period)				
^{239}Pu	1.29E-17	1.0E-10	1.3E-07	IN COMPLIANCE
^{90}Sr	6.24E-15	4.5E-08	1.4E-07	IN COMPLIANCE

[1] From *Operating Specifications from the 242-A Evaporator-Crystallizer* (Wahlquist 1993).

[2] The vessel vent values were obtained by entering the feed composite values from Table G-2 into the process flowsheet for the 242-A Evaporator.

This page intentionally left blank.

APPENDIX I

CALCULATIONS

This page intentionally left blank.

THROUGHPUT

Thoughput = total material transferred through Evaporator feed line

$$THROUGHPUT = \sum_{n=1}^{p} \frac{x}{\left(\frac{1}{1-WVRF_{pass}}\right)^{n-1}} + (w)\,(t)$$

where t = processing time = throughput/feed rate (min)
x = amount of waste to be processed (gal)
p = number of evaporator passes
w = process condensate recycle for seal water sytems (gpm)
$WVRF_{pass}$ = waste volume reduction factor per evaporator pass
F = feed rate (gal/min)

Assuming $WVRF_{pass}$ of 50%, the equation above can be simplified as

$$\text{Throughput} = 2\,(x)\,(WVR_{overall}) + (w)\,(t)$$

or

$$Throughput = \frac{2\,(X)\,WVR_{overall}}{1+W/F}$$

assume $x = 2.46 \times 10^6$ gal
w = 2 gpm (seal water)
F = 100 gpm

At 85% $WVR_{overall}$, Throughput = 4.27×10^6 gal

At 90% $WVR_{overall}$, Throughput = 4.52×10^6 gal

CAMPAIGN DURATION

$$CampaignDuration=\frac{throughput(gal)}{feedrate(gpm)\,xoperatingeffiencyx1440(min/day)}$$

At 85% $WVR_{overall}$, assume throughpout = 4.27×10^6 gal
feed rate = 100 gpm
operating efficiency[1] = 0.73

Campaign Duration = 41 days

At 90% $WVR_{overall}$, assume throughpout = 4.52×10^6 gal
feed rate = 100 gpm
operating efficiency[1] = 0.73

Campaign Duration = 43 days

[1] Operating efficiency was based on evaporator campaigns 94-1 and 94-2 which includes outages.

LERF ACCUMULATION

I. Process condensate generation without P.C recycle system on line

Process Condensate[1] = 1.26 x WVRF x Feed volume (gal)

[1]based on 94-1 and 94-2 campaigns

Assume feed volume = 2.46 x 10^6 gal,

At 85% WVR, Process Condensate Generation = 2.63 x 10^6 gal

At 90% WVR, Process Condensate Generation = 2.79 x 10^6 gal

II. Process condensate generation with P.C recycle system on line

Process Condensate = 1.26 x WVRF x Feed volume (gal) - seal water (gal/min)
x throughput (gal) / feedrate (gal/min)

Assume feed volume = 2.51 x 10^6 gal,
seal water = 2 gal/min
feed rate = 100 gal/min

At 85% WVR and throughput = 4.27 x 10^6 gal,

Process Condensate = 2.55 x 10^6 gal

At 90% WVR and throughput = 4.52 x 10^6 gal,

Process Condensate = 2.70 x 10^6 gal

CRITICALITY CALCULATION

Evaporator Feed Fissile Limit < 0.005 g/L
DST Fissile Limit < 0.013 g/L

$$Fissile(g/L) = \frac{Pu^{239}(uCi/ml)\,x1E\text{-}06\,(Ci/uCi)}{6.2E\text{-}02\,(Ci/g)\,x1E\text{-}03\,(L/ml)} + \frac{U_{gr}(g/L)\,x1.0778E\text{-}10U_{233}}{U_{gr}}$$

Parameter	$Pu^{239/240}$ (µCi/mL)	U_{gross} (g/L)	Fissile (g/L)
106-AP	<1.36E-04	4.44E-04	<2.19E-06
107-AP	8.77E-05	5.63E-03	1.41E-06
102-AW	<6.62E-05	4.84E-04	<1.07E-06
106-AW	4.31E-04	1.28E-04	6.96E-06
Composite[1]	<1.70E-04	2.34E-03	<2.74E-06
Slurry[2]	<1.70E-03	2.34E-02	<2.74E-05

[1] Composite data from Appendix G, Table G-2

[2] Using assumption that all constituents concentrate at the same ratio, slurry values were calculated at 90% WVR by using the formula, slurry = feed / (1-WVRF).

WVRF FOR FEED COMPOSITE AT FISSILE LIMIT CALCULATIONS

WVRF for feed composite to reach evaporator feed fissile limit of 0.005 g/L

$$WVRF_{limit}=1.0-\left[\frac{fissile(g/L)}{fissilelimit(g/L)}\right]x100\%$$

$$WVRF_{limit}=1.0-\left[\frac{<2.73E\text{-}06\,(g/L)}{0.005\,(g/L)}\right]x100\%\geq 99.9\%$$

TRU CALCULATION

Limit < 100 nCi/g

$$TRU(nCi/g) = \frac{[Pu^{239}(uCi/mL) + Am^{241}(uCi/mL)]\, x10^{3}(nCi/uCi)}{SpG(g/ml)}$$

Parameter	Pu^{239} (μCi/mL)	Am^{241} (μCi/ml)	SpG (g/mL)	TRU (nCi/g)
106-AP	<1.36E-04	2.16E-04	0.997	<0.353
107-AP	8.77E-05	<3.11E-04	1.01	<0.395
102-AW	<6.62E-05	1.08E-04	0.999	<0.174
106-AW	4.31E-03	9.51E-04	1.10	4.80
Feed[1]	<1.70E-04	3.86E-04	1.02	<0.545
Slurry[2]	<1.70E-03	3.86E-03	1.23[3]	<4.54

[1] Feed composite values from Appendix G, Table G-2

[2] Using assumption that all constituents concentrate at the same ratio, slurry values were calculated at 90% WVR by using the formula, slurry = feed / (1-WVRF).

[3] Slurry specific gravity was calculated at 90% WVR using data from Predict and the formula, Sp. G = 1.017 + 0.0587[AlO_2] - 0.01943[OH] - 0.000505(TEMP) + 0.0459([AlO_2] + [OH] + [NO_3] + [NO_2]) - 0.000883[NO_3][NO_2], taken from RHO-RE-ST-14 P (Reynolds 1983).

HEAT GENERATION CALCULATION

Limit $<$ 70,00 BTu/hr

$\text{Heat}_{\text{supernate}}$ (BTu/hr) = [Cs^{137} (μCi/mL) x 1.6E-02 (BTu/hr.Ci) + Cs^{90} (μCi/ml)
x 2.3E-02 (BTu/hr.Ci)] x Supernate volume (gal)
x 3785 (ml/gal) x 1.0E-06 (Ci/μCi)

Tanks	Supernate (gal)	Cs^{137} (μCi/mL)	Sr^{90} (μCi/mL)	$\text{Heat}_{\text{supernate}}$ (BTu/hr)
106-AP	9.34E+05	4.77E+00	1.18E-04	3.00E+02
107-AP	9.96E+05	9.70E+00	2.18E-02	5.86E+02
102-AW	1.76E+05	2.52E+00	6.30E-03	2.69E+01
106-AW[1]	4.96E+05	3.17+00	5.49E-02	9.52E+01
106-AW[2]	2.63E+05	1.15E+01	1.89E-01	1.83E+02

[1] prior to 95-1 Evaporator Campaign.
[2] after 95-1 Evaporator Campaign.

$\text{Heat}_{\text{sludge}}$ (BTu/hr) = [Cs^{137} (μCi/g) x 1.6E-02 (BTu/hr.Ci) + Cs^{90} (μCi/g)
x 2.3E-02 (BTu/hr.Ci)] x 1.0E-06 (Ci/μCi) x sludge
vol(in) x Sp. G (g/ml) x 3785 (ml/gal) x 2750 (gal/in)

Tanks	Sludge (in)	Sp.G (g/ml)	Cs^{137} (μCi/g)	Sr^{90} (μCi/g)	$\text{Heat}_{\text{sludge}}$ (BTu/hr)
102-AW[1]	1.73E+01	1.43	3.30E+02	1.98E+03	1.31E+04
106-AW[1]	6.00E+01	1.43	3.30E+02	1.98E+03	4.54E+04

[1] Sludges in tanks 102-AW and 106-AW have not been sampled before. For the purpose of calculating the tank heat load, it is assumed (worst case) the radioactive heat generation from tanks 102-AW and 106-AW is the same that from high heat tank 106-C (I.M 65453-87-074, Weiss 1987)

TANK HEAT LOAD = $\text{HEAT}_{\text{supernate}}$ + $\text{HEAT}_{\text{sludge}}$

Tanks	$\text{Heat}_{\text{supernate}}$ (Btu/hr)	$\text{Heat}_{\text{sludge}}$ (Btu/hr)	$\text{Heat}_{\text{tank}}$ (BTu/hr)
106-AP	3.00E+02	0	3.00E+02
107-AP	5.86E+02	0	5.86E+02
102-AW	2.69E+01	1.31E+04	1.31E+04
106-AW[1]	9.52E+01	4.54+04	4.55E+04
106-AW[2]	1.83E+02	4.54E+04	4.56E+04

REYNOLDS CALCULATION

Limit $\geq$ 20,000

$$Re=\frac{dvD}{n}$$

where d = pipe diameter (ft)
v = velocity (ft/s)
D = density (lb/ft^3)
n = viscosity (lb/ft-s)

Parameter	d (ft)	v (ft/s)	D (lb/ft^3)	n (lb/ft-s)[1]	Re
106-AP	0.25	4.54	62.45	6.70E-04	1.06E+05
107-AP	0.25	4.54	62.58	6.70E-04	1.07E+05
102-AW	0.25	4.54	62.58	6.70E-04	1.06E+05
106-AW	0.25	4.54	68.72	2.19E-03	3.56E+04
Slurry	0.17	5.11	77.05	5.99E-03	1.09E+04

[1] Due to the unavailable data of its analysis, the temperature is conservatively assumed to be 20 degree celsius and viscosity value was calculated using the formula, 42.65*SPG - 0.3850*T -35.82 from IM-13314-88-105 (Reynolds 1988)

% TOC ON A DRY BASIS CALCULATION

Limit < 3% (for non-complex)

$$\%TOC_{drybasis}=\frac{TOC(g/l)}{Total(g/l)}x100\%$$

Parameter	106-AP (g/l)	107-AP (g/l)	102-AW (g/l)	106-AW (g/l)	Composite (g/l)	Slurry* (g/l)
Al	2.13E-01	2.73E-01	1.10E-01	1.11E+00	3.98E-01	4.02E+00
Na	4.72E+00	1.14E+01	2.57E+00	4.28E+01	1.42E+01	1.42E+02
F	1.49E-01	4.60E+00	1.06E-01	4.77E+00	2.66E+00	1.81E+00
OH	6.61E+00	5.42E+00	3.17E+00	4.05E+00	5.46E+00	5.54E+01
PO4	2.13E-01	6.06E-01	1.07E-01	7.67E-01	4.55E-01	0.00E+00
SO4	1.45E-01	6.06E-01	9.30E-02	2.67E+00	7.88E-01	7.97E+00
NO3	4.31E+00	6.82E+00	2.26E+00	3.22E+01	1.04E+01	1.05E+02
NO2	1.09E+00	1.59E+00	6.47E-01	1.54E+01	3.94E+00	4.00E+01
TIC	9.06E-01	3.36E-01	5.93E-01	1.93E+01	4.14E+00	1.79E+01
TOC	4.27E-01	2.39E-01	2.12E-01	1.15E+00	4.80E-01	4.87E+00
Total	1.88E+01	3.19E+01	9.87E+00	1.24E+02	4.29E+01	3.79E+02
%TOC	2.27	0.75	2.15	0.93	1.12	1.28

*Slurry values were obtained at 90% WVR from Predict

HYDROXIDE CONCENTRATION CALCULATION FOR CAMPAIGN FEED COMPOSITE

Limit: when $[NO3] \leq 1.0M$, $0.01M \leq [OH] \leq 5.0M$
and $0.011M \leq [NO2] \leq 5.5$ M

Parameter	[NO3] (M)	[NO2] (M)	[PO4] (M)	[CO3] (M)	[OH] (M)
106-AP	6.95E-02	2.37E-02	2.24E-03	1.51E-02	3.89E-01
107-AP	1.10E-01	3.46E-02	6.38E-03	5.60E-03	3.19E-01
102-AW	3.65E-02	1.41E-02	1.12E-03	9.89E-03	1.87E-01
106-AW	5.19E-01	3.34E-01	8.07E-03	3.21E-01	2.38E-01
SIMPLE MIX[1]	1.67E-01	8.56E-02	4.79E-03	6.90E-02	3.21E-01
COMPOSITE[2]	1.67E-01	8.56E-02	0.00E+00	0.00E+00	2.47E-01

[1] Simple mix is calculated using 37.57% for tank 106-AP, 36.86% for tank 107-AP, 6.69 for tank 102-AW, and 18.88% for tank 106-AW.

[2] For the purpose of comparison of feed composition to Double-Shell Tank corrosion specifications, it is assumed (worst case) that all of the carbonate and phosphate exists in the waste as bicarbonate and biphosphate. $[OH]$ of composite = $[OH]^{simple\ mix} - [HPO4^-] - [HCO3^-]$

AMMONIA RELEASE CALCULATIONS[1]

I. Ammonia in Process Condensate Calculation

Limit $NH_{3(process\ condensate)} < 10,000$ mg/L

$NH_{3(process\ condensate)} = 0.939 \times NH_{3(feed)}$ (mass balance)

Assume (worst case during first 24 hrs)
pot volume = 25,000 gal/dy
feed rate = 100 gpm
WVRF = 50% (PC flow = 0.5 feed flow)
$NH_{3(feed)}$ concentration = 1040 mg/L

Total feed volume = (25,000 gal/dy + 100 g/min x 1440 min/dy) x 3.785 L/gal
= 6.40E+05 L/dy

$NH_{3(feed)}$ = 1040 mg/L x 6.40E+05 L/dy = 6.66E+08 mg/dy

$NH_{3(pocess\ condensate)}$ = (0.939 x 6.66E+08 mg/dy)/(0.5 x 6.40E+05 L/dy)
= 1.95E+03 mg/L

I. Ammonia in Vessel Vent Calculation

Limit $NH_{3(vessel\ vent)} < 100$ lbs/dy

$NH_{3(vessel\ vent)} = 0.061 \times NH_{3(feed)}$ (mass balance)

Assume (worst case during first 24 hrs)
pot volume = 25,000 gal/dy
feed rate = 100 gpm
$NH_{3(feed)}$ concentration = 1040 mg/L

Total feed volume = (25,000 gal/dy + 100 g/min x 1440 min/dy) x 3.785 L/gal
= 6.40E+05 L/dy

$NH_{3(feed)}$ = 1040 mg/L x 1.0E-03 g/mg x 6.40E+05 L/dy x 1 lb/454 g
= 1.47E+03 lbs/dy

$NH_{3(vessel\ vent)}$ = 0.061 x 1.47E+03 lbs/dy = 90 lbs/dy

---

[1] the ammonia concentrations in process condensate and in vessel vent effluents are calculated using the formulas listed in I.M # 71730-95-95004.

SLURRY DENSITY AT 90% WVR CALCULATION

Limit < 1.41 g/ml

$$\text{Density}^1 = 1.017 + 0.0587[AlO_2] - 0.01943[OH] - 0.000505(TEMP) + 0.0459([AlO_2] + [OH] + [NO_3] + [NO_2]) - 0.000883[NO_3][NO_2]$$

[1] Density formula was taken from RHO-RE-ST-14 P (Reynolds 1983)

From composite predict run at 90% WVR,

```
PASS  FIVE   VOLUME REDUCTION OF   .90
PASS STOPPED AT SPECIFIED WVR LIMIT.
TEMPERATURE    49.2 C  120.5 F    PRESSURE   60.0 Torr
PASS WVR         .6               TOTAL WVR            90.0
                                     EVAPORATOR           TANK CONDITIONS
                                     CONDITIONS                 20.0 C
                 FEED      SLURRY    SUPERNATE SOLIDS*    SUPERNATE SOLIDS
VOLUME, gal      .233E+06  .232E+06  .232E+06  .000       .232E+06  122.
HYDROXIDE,M         3.238     3.258     3.258      .000      3.258       .000
ALUMINATE,M          .148      .149      .149      .000       .149       .000
NITRATE,M           1.685     1.695     1.695      .000      1.695       .000
NITRITE,M            .864      .869      .869      .000       .869       .000
CARBONATE,M          .297      .298      .298      .000       .292       .007
PHOSPHATE,M          .000      .000      .000      .000       .000       .000
SULFATE,M            .083      .083      .083      .000       .083       .000
FLUORIDE,M           .094      .095      .095      .000       .095       .000
ORGANIC,G/L         4.842     4.872     4.872      .000      4.872       .000
```

Assumme temperature = 20 degree celsius

========> Density (g/ml) = 1.23

This page intentionally left blank.

APPENDIX J

PREDICT RUNS

This page intentionally left blank.

106-AP PREDICT RUN

```
PASS    ONE    DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE     44.2 C  111.5 F     PRESSURE   60.0 Torr
PASS WVR        50.0                TOTAL WVR           50.0
                                       EVAPORATOR                TANK CONDITIONS
                                       CONDITIONS                   20.0 C
                    FEED       SLURRY     SUPERNATE SOLIDS*      SUPERNATE SOLIDS
VOLUME, gal      .988E+06   .494E+06   .494E+06  .000          .494E+06  276.
HYDROXIDE,M          .389       .778       .778       .000         .778       .000
ALUMINATE,M          .008       .016       .016       .000         .016       .000
NITRATE,M            .069       .139       .139       .000         .139       .000
NITRITE,M            .024       .047       .047       .000         .047       .000
CARBONATE,M          .015       .030       .030       .000         .030       .000
PHOSPHATE,M          .002       .004       .004       .000         .000       .002
SULFATE,M            .002       .003       .003       .000         .003       .000
FLUORIDE,M           .008       .016       .016       .000         .016       .000
ORGANIC,G/L          .427       .854       .854       .000         .854       .000


PASS    TWO    DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE     44.5 C  112.2 F     PRESSURE   60.0 Torr
PASS WVR        50.0                TOTAL WVR           75.0
                                       EVAPORATOR                TANK CONDITIONS
                                       CONDITIONS                   20.0 C
                    FEED       SLURRY     SUPERNATE SOLIDS*      SUPERNATE SOLIDS
VOLUME, gal      .494E+06   .247E+06   .247E+06  .000          .247E+06  .000
HYDROXIDE,M          .778      1.556      1.556       .000        1.556       .000
ALUMINATE,M          .016       .032       .032       .000         .032       .000
NITRATE,M            .139       .278       .278       .000         .278       .000
NITRITE,M            .047       .095       .095       .000         .095       .000
CARBONATE,M          .030       .060       .060       .000         .060       .000
PHOSPHATE,M          .000       .000       .000       .000         .000       .000
SULFATE,M            .003       .006       .006       .000         .006       .000
FLUORIDE,M           .016       .031       .031       .000         .031       .000
ORGANIC,G/L          .854      1.708      1.708       .000        1.708       .000
```

106-AP PREDICT RUN (CONT.)

```
PASS THREE    DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE     46.0 C  114.9 F     PRESSURE   60.0 Torr
PASS WVR        50.0                TOTAL WVR             87.5
                                       EVAPORATOR                TANK CONDITIONS
                                       CONDITIONS                    20.0 C
                   FEED      SLURRY    SUPERNATE  SOLIDS*       SUPERNATE  SOLIDS
VOLUME, gal     .247E+06  .123E+06  .123E+06   .000         .123E+06   .000
HYDROXIDE,M        1.556     3.112     3.112        .000       3.112        .000
ALUMINATE,M         .032      .063      .063        .000        .063        .000
NITRATE,M           .278      .556      .556        .000        .556        .000
NITRITE,M           .095      .190      .190        .000        .190        .000
CARBONATE,M         .060      .121      .121        .000        .121        .000
PHOSPHATE,M         .000      .000      .000        .000        .000        .000
SULFATE,M           .006      .012      .012        .000        .012        .000
FLUORIDE,M          .031      .063      .063        .000        .063        .000
ORGANIC,G/L        1.708     3.416     3.416        .000       3.416        .000


PASS  FOUR    DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE     51.9 C  125.3 F     PRESSURE   60.0 Torr
PASS WVR        50.0                TOTAL WVR             93.7
                                       EVAPORATOR                TANK CONDITIONS
                                       CONDITIONS                    20.0 C
                   FEED      SLURRY    SUPERNATE  SOLIDS*       SUPERNATE  SOLIDS
VOLUME, gal     .123E+06  .625E+05  .617E+05   763.         .617E+05   938.
HYDROXIDE,M        3.112     6.148     6.224        .000       6.224        .000
ALUMINATE,M         .063      .125      .126        .000        .126        .000
NITRATE,M           .556     1.098     1.112        .000       1.112        .000
NITRITE,M           .190      .375      .379        .000        .379        .000
CARBONATE,M         .121      .239      .097        .072        .062        .090
PHOSPHATE,M         .000      .000      .000        .000        .000        .000
SULFATE,M           .012      .024      .024        .000        .024        .000
FLUORIDE,M          .063      .124      .072        .027        .072        .027
ORGANIC,G/L        3.416     6.749     6.832        .000       6.832        .000
```

106-AP PREDICT RUN (CONT.)

```
PASS  FIVE   DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 8 MOLAR CAUSTIC LIMI
TEMPERATURE    55.6 C  132.2 F    PRESSURE   60.0 Torr
PASS WVR       22.2               TOTAL WVR          95.1
                                     EVAPORATOR           TANK CONDITIONS
                                     CONDITIONS                 20.0 C
                 FEED      SLURRY    SUPERNATE SOLIDS*    SUPERNATE SOLIDS
VOLUME, gal      .608E+05  .475E+05  .473E+05  181.       .473E+05  385.
HYDROXIDE,M         6.224     7.970     8.000      .000      8.000       .000
ALUMINATE,M          .126      .162      .162      .000       .162       .000
NITRATE,M           1.112     1.424     1.429      .000      1.368       .048
NITRITE,M            .379      .486      .487      .000       .487       .000
CARBONATE,M          .062      .079      .040      .031       .014       .051
PHOSPHATE,M          .000      .000      .000      .000       .000       .000
SULFATE,M            .024      .031      .031      .000       .031       .000
FLUORIDE,M           .072      .092      .049      .033       .049       .033
ORGANIC,G/L         6.832     8.748     8.781      .000      8.781       .000
```

This page intentionally left blank.

107-AP PREDICT RUN

```
PASS    ONE    DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE     44.3 C  111.7 F     PRESSURE   60.0 Torr
PASS WVR        50.0                TOTAL WVR            50.0
                                       EVAPORATOR             TANK CONDITIONS
                                       CONDITIONS                  20.0 C
                   FEED       SLURRY   SUPERNATE SOLIDS*      SUPERNATE SOLIDS
VOLUME, gal      .969E+06   .484E+06   .484E+06  .000         .484E+06  771.
HYDROXIDE,M          .319       .638       .638      .000         .638      .000
ALUMINATE,M          .010       .020       .020      .000         .020      .000
NITRATE,M            .110       .220       .220      .000         .220      .000
NITRITE,M            .035       .069       .069      .000         .069      .000
CARBONATE,M          .006       .011       .011      .000         .011      .000
PHOSPHATE,M          .006       .013       .013      .000         .000      .006
SULFATE,M            .006       .013       .013      .000         .013      .000
FLUORIDE,M           .242       .484       .484      .000         .484      .000
ORGANIC,G/L          .239       .478       .478      .000         .478      .000
```

```
PASS    TWO    DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE     44.7 C  112.5 F     PRESSURE   60.0 Torr
PASS WVR        50.0                TOTAL WVR            75.0
                                       EVAPORATOR             TANK CONDITIONS
                                       CONDITIONS                  20.0 C
                   FEED       SLURRY   SUPERNATE SOLIDS*      SUPERNATE SOLIDS
VOLUME, gal      .484E+06   .244E+06   .242E+06  .220E+04     .242E+06  .220E+04
HYDROXIDE,M          .638      1.265      1.276      .000        1.276      .000
ALUMINATE,M          .020       .040       .040      .000         .040      .000
NITRATE,M            .220       .436       .440      .000         .440      .000
NITRITE,M            .069       .137       .138      .000         .138      .000
CARBONATE,M          .011       .022       .022      .000         .022      .000
PHOSPHATE,M          .000       .000       .000      .000         .000      .000
SULFATE,M            .013       .025       .025      .000         .025      .000
FLUORIDE,M           .484       .959       .365      .302         .365      .302
ORGANIC,G/L          .478       .947       .956      .000         .956      .000
```

107-AP PREDICT RUN (CONT.)

```
PASS THREE    DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE    46.0 C   114.9 F     PRESSURE    60.0 Torr
PASS WVR       50.0                 TOTAL WVR              87.3
                                       EVAPORATOR                 TANK CONDITIONS
                                       CONDITIONS                    20.0 C
                   FEED       SLURRY   SUPERNATE  SOLIDS*         SUPERNATE  SOLIDS
VOLUME, gal      .240E+06   .121E+06   .120E+06   970.            .120E+06   970.
HYDROXIDE,M         1.276      2.532      2.552        .000          2.552       .000
ALUMINATE,M          .040       .080       .081        .000           .081       .000
NITRATE,M            .440       .873       .880        .000           .880       .000
NITRITE,M            .138       .275       .277        .000           .277       .000
CARBONATE,M          .022       .044       .045        .000           .045       .000
PHOSPHATE,M          .000       .000       .000        .000           .000       .000
SULFATE,M            .025       .050       .050        .000           .050       .000
FLUORIDE,M           .365       .724       .192        .269           .192       .269
ORGANIC,G/L          .956      1.897      1.912        .000          1.912       .000


PASS   FOUR   DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE    51.2 C   124.2 F     PRESSURE    60.0 Torr
PASS WVR       50.0                 TOTAL WVR              93.5
                                       EVAPORATOR                 TANK CONDITIONS
                                       CONDITIONS                    20.0 C
                   FEED       SLURRY   SUPERNATE  SOLIDS*         SUPERNATE  SOLIDS
VOLUME, gal      .119E+06   .597E+05   .594E+05   275.            .594E+05   275.
HYDROXIDE,M         2.552      5.081      5.104        .000          5.104       .000
ALUMINATE,M          .081       .161       .162        .000           .162       .000
NITRATE,M            .880      1.752      1.760        .000          1.760       .000
NITRITE,M            .277       .551       .554        .000           .554       .000
CARBONATE,M          .045       .089       .090        .000           .090       .000
PHOSPHATE,M          .000       .000       .000        .000           .000       .000
SULFATE,M            .050       .100       .101        .000           .101       .000
FLUORIDE,M           .192       .382       .077        .154           .077       .154
ORGANIC,G/L         1.912      3.806      3.824        .000          3.824       .000
```

107-AP PREDICT RUN (CONT.)

```
PASS  FIVE   DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 8 MOLAR CAUSTIC LIMI
TEMPERATURE    60.7 C  141.3 F    PRESSURE   60.0 Torr
PASS WVR       36.2               TOTAL WVR           95.7
                                     EVAPORATOR           TANK CONDITIONS
                                     CONDITIONS                20.0 C
                 FEED      SLURRY    SUPERNATE SOLIDS*    SUPERNATE SOLIDS
VOLUME, gal      .592E+05  .381E+05  .377E+05  350.        .377E+05  .246E+04
HYDROXIDE,M         5.104     7.927     8.000      .000       8.000      .000
ALUMINATE,M          .162      .251      .253      .000        .253      .000
NITRATE,M           1.760     2.733     2.759      .000       1.342      .904
NITRITE,M            .554      .860      .868      .000        .868      .000
CARBONATE,M          .090      .139      .041      .063        .010      .083
PHOSPHATE,M          .000      .000      .000      .000        .000      .000
SULFATE,M            .101      .157      .158      .000        .158      .000
FLUORIDE,M           .077      .119      .033      .056        .033      .056
ORGANIC,G/L         3.824     5.939     5.994      .000       5.994      .000
```

This page intentionally left blank.

106-AW PREDICT RUN

```
PASS   ONE   DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE    45.8 C  114.5 F    PRESSURE   60.0 Torr
PASS WVR       50.0               TOTAL WVR          50.0
                                     EVAPORATOR           TANK CONDITIONS
                                     CONDITIONS                20.0 C
                 FEED      SLURRY    SUPERNATE SOLIDS*    SUPERNATE SOLIDS
VOLUME, gal      .496E+06  .249E+06  .248E+06  .110E+04   .248E+06  .160E+04
HYDROXIDE,M          .238      .474      .476      .000       .476      .000
ALUMINATE,M          .041      .082      .082      .000       .082      .000
NITRATE,M            .519     1.033     1.038      .000      1.038      .000
NITRITE,M            .334      .665      .668      .000       .668      .000
CARBONATE,M          .321      .639      .642      .000       .642      .000
PHOSPHATE,M          .008      .016      .016      .000       .000      .008
SULFATE,M            .028      .055      .056      .000       .056      .000
FLUORIDE,M           .251      .500      .207      .147       .207      .147
ORGANIC,G/L         1.150     2.290     2.300      .000      2.300      .000


PASS   TWO   DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE    50.2 C  122.3 F    PRESSURE   60.0 Torr
PASS WVR       50.0               TOTAL WVR          74.8
                                     EVAPORATOR           TANK CONDITIONS
                                     CONDITIONS                20.0 C
                 FEED      SLURRY    SUPERNATE SOLIDS*    SUPERNATE SOLIDS
VOLUME, gal      .246E+06  .128E+06  .123E+06  .475E+04   .123E+06  .475E+04
HYDROXIDE,M          .476      .917      .952      .000       .952      .000
ALUMINATE,M          .082      .159      .165      .000       .165      .000
NITRATE,M           1.038     1.999     2.076      .000      2.076      .000
NITRITE,M            .668     1.286     1.336      .000      1.336      .000
CARBONATE,M          .642     1.236      .863      .210       .863      .210
PHOSPHATE,M          .000      .000      .000      .000       .000      .000
SULFATE,M            .056      .107      .111      .000       .111      .000
FLUORIDE,M           .207      .399      .088      .164       .088      .164
ORGANIC,G/L         2.300     4.429     4.600      .000      4.600      .000
```

106-AW PREDICT RUN (CONT.)

```
PASS THREE    DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE     56.0 C  132.7 F     PRESSURE   60.0 Torr
PASS WVR        50.0                TOTAL WVR              86.8
                                       EVAPORATOR              TANK CONDITIONS
                                       CONDITIONS                  20.0 C
                    FEED       SLURRY    SUPERNATE  SOLIDS*     SUPERNATE  SOLIDS
VOLUME, gal     .118E+06   .667E+05   .592E+05   .752E+04   .592E+05   .106E+05
HYDROXIDE,M         .952      1.690      1.904       .000      1.904       .000
ALUMINATE,M         .165       .292       .330       .000       .330       .000
NITRATE,M          2.076      3.684      4.152       .000      2.862       .645
NITRITE,M          1.336      2.371      2.672       .000      2.672       .000
CARBONATE,M         .863      1.532       .228       .749       .182       .772
PHOSPHATE,M         .000       .000       .000       .000       .000       .000
SULFATE,M           .111       .197       .126       .048       .126       .048
FLUORIDE,M          .088       .155       .048       .064       .048       .064
ORGANIC,G/L        4.600      8.164      9.200       .000      9.200       .000


PASS  FOUR    DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE     72.7 C  162.8 F     PRESSURE   60.0 Torr
PASS WVR        50.0                TOTAL WVR              91.7
                                       EVAPORATOR              TANK CONDITIONS
                                       CONDITIONS                  20.0 C
                    FEED       SLURRY    SUPERNATE  SOLIDS*     SUPERNATE  SOLIDS
VOLUME, gal     .486E+05   .259E+05   .243E+05   .159E+04   .243E+05   .617E+04
HYDROXIDE,M        1.904      3.574      3.808       .000      3.808       .000
ALUMINATE,M         .330       .619       .659       .000       .659       .000
NITRATE,M          2.862      5.372      4.693       .515      1.856      1.934
NITRITE,M          2.672      5.016      5.344       .000      2.873      1.236
CARBONATE,M         .182       .343       .049       .158       .014       .175
PHOSPHATE,M         .000       .000       .000       .000       .000       .000
SULFATE,M           .126       .237       .253       .000       .253       .000
FLUORIDE,M          .048       .090       .013       .042       .013       .042
ORGANIC,G/L        9.200     17.271     18.400       .000     18.400       .000
```

106-AW PREDICT RUN (CONT.)

```
PASS   FIVE     DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE     85.7 C  186.3 F     PRESSURE   60.0 Torr
PASS WVR        50.0                TOTAL WVR            93.5
                                       EVAPORATOR                 TANK CONDITIONS
                                       CONDITIONS                      20.0 C
                  FEED       SLURRY    SUPERNATE  SOLIDS*         SUPERNATE  SOLIDS
VOLUME, gal     .181E+05   .934E+04   .907E+04  273.             .907E+04  .261E+04
HYDROXIDE,M        3.808      7.394      7.616       .000           7.616      .000
ALUMINATE,M         .659      1.280      1.318       .000            .691      .314
NITRATE,M          1.856      3.604      3.608       .052            .568     1.572
NITRITE,M          2.873      5.578      4.935       .405           1.021     2.362
CARBONATE,M         .014       .027       .028       .000            .000      .014
PHOSPHATE,M         .000       .000       .000       .000            .000      .000
SULFATE,M           .253       .490       .505       .000            .505      .000
FLUORIDE,M          .013       .025       .002       .012            .002      .012
ORGANIC,G/L       18.400     35.725     36.800       .000          36.800      .000


PASS   SIX      DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 8 MOLAR CAUSTIC LIMI
TEMPERATURE     58.5 C  137.3 F     PRESSURE   60.0 Torr
PASS WVR         4.8                TOTAL WVR            93.6
                                       EVAPORATOR                 TANK CONDITIONS
                                       CONDITIONS                      20.0 C
                  FEED       SLURRY    SUPERNATE  SOLIDS*         SUPERNATE  SOLIDS
VOLUME, gal     .646E+04   .615E+04   .615E+04  .000             .615E+04  .000
HYDROXIDE,M        7.616      8.000      8.000       .000           8.000      .000
ALUMINATE,M         .691       .726       .726       .000            .726      .000
NITRATE,M           .568       .596       .596       .000            .596      .000
NITRITE,M          1.021      1.072      1.072       .000           1.072      .000
CARBONATE,M         .000       .000       .000       .000            .000      .000
PHOSPHATE,M         .000       .000       .000       .000            .000      .000
SULFATE,M           .505       .531       .531       .000            .531      .000
FLUORIDE,M          .002       .002       .002       .000            .002      .000
ORGANIC,G/L       36.800     38.655     38.655       .000          38.655      .000
```

This page intentionally left blank.

102-AW PREDICT RUN

```
PASS   ONE   DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE     44.1 C  111.3 F    PRESSURE   60.0 Torr
PASS WVR        50.0               TOTAL WVR           50.0
                                      EVAPORATOR            TANK CONDITIONS
                                      CONDITIONS                 20.0 C
                  FEED      SLURRY    SUPERNATE SOLIDS*     SUPERNATE SOLIDS
VOLUME, gal     .211E+06  .105E+06  .105E+06  .000        .105E+06  29.5
HYDROXIDE,M         .187      .374      .374      .000        .374      .000
ALUMINATE,M         .004      .008      .008      .000        .008      .000
NITRATE,M           .036      .073      .073      .000        .073      .000
NITRITE,M           .014      .028      .028      .000        .028      .000
CARBONATE,M         .010      .020      .020      .000        .020      .000
PHOSPHATE,M         .001      .002      .002      .000        .000      .001
SULFATE,M           .001      .002      .002      .000        .002      .000
FLUORIDE,M          .006      .011      .011      .000        .011      .000
ORGANIC,G/L         .212      .424      .424      .000        .424      .000


PASS   TWO   DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE     44.2 C  111.5 F    PRESSURE   60.0 Torr
PASS WVR        50.0               TOTAL WVR           75.0
                                      EVAPORATOR            TANK CONDITIONS
                                      CONDITIONS                 20.0 C
                  FEED      SLURRY    SUPERNATE SOLIDS*     SUPERNATE SOLIDS
VOLUME, gal     .105E+06  .527E+05  .527E+05  .000        .527E+05  .000
HYDROXIDE,M         .374      .748      .748      .000        .748      .000
ALUMINATE,M         .008      .016      .016      .000        .016      .000
NITRATE,M           .073      .146      .146      .000        .146      .000
NITRITE,M           .028      .056      .056      .000        .056      .000
CARBONATE,M         .020      .040      .040      .000        .040      .000
PHOSPHATE,M         .000      .000      .000      .000        .000      .000
SULFATE,M           .002      .004      .004      .000        .004      .000
FLUORIDE,M          .011      .022      .022      .000        .022      .000
ORGANIC,G/L         .424      .848      .848      .000        .848      .000
```

102-AW PREDICT RUN (CONT.)

```
ASS THREE   DOUBLE SHELL SLURRY RUN
ASS STOPPED AT 50% WVR LIMIT.
EMPERATURE    44.6 C  112.2 F     PRESSURE   60.0 Torr
ASS WVR       50.0                TOTAL WVR          87.5
                                     EVAPORATOR           TANK CONDITIONS
                                     CONDITIONS                20.0 C
               FEED       SLURRY     SUPERNATE  SOLIDS*   SUPERNATE  SOLIDS
OLUME, gal    .527E+05   .264E+05   .264E+05   .000      .264E+05   .000
YDROXIDE,M        .748      1.496      1.496      .000      1.496       .000
LUMINATE,M        .016       .033       .033      .000       .033       .000
ITRATE,M          .146       .292       .292      .000       .292       .000
ITRITE,M          .056       .113       .113      .000       .113       .000
ARBONATE,M        .040       .079       .079      .000       .079       .000
HOSPHATE,M        .000       .000       .000      .000       .000       .000
ULFATE,M          .004       .008       .008      .000       .008       .000
LUORIDE,M         .022       .045       .045      .000       .045       .000
RGANIC,G/L        .848      1.696      1.696      .000      1.696       .000
```

```
ASS  FOUR   DOUBLE SHELL SLURRY RUN
ASS STOPPED AT 50% WVR LIMIT.
EMPERATURE    46.1 C  114.9 F     PRESSURE   60.0 Torr
SS WVR        50.0                TOTAL WVR          93.7
                                     EVAPORATOR           TANK CONDITIONS
                                     CONDITIONS                20.0 C
               FEED       SLURRY     SUPERNATE  SOLIDS*   SUPERNATE  SOLIDS
LUME, gal     .264E+05   .132E+05   .132E+05   .000      .132E+05   .000
DROXIDE,M        1.496      2.992      2.992      .000      2.992       .000
UMINATE,M         .033       .065       .065      .000       .065       .000
TRATE,M           .292       .584       .584      .000       .584       .000
TRITE,M           .113       .226       .226      .000       .226       .000
RBONATE,M         .079       .158       .158      .000       .158       .000
OSPHATE,M         .000       .000       .000      .000       .000       .000
LFATE,M           .008       .016       .016      .000       .016       .000
UORIDE,M          .045       .089       .089      .000       .089       .000
GANIC,G/L        1.696      3.392      3.392      .000      3.392       .000
```

102-AW PREDICT RUN (CONT.)

```
PASS   FIVE    DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE     51.7 C  125.1 F     PRESSURE   60.0 Torr
PASS WVR        50.0                TOTAL WVR         96.9
                                    EVAPORATOR              TANK CONDITIONS
                                    CONDITIONS                 20.0 C
                   FEED     SLURRY  SUPERNATE SOLIDS*       SUPERNATE SOLIDS
VOLUME, gal     .132E+05  .671E+04  .659E+04  121.          .659E+04  141.
HYDROXIDE,M        2.992     5.876     5.984       .000        5.984       .000
ALUMINATE,M         .065      .128      .130       .000         .130       .000
NITRATE,M           .584     1.147     1.168       .000        1.168       .000
NITRITE,M           .226      .443      .451       .000         .451       .000
CARBONATE,M         .158      .311      .107       .105         .070       .123
PHOSPHATE,M         .000      .000      .000       .000         .000       .000
SULFATE,M           .016      .030      .031       .000         .031       .000
FLUORIDE,M          .089      .175      .072       .053         .072       .053
ORGANIC,G/L        3.392     6.662     6.784       .000        6.784       .000


PASS    SIX    DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 8 MOLAR CAUSTIC LIMI
TEMPERATURE     56.3 C  133.3 F     PRESSURE   60.0 Torr
PASS WVR        25.2                TOTAL WVR         97.6
                                    EVAPORATOR              TANK CONDITIONS
                                    CONDITIONS                 20.0 C
                   FEED     SLURRY  SUPERNATE SOLIDS*       SUPERNATE SOLIDS
VOLUME, gal     .645E+04  .485E+04  .483E+04  24.8          .483E+04  70.8
HYDROXIDE,M        5.984     7.959     8.000       .000        8.000       .000
ALUMINATE,M         .130      .173      .174       .000         .174       .000
NITRATE,M          1.168     1.554     1.561       .000        1.362       .149
NITRITE,M           .451      .600      .603       .000         .603       .000
CARBONATE,M         .070      .093      .039       .041         .013       .060
PHOSPHATE,M         .000      .000      .000       .000         .000       .000
SULFATE,M           .031      .041      .041       .000         .041       .000
FLUORIDE,M          .072      .096      .047       .037         .047       .037
ORGANIC,G/L        6.784     9.023     9.070       .000        9.070       .000
```

This page intentionally left blank.

COMPOSITE PREDICT RUN

```
PASS   ONE   DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE    44.4 C  111.9 F    PRESSURE   60.0 Torr
PASS WVR       50.0               TOTAL WVR           50.0
                                    EVAPORATOR             TANK CONDITIONS
                                    CONDITIONS                  20.0 C
                 FEED      SLURRY   SUPERNATE SOLIDS*      SUPERNATE SOLIDS
VOLUME, gal    .246E+07  .123E+07  .123E+07  .000         .123E+07  .147E+04
HYDROXIDE,M        .321      .642      .642      .000         .642      .000
ALUMINATE,M        .015      .029      .029      .000         .029      .000
NITRATE,M          .167      .334      .334      .000         .334      .000
NITRITE,M          .086      .171      .171      .000         .171      .000
CARBONATE,M        .069      .138      .138      .000         .138      .000
PHOSPHATE,M        .005      .010      .010      .000         .000      .005
SULFATE,M          .008      .016      .016      .000         .016      .000
FLUORIDE,M         .140      .280      .280      .000         .280      .000
ORGANIC,G/L        .480      .960      .960      .000         .960      .000


PASS   TWO   DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 50% WVR LIMIT.
TEMPERATURE    45.3 C  113.5 F    PRESSURE   60.0 Torr
PASS WVR       50.0               TOTAL WVR           75.0
                                    EVAPORATOR             TANK CONDITIONS
                                    CONDITIONS                  20.0 C
                 FEED      SLURRY   SUPERNATE SOLIDS*      SUPERNATE SOLIDS
VOLUME, gal    .123E+07  .617E+06  .614E+06  .278E+04     .614E+06  .278E+04
HYDROXIDE,M        .642     1.278     1.284      .000        1.284      .000
ALUMINATE,M        .029      .059      .059      .000         .059      .000
NITRATE,M          .334      .665      .668      .000         .668      .000
NITRITE,M          .171      .341      .342      .000         .342      .000
CARBONATE,M        .138      .275      .276      .000         .276      .000
PHOSPHATE,M        .000      .000      .000      .000         .000      .000
SULFATE,M          .016      .033      .033      .000         .033      .000
FLUORIDE,M         .280      .557      .259      .150         .259      .150
ORGANIC,G/L        .960     1.911     1.920      .000        1.920      .000
```

COMPOSITE PREDICT RUN (CONT.)

```
SS THREE    DOUBLE SHELL SLURRY RUN
SS STOPPED AT 50% WVR LIMIT.
MPERATURE     48.2 C  118.7 F     PRESSURE   60.0 Torr
SS WVR        50.0                TOTAL WVR            87.4
                                     EVAPORATOR                TANK CONDITIONS
                                     CONDITIONS                    20.0 C
                FEED       SLURRY    SUPERNATE  SOLIDS*        SUPERNATE  SOLIDS
LUME, gal     .611E+06   .308E+06   .306E+06   .239E+04      .306E+06   .293E+04
DROXIDE,M        1.284      2.548      2.568       .000         2.568       .000
UMINATE,M         .059       .117       .118       .000          .118       .000
TRATE,M           .668      1.326      1.336       .000         1.336       .000
TRITE,M           .342       .679       .685       .000          .685       .000
RBONATE,M         .276       .548       .530       .011          .508       .022
OSPHATE,M         .000       .000       .000       .000          .000       .000
LFATE,M           .033       .065       .066       .000          .066       .000
UORIDE,M          .259       .515       .118       .200          .118       .200
GANIC,G/L        1.920      3.810      3.840       .000         3.840       .000


SS  FOUR    DOUBLE SHELL SLURRY RUN
SS STOPPED AT 50% WVR LIMIT.
MPERATURE     55.4 C  131.7 F     PRESSURE   60.0 Torr
SS WVR        50.0                TOTAL WVR            93.6
                                     EVAPORATOR                TANK CONDITIONS
                                     CONDITIONS                    20.0 C
                FEED       SLURRY    SUPERNATE  SOLIDS*        SUPERNATE  SOLIDS
LUME, gal     .303E+06   .163E+06   .151E+06   .116E+05      .151E+06   .162E+05
DROXIDE,M        2.568      4.769      5.136       .000         5.136       .000
UMINATE,M         .118       .218       .235       .000          .235       .000
TRATE,M          1.336      2.481      2.672       .000         1.955       .359
TRITE,M           .685      1.272      1.370       .000         1.370       .000
RBONATE,M         .508       .943       .090       .463          .052       .482
OSPHATE,M         .000       .000       .000       .000          .000       .000
LFATE,M           .066       .122       .131       .000          .131       .000
UORIDE,M          .118       .219       .051       .093          .051       .093
GANIC,G/L        3.840      7.132      7.680       .000         7.680       .000
```

COMPOSITE PREDICT RUN (CONT.)

```
PASS  FIVE   DOUBLE SHELL SLURRY RUN
PASS STOPPED AT 8 MOLAR CAUSTIC LIMI
TEMPERATURE     65.8 C  150.5 F     PRESSURE   60.0 Torr
PASS WVR        35.8                TOTAL WVR          95.5
                                       EVAPORATOR           TANK CONDITIONS
                                       CONDITIONS               20.0 C
                 FEED      SLURRY      SUPERNATE SOLIDS*    SUPERNATE SOLIDS
VOLUME, gal     .135E+06  .871E+05   .868E+05  309.        .868E+05  .728E+04
HYDROXIDE,M        5.136     7.972      8.000      .000       8.000      .000
ALUMINATE,M         .235      .365       .366      .000        .366      .000
NITRATE,M          1.955     3.034      3.045      .000       1.246     1.155
NITRITE,M          1.370     2.126      2.133      .000       1.834      .192
CARBONATE,M         .052      .081       .047      .022        .008      .047
PHOSPHATE,M         .000      .000       .000      .000        .000      .000
SULFATE,M           .131      .204       .205      .000        .205      .000
FLUORIDE,M          .051      .079       .022      .036        .022      .036
ORGANIC,G/L        7.680    11.920     11.963      .000      11.963      .000
```

This page intentionally left blank.

APPENDIX K

REFERENCE LETTERS

This page intentionally left blank.

Westinghouse
Hanford Company

Internal
Memo

From: Single-Shell Tanks
Phone: 3-3531 R1-49
Date: August 6, 1992
Subject: ISOTOPIC URANIUM ANALYSIS COMPOSITION

7C242-92-019

To: S. D. Godfrey R1-51

cc: K. G. Carothers R1-51 KGC
J. E. Geary R1-43
R. J. Nicklas R1-43
T. S. Vail R1-49
CCP:DRH File/LB

When performing an isotopic uranium analysis from total uranium concentration, it has been calculated that the following break-down can be used to determine U-233, U-235 and U-238 concentrations when dealing with spent N Reactor fuel.

U-233	1.077E-8	%
U-235	0.933	%
U-238	99.012	%

The included calculations were based on data contained in SD-CP-TI-105 <u>ORIGEN2 Predictions of N Reactor Fuel Actinide Composition</u> for 6% plutonium enrichment.

C. C. Pitkoff, Engineer
Single-Shell Tanks

lmt

Attachment

7C242-92-019
ATTACHMENT 1
Page 1 of 2

6% ENRICHMENT FUEL MIXTURES AND URANIUM ISOTOPE PERCENTAGES

A. Pure MK IV Fuel

Inner Cell: 913 MWD Burn Up
Outer Cell: 1188 MWD Burn Up

U Isotope	Mass	Wt. Fraction	Wt. %
233	1.049E-4 g	1.0512E-10	1.0512E-8 %
234	6.800E1 g	6.8143E-5	
235	8.354E3 g	8.3716E-3	8.3716E-1 %
236	5.911E2 g	5.9234E-4	
237	1.569E-7 g	1.5723E-13	
238	9.889E5 g	0.99098	99.098 %
	0.000 g		
	9.979E5 g		

B. Pure MK IA Fuel

Inner Cell: 946 MWD Burn Up
Outer Cell: 1537 MWD Burn Up

U Isotope	Mass	Wt. Fraction	Wt. %
233	1.095E-4 g	1.0976E-10	1.0976E-8 %
234	8.098E1 g	8.1175E-5	
235	1.010E4 g	1.0124E-2	1.0124 %
236	4.695E2 g	4.7063E-4	
237	1.544E-7 g	1.5477E-13	
238	9.870E5 g	0.9894	98.94 %
239	0.000 g		
	9.976E5 g		

C. Inner and Outer Cell Fuel Mixture #1

Inner Cell: 1101 MWD Burn Up of MK IV Fuel
Outer Cell: 3300 MWD Burn Up of MK IA Fuel

U Isotope	Mass	Wt. Fraction	Wt. %
233	1.059E-4 g	1.06E-10	1.06E-8 %
234	7.056E1 g	7.070E-5	
235	8.710E3 g	8.729E-3	8.729E-1 %
236	5.681E2 g	5.693E-4	
237	1.566E-7 g	1.569E-13	
238	9.885E5 g	0.9906	99.06 %
239	0.000 g	0.000	
	9.978E5		

6% ENRICHMENT FUEL MIXTURES AND URANIUM ISOTOPE PERCENTAGES (cont.)

D. Inner and Outer Cell Fuel Mixture #2

Inner Cell: 1101 MWD Burn Up of MK IV Fuel
Outer Cell: 3300 MWD Burn Up of 20% MK 1A and 80% MK IV Fuels

U Isotope	Mass	Wt. Fraction	Wt. %
233	2.191E-5 g	1.0982E-10	1.0982E-8 %
234	1.620E1 g	8.1203E-5	
235	2.019E3 g	0.0101	1.01 %
236	9.389E1 g	4.7062E-4	
237	3.088E-8 g	1.5479E-13	
238	1.974E5 g	0.9895	98.95 %
239	0.000 g		
	1.995E5 g		

E. Average U Isotope Concentration for the 4 Given Fuel Types

U 233	U 235	U 238
1.0512E-8 %	8.3716E-1 %	99.098 %
1.0976E-8 %	1.0124 %	98.94 %
1.0982E-8 %	1.01 %	98.95 %
1.06E-8 %	0.8729 %	99.06 %
4.3070E-8 %	3.732 %	396.048 %
/ 4	/ 4	/ 4
1.077E-8 %	0.933 %	99.012 %

Avg. U 233 = 1.077E-8 %
Avg. U 235 = 0.933 %
Avg. U 238 = 99.012 %

This page intentionally left blank.

Westinghouse
Hanford Company

Internal
Memo

From: Process Chemistry and Development
Phone: 373-2182 T6-09
Date: April 26, 1995
Subject: EVAPORATOR CAMPAIGN 95-1 BOILDOWN REPORT

8E110-PCD95-034

To:	E. Q. Le	R1-43
cc:	T. M. Blaak	R1-67
	M. D. Guthrie	R1-43
	J. R. Jewett	T6-09
	E. Q. Le	R1-43
	G. L. Miller	T6-06
	R. J. Nicklas	R1-43
	J. P. Sederburg	R2-11
	B. H. VonBargen	R1-43
	MAB File/LB	

Reference:
(1) Internal Memo, E. Q. Le to M. A. Beck "242-A Evaporator Campaign 95-1 Boildown Studies" 71730-95-003, March 27, 1995.

(2) Controlled Laboratory Notebook, WHC-N-120-8, pgs. 105-120, M. A. Beck, 1994.

(3) M. A. Beck, "Determination Of Boiling Pressures And Temperatures As A Function Of % WVR (Boildown)," LT-519-183, Revision A-1, March 1995.

(4) J. R. Jewett, "Rheology measurement for the Haake CV20", LT-519-115, Revision A-0, January 19, 1994.

This letter reports the results of boildown studies performed by Process Chemistry and Development (PCD) for 242-A Evaporator Program campaign 95-1. This work was initiated by Reference 1. In support of the Evaporator (Waste Tank System Engineering [WTSE]) process needs, PCD performed a mixing/compatibility study, a boildown study, a specific gravity study, and plans on performing a viscosity study. All raw data are recorded in a controlled laboratory notebook (Reference 2).

I. MIXING/COMPATIBILITY STUDY

Mixing/compatibility studies were performed by PCL. A single tank composite was made up for each tank, from approximately equal volumes of each of the available samples. From each of the single tank composites, multi-tank composites were made.

There were noticeable differences in the density of the samples that made up the single tank composite AP-106. Single tank composite AP-106 was deep yellow in color.

No differences in color or density were observed in making up the AP-107 single tank composite.

The AW-106 composite foamed slightly on adding the two samples together. This foaming was probably due to the distance the sample had to drop down the graduated cylinder. Only a few small bubbles were observed after one minute.

Differences in the color that followed the trend of density (darker color tended to be denser) were observed in the samples. The color of the composites became the average of the individual samples that made up the composites.

The AP-106+AP-107 composite consisted of 52% AP-106 and 48% AP-107. It was light yellow in color.

The overall composite consisted of 47% AP-106, 35% AP-107, and 18% AW-106. It was light yellow/orange in color.

The mixing/compatibility study included Differential Scanning Calorimetry (DSC) on the composites after mixing. No exotherms were detected in any of the final composites, in scans conducted to 500 degree Celsius. The endotherm associated with water boiling and loss was observed in each of the samples. See Attachment 1, Table 1, for a summary of the mixing compatibility data. See Attachment 2 for the actual DSC plots.

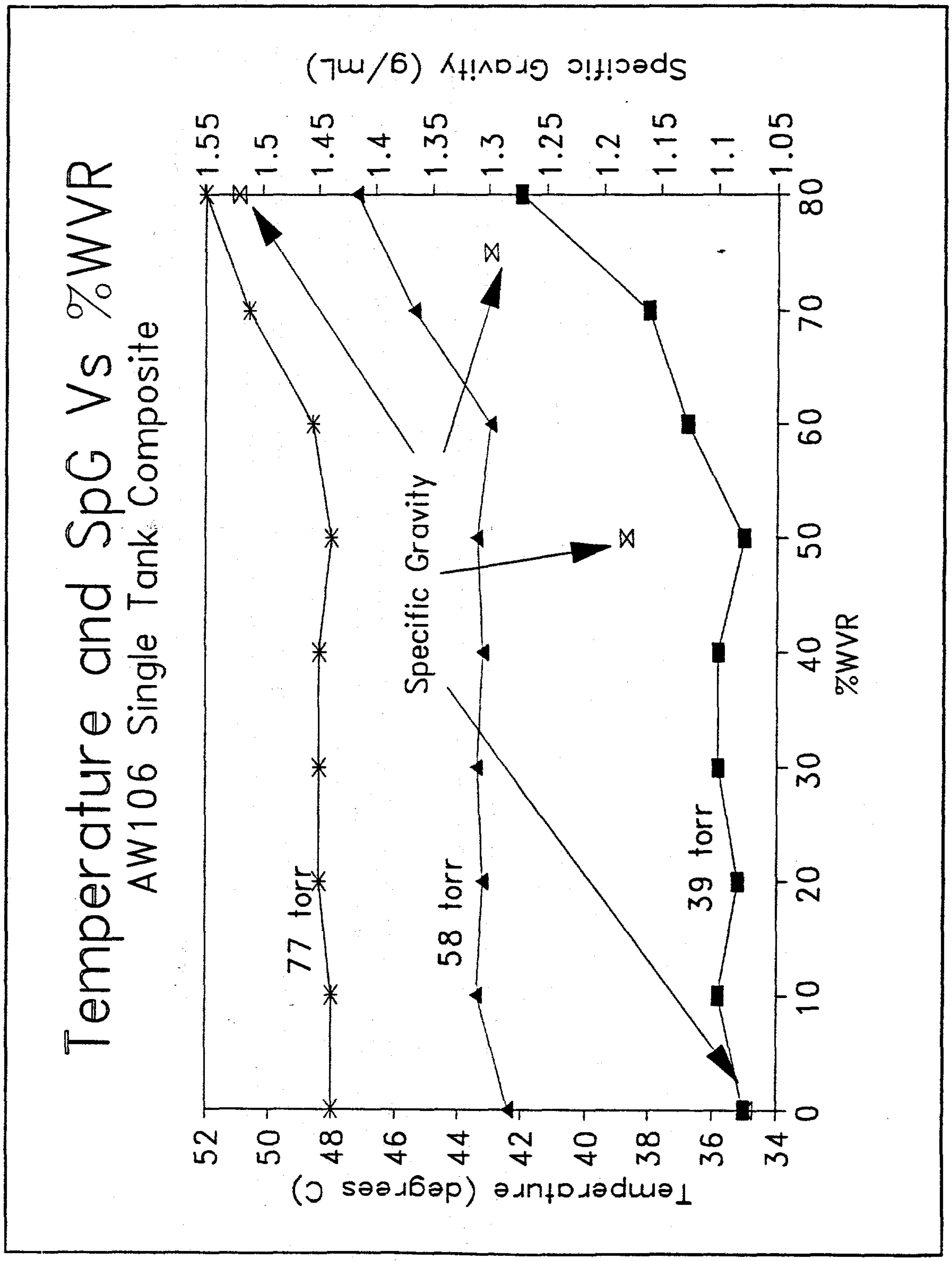
II. BOILDOWN PRESSURE-TEMPERATURE STUDY

Three separate boildown pressure-temperature studies were requested. These studies were to be conducted on AW-106, AP-106+AP-107 composite, and an overall composite. The boildowns were performed per LT-519-183, "Determination of Boiling Pressures and Temperatures as a Function of WVR (Boildown)" (Reference 3). The temperature was measured at 40, 60, and 80 torr at waste volume reduction (WVR) intervals of 10 percent. Observations of chemical reactions and physical changes such as color, foaming, appearance, precipitation, phase separation (solids settle or remain suspended) are presented in Tables 1, 2, and 3. The Tables are essentially copies of the data in the notebook (Reference 2). Graphs 1, 2 and 3, show the same data as the tables in graphical format. Per Reference 3 calibrations were done for both temperature and pressure. Graph 4 shows the pressure calibration regression. The temperaturel calibration showed that the thermocouple had a nearly identical response to an ASTM standardized thermometer.

Table 1
AW106 Boildown Observations and Data

%WVR	Volume (ml)	Indicated Pressure	Indicated Temp	Observations 4/17/95
0	0	737		200 mL still bottom, 151 mL solution Ambient air 1.075g/mL deep yellow, clear liquid Condenser @ 7°C
0	0	75	48.0	initial try had considerable foaming (small bubbles, which didn't break), overflow into condensate collector necessitated starting over. second try had larger bubbles which presented no problems
0	0	55	42.4	sudden changes in pressure (even 1 torr) can cause excessive foaming
0	0	35	35.0	At a steady pressure, the solution is almost quiescent
10	15	75	48.0	
10	15	55	43.4	shows signs of superheating (cycles of quiescence and bumping)
10	15	35	35.8	
~20	32	75	48.4	
~20	32	55	43.2	
~20	32	35	35.2	
30	45	75	48.4	~110 mL in flask (with a big vortex formed)
30	45	55	43.4	same large bubbles
30	45	35	35.8	~80mR @ contact
40	60	75	48.4	solution seems more viscous
40	60	55	43.2	deep orange color, still clear
40	60	35	35.8	
50	75	75	48.0	thermocouple out of solution all further temperature measurements depend on whether the solution bumps, foams or is quiescent.
50	75	55	43.4	no solids, even when cooled to sample for specific gravity Specific gravity 1.180g/mL.
50	75	35	35.0	
60	90	75	48.6	Milky haze in orange solution. Heavy foaming (2X liquid volume) large bubbles.
60	90	55	43.0	Very hazy when cooled to 43°C.
60	90	35	36.8	
70	90	75	50.6	Solution still cloudy at 48 °C (no change from previous, lower temperature)
70	90	55	45.4	~45mL solution still in pot solids drying above bubble area
70	90	35	38.0	@75 %WVR (112 mL) specific gravity = 1.3 g/mL had to wash solids off sides to get a representitive sample. Bubbling steady.
80	120	75	52.0	Visually very cloudy, unable to see to reach a higher %WVR endpoint.
80	120	55	47.2	Specific Gravity 1.52 g/mL
80	120	35	42.0	Yellow, easily settled, fine, sludge-like solids. estimate 30-50% solids by volume.
Endpoint 80 %WVR	120			~1850mR at contact

Graph 1
AW106



E. Q. Le
Page 5
April 26, 1995

8E110-PCD95-034

Table 2
AP106/AP107 Observations and Data

%WVR	Volume (ml)	Indicated Pressure	Indicated Temp	Observations 4/19/95
0	0	740	21.8	200 mL still bottom flask, 200 mL solution Ambient air 1.05g/mL pale yellow, clear liquid Condenser @ 7°C
0	0	75	48.0	large bubbles which presented no problems
0	0	55	42.0	
0	0	35	36.0	
~10	24	75	48.0	
~10	24	55	42.6	
~10	24	35	36.0	
20	40	75	48.4	
20	40	55	42.2	
20	40	35	36.4	
30	62	75	47.8	
30	62	55	43.0	
30	62	35	36.0	
40	80	75	48.2	
40	80	55	43.6	
40	80	35	36.8	changed condensate collection flask
50	100	75	48.6	large, easily broken bubbles, foam about the same volume as the liquid.
50	100	55	43.2	Volume in still bottom about 100 mL
50	100	35	36.6	
60	120	75	48.2	thermocouple out of solution, thermocouple immersed in foam. All further temperature measurements depend on whether the solution bumps, foams or is quiescent. Heavy foaming, large bubbles. Solution clear @ 48 °C.
60	120	55	42.6	
60	120	35	36.2	
70	140	75	49.6	
70	140	55	43.6	thermocouple engulfed in bubbles
70	140	35	36.6	solution still clear, much foaming (foam volume 6 times that of the liquid) The bubbles don't persist long, but are continually generated.
80	160	75	51.2	
80	160	55	45.8	Specific Gravity @ 80 %WVR 1.25 g/mL. No foaming, bubbles break immediately (perhaps this is related to the growing amount of solids adhering to the sides of the still bottom flask)
80	160	35	38.0	Specific Gravity @ 170 mL 85% WVR 1.38 g/mL.
90	178	75	56.4	Bubbles do no reach up to thermocouple, temperature measurements suspect.
90	178	55	60.4	
90	178	35	51.2	Specific gravity = 1.66 g/mL Orange, heavy slurry, recovered about 10 mL, and did not recover about 5mL. Texture, flow reminiscent of crystallized honey, but was not sticky.

Graph 2
AP106/AP107 Composite

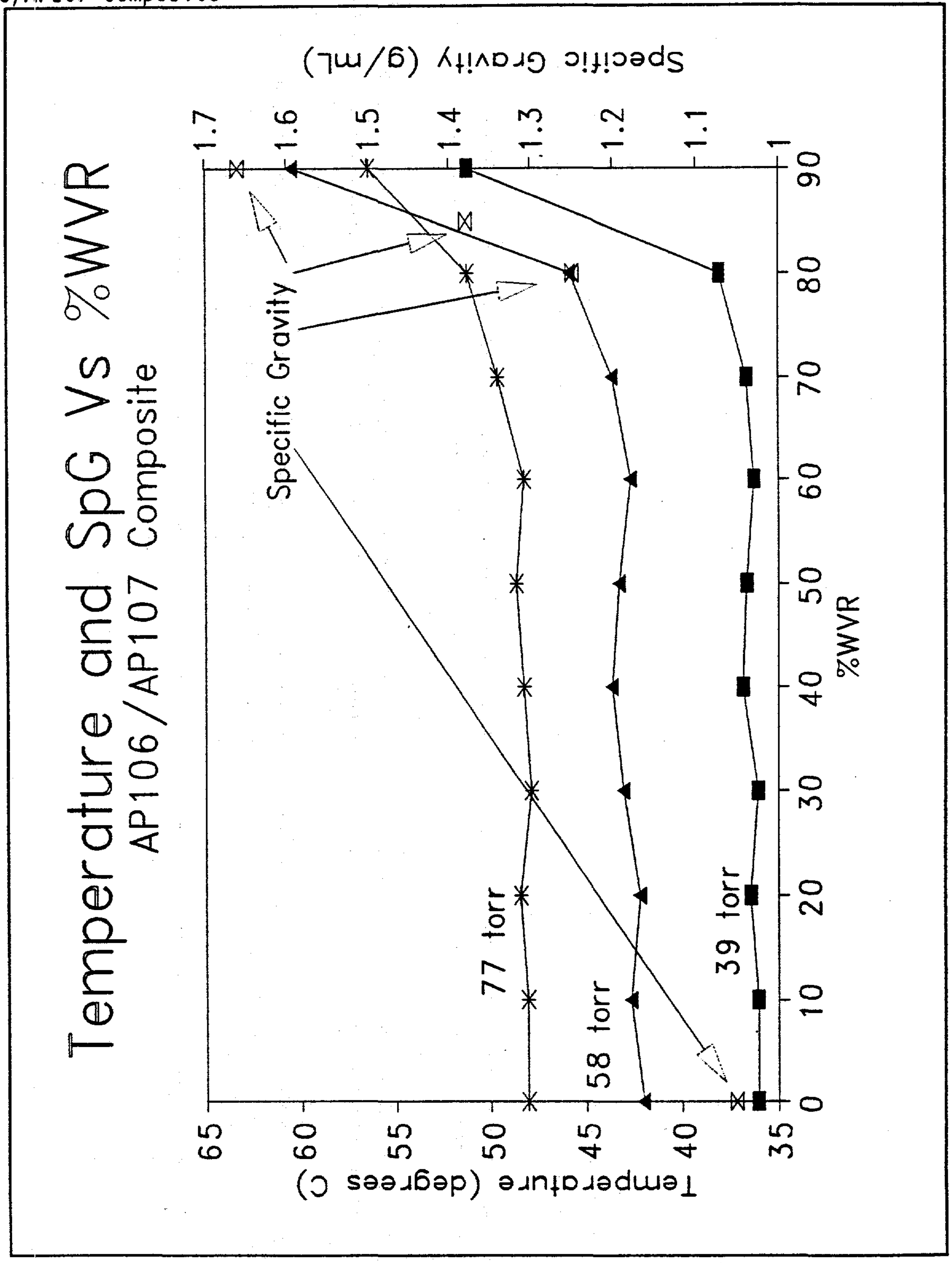
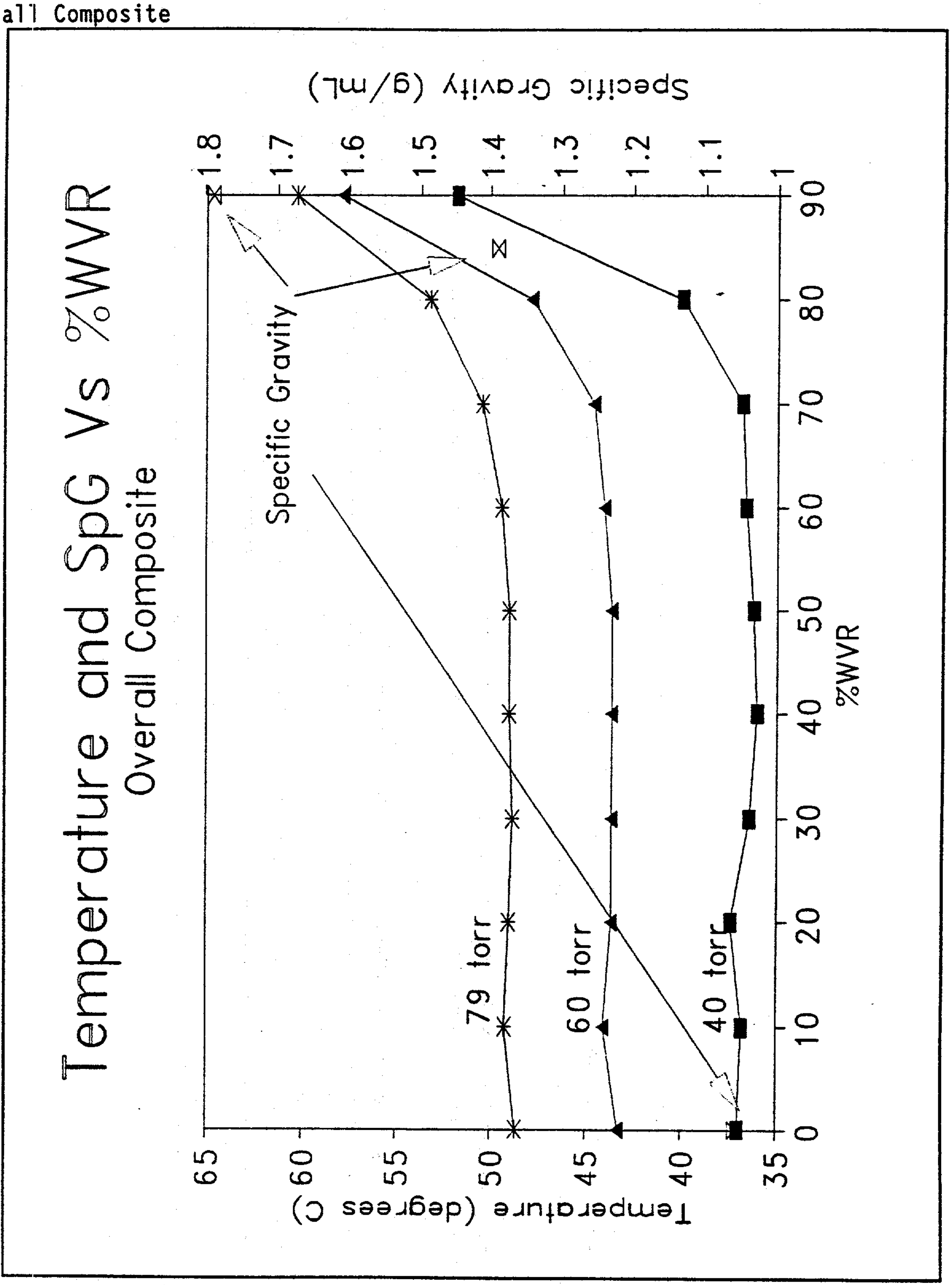


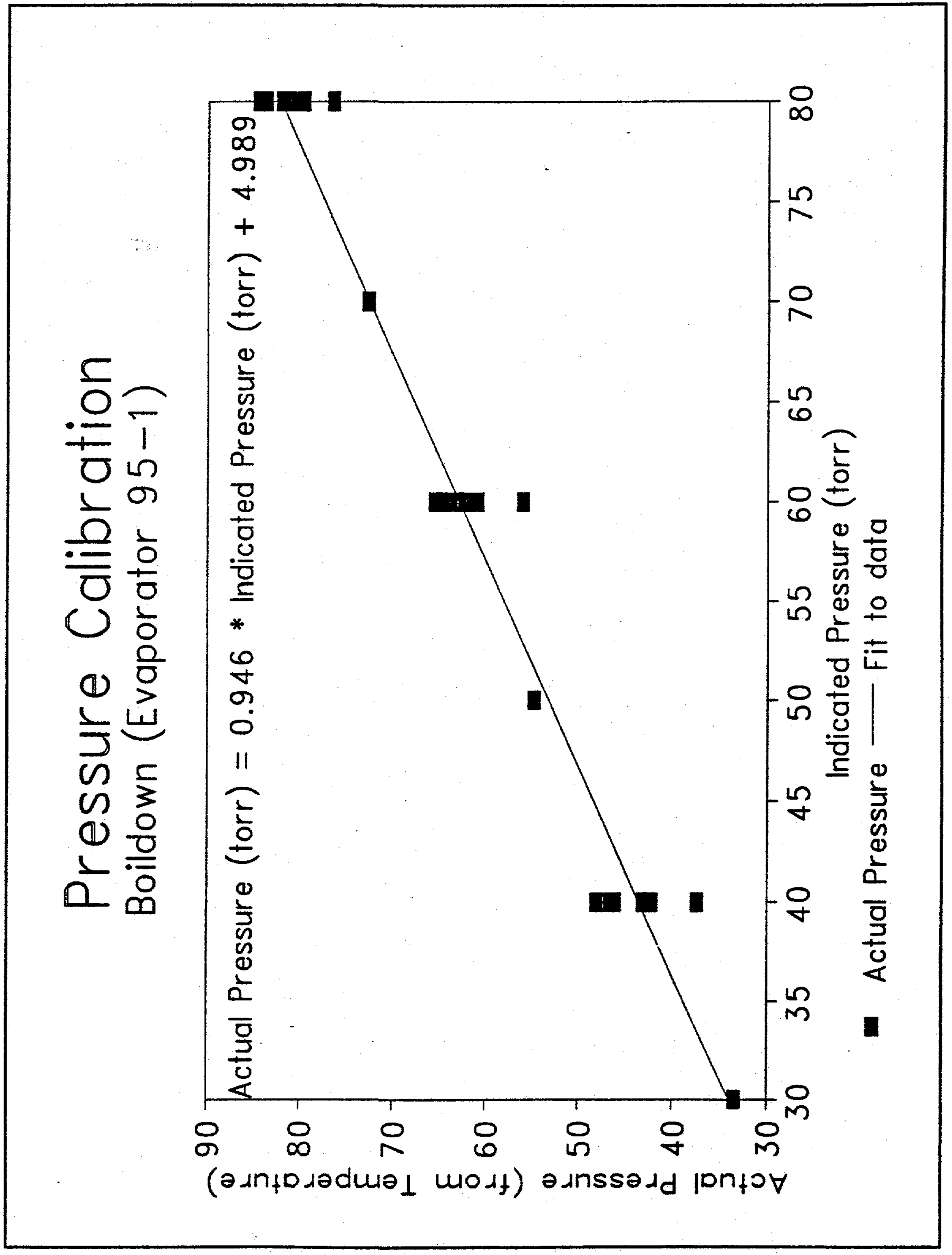
Table 3
Overall Composite Data

%WVR	Volume (ml)	Indicated Pressure	Indicated Temp	Observations 4/24/95
0	0	740	21.8 air 23.6 soln	200 mL still bottom flask, 200 mL solution Ambient air 1.056g/mL yellow, clear liquid Condenser @ 7°C ~15 mR/hr @ hood face. Samples ~1000 mR (corrected)
0	0	77	48.6	heavy mixed size(bubble size) foaming
0	0	57	43.2	fixed a possible leak in o-ring seal.. 43.4 °C after fix.
0	0	36	37.0	light, large, easily broken bubble foam (not really a foam though).
10	20	77	49.2	
10	20	57	44.0	
10	20	36	36.8	
20	40	77	49.0	Bubbles large, easily broken, no problem On pressure reduction, Erratic "burping" some times blows material up to recirculation portion of apparatus.
20	40	57	43.6	
20	40	36	37.4	
30	60	77	48.8	solution clear, deeper yellow orange than start.
30	60	57	43.6	
30	60	36	36.4	
40	80	77	49.0	
40	80	57	43.6	
40	80	36	36.0	changed condensate collection flask
50	100	77	49.0	large bubbles, foam about the 6X volume of the liquid.
50	100	57	43.6	Volume in still bottom about 100 mL
50	100	36	36.2	
60	120	77	49.4	thermocouple barely touching solution, thermocouple immersed in foam. All further temperature measurements depend on whether the solution bumps, foams or is quiescent. Heavy foaming, large bubbles. Solution clear @ 48 °C.
60	120	57	44.0	
60	120	36	36.6	
70	140	77	50.4	foam 6X liquid volume, continuous.
70	140	57	44.6	
70	140	36	36.8	solution still clear,
80	160	77	53.2	@ 75% WVR, milky haze visible @ 48 °C. @ 80% WVR, Foaming small bubbles, small foam layer (1/4 liquid volume).
80	160	57	47.8	Thermocouple completely out of solution, not much foam touching it.
80	160	36	40.0	Specific Gravity @ 170 mL 85% WWR 1.39 g/mL. Solution completely opaque, but very liquid.
90	178	77	60.2	Bubbles do no reach up to thermocouple, temperature measurements suspect.
90	178	57	57.8	
90	178	36	51.8	Specific gravity = 1.79 g/mL Orange, heavy slurry, recovered 10-15 mL (16.41g), and did not recover about 2 mL. Texture, flow reminiscent of thick applesauce.

Graph 3
Overall Composite



Graph 4
Pressure Calibration with Deionized Water



Based on PREDICT calculations (Reference 1) for AW-106, AP-106+AP-107, and overall composites, it was indicated that the customers (WTSE) limit, of 8 molar caustic, would be reached at a WVR of 93.6%, 95.4%, and 95.7% respectively. The PREDICTed endpoint %WVRs were not obtained, which is consistent with the author's past experience in conducting boildown tests. The test endpoint is defined as the point at which the slurry becomes greater than 50% solid by volume, or if the slurry becomes intractable. The endpoint is estimated visually, and is subject to interferences from solids adhering to the sides of the flask.

The temperatures recorded at high %WVR's are much less reliable than the values recorded at lower %WVR's. The thermocouple is out of contact of the solution at high %WVR's, which means that the measurement is the temperature of the headspace, unless significant foaming occurs. The temperature will be biased high if no splashes or bubbles contact the thermocouple tip. Some anomalies in the data (a lower pressure having a higher temperature, See Graph 2) may be explained by the differences in foaming or bubbling.

To enable viscosity studies to be performed, PCD has retained the still bottoms (final boildown product) of all samples. In addition, PCD has retained samples of the condensate from the high %WVR portion of the boildown to facilitate possible studies on the condensate. The condensate samples were placed in septum vials with as little headspace as possible.

III. SPECIFIC GRAVITY STUDY

Specific gravity studies were performed on AW-106, AP-106+AP-107, and overall composites. The specific gravity was measured at approximately room temperature and at ambient pressure. The specific gravity was measured by pipetting or ladling (for slurries) a representative sample of still bottoms into a pretared volumetric flask, and weighing the flask. No temperature control, or measurement was available for specific gravity measurements. The temperature of the aliquots was about 25-30 °C, based on the temperature of the still bottoms on reassembly of the boildown apparatus. At high %WVR's, the slurry-like nature of the samples prevented precise measurement of specific gravity, since it was impossible to scrape all the material below the volume mark. The number of significant figures for specific gravity in the summary table are adjusted to reflect the author's estimation of their reliability. For the AW-106 boildown test, the specific gravity measurements were obtained at 50%, 75% and 80% WVR. For AP-106+AP-107 and overall composites, the specific gravity measurements were obtained at 85% and 90% (endpoint) WVR. See Table 4 for a summary of the specific gravity results.

IV. VISCOSITY STUDY

Viscosity measurements will be performed at the boildown study end points on final boildown products of AW-106, AP-106+AP-107, and overall composites. PCD is developing the capability to perform viscosity tests on smaller samples, but does not have the capability to meet Waste Tank System Engineering's immediate milestones. If the viscosity tests are done, they will be performed according to the procedure in Reference 5. PCD requests that WTSE determine when the viscosity measurments will be needed.

V. DATA LIMITATIONS

The values of %WVR should be understood to be biased low, especially at high %WVR, as the measurement is taken from the amount of condensate collected, not the amount of water lost from the still pot. The temperature values at high %WVRs are likely to be biased high. The specific gravity measurements are likely to be biased high at high %WVR.

VI. SUMMARY

Except for some foaming, no problems were encountered in performing the boildowns, and so none is expected in Evaporator operation. The foaming may be a function of the scale of the apparatus, and may not affect the Evaporator. Any material that is made up of waste largely from the "AP" tanks should be able to reach 90% WVR.

Mark A Beck

M. A. Beck, Senior Chemist
Process Chemistry and Development

mab
2 Attachments

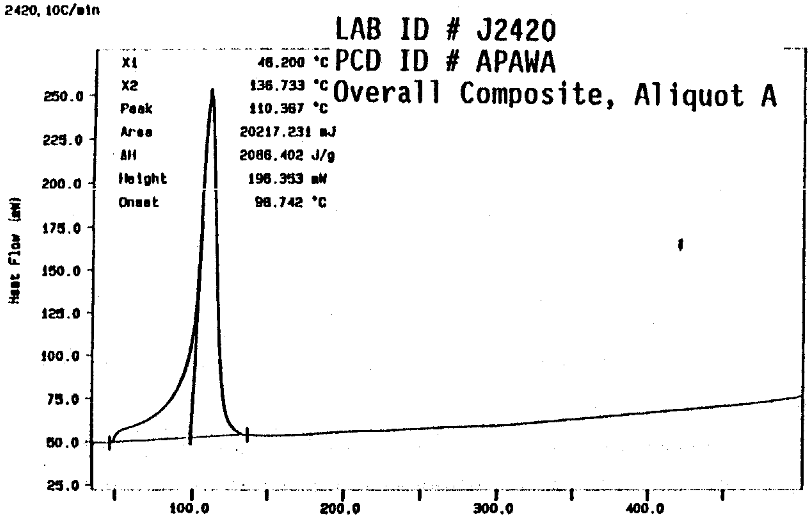
Attachment 1
Table 1
Composite Make-up Summary

CAMPAIGN 95-1 BOILDOWN STUDY SUMMARY TABLE

COMPOSITE	COMPOSITION Desired %, WSTE ID (Lab ID#)[mL of sample used]	MIXING/ COMPATIBILITY	Sp.G (g/mL) At specified %WVR	VISCOSITY
AP-106	106-AP-1d (V164), [83 mL] 33% 106-AP-2d (V166), [83 mL] 106-AP-3d (V165). [83 mL]		NOT Required	NOT Required
AP-107	107-AP-1d(S95V000017) [50 mL] 20% 107-AP-2d(S95V000018) [48 mL] 107-AP-3d(S95V000019) [52 mL] 107-AP-4a(S95V000004) [50 mL] 107-AP-5a(S95V000005) [50 mL]	No DSC,	NOT Required	NOT Required
AW-106	106-AW-1, [128 mL] 49+% 106-AW-2. [130 mL] 50%	DSC- No exotherms mixing observations- some density differences between samples	0% 1.075 g/mL 50% 1.180 g/mL 75% 1.3 g/mL 80% 1.5 g/mL	(at 93.6% WVR or end point)
AP-106 AP-107	52.5% AP-106 [114 mL] 52% 47.5% AP-107 [104 mL] 48%	DSC- No exotherms mixing observations- no changes, color is more like AP016 (darker yellow)	0% 1.050 g/mL 80% 1.25 g/mL 85% 1.38 g/mL 90% 1.66 g/mL	(at 95.4% WVR or end point)
Overall	42.2% AP-106, [108 mL] 47% 38.2% AP-107, [80 mL] 35% 19.6% AW-106, [41 mL] 18%	DSC- No exotherms mixing observations- no changes, noted that AP-106 seemed denser.	0% 1.056 g/mL 85% 1.39 g/mL 90% 1.8 g/mL	(at 95.7% WVR or end point)

Attachment 2
Differential Scanning Calorimetry Plots

DSC
Info: SAM041204 Wed Apr 12 13:22:22 1995
Sample Weight: 9.690 mg
J 2420, 10C/min

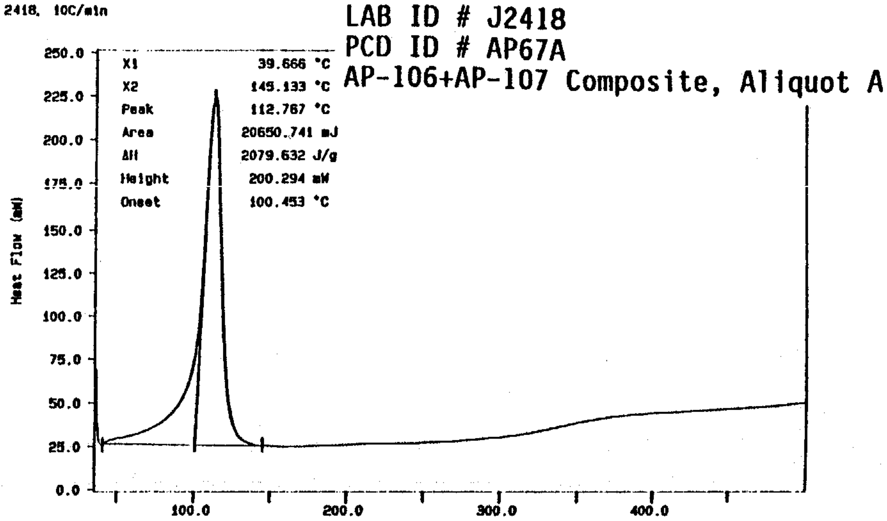

LAB ID # J2420
PCD ID # APAWA
Overall Composite, Aliquot A

X1	46.200 °C
X2	136.733 °C
Peak	110.367 °C
Area	20217.231 mJ
ΔH	2086.402 J/g
Height	196.353 mW
Onset	98.742 °C

exotherm down, nitrogen purge gas
TEMP1: 35.0 C TIME1: 0.0 min RATE1: 10.0 C/min
TEMP2: 500.0 C

SW Fulton
Westinghouse Hanford Co.
222-S Lab
Wed Apr 12 13:37:38 1995

Curve 1: DSC
File info: SAM041201 Wed Apr 12 10:32:19 199
Sample Weight: 9.930 mg
J 2418, 10C/min

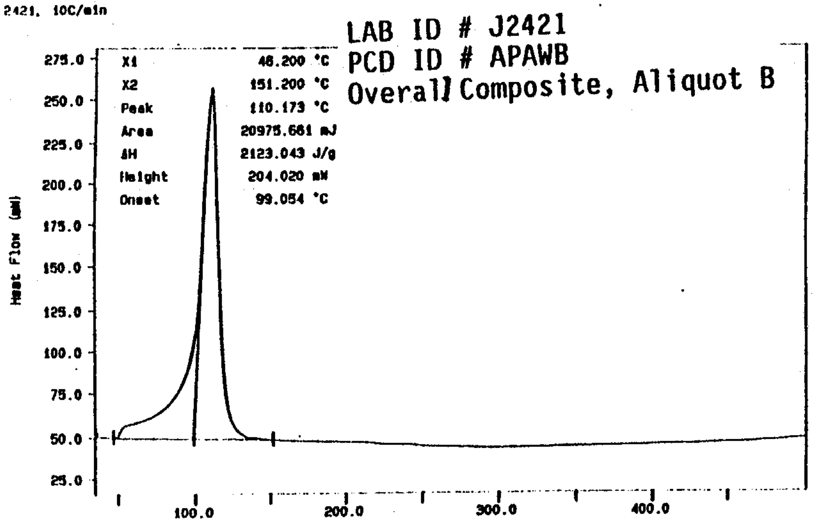

LAB ID # J2418
PCD ID # AP67A
AP-106+AP-107 Composite, Aliquot A

X1	39.666 °C
X2	145.133 °C
Peak	112.767 °C
Area	20650.741 mJ
ΔH	2079.632 J/g
Height	200.294 mW
Onset	100.453 °C

exotherm down, nitrogen purge gas
TEMP1: 35.0 C TIME1: 0.0 min RATE1: 10.0 C/min
TEMP2: 500.0 C

SW Fulton
Westinghouse Hanford Co.
222-S Lab
Wed Apr 12 10:43:07 1995

Curve 1: DSC
File info: SAM041205 Wed Apr 12 14:32:57 1995
Sample Weight: 9.880 mg
J 2421, 10C/min

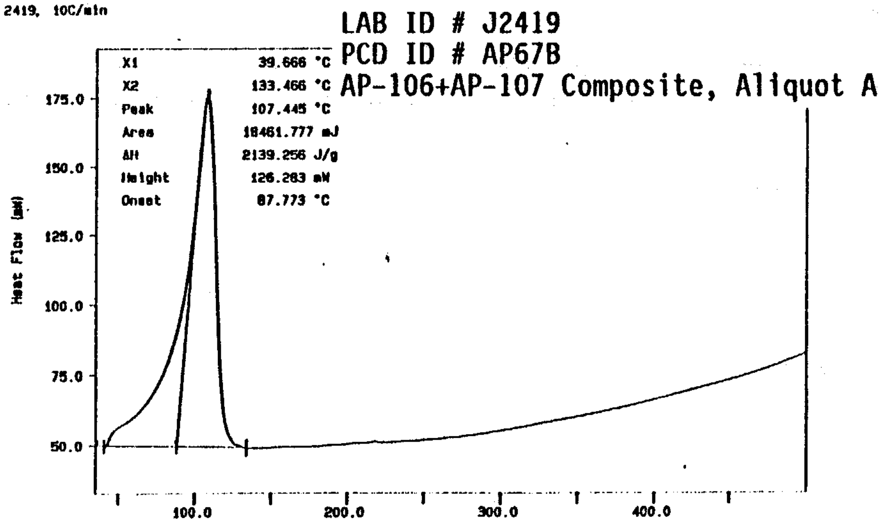

LAB ID # J2421
PCD ID # APAWB
Overall Composite, Aliquot B

X1	46.200 °C
X2	151.200 °C
Peak	110.173 °C
Area	20975.661 mJ
ΔH	2123.043 J/g
Height	204.020 mW
Onset	99.054 °C

exotherm down, nitrogen purge gas
TEMP1: 35.0 C TIME1: 0.0 min RATE1: 10.0 C/min
TEMP2: 500.0 C

SW Fulton
Westinghouse Hanford Co.
222-S Lab
Wed Apr 12 15:03:16 1995

Curve 1: DSC
File info: SAM041203 Wed Apr 12 12:27:02 1995
Sample Weight: 8.630 mg
J 2419, 10C/min


LAB ID # J2419
PCD ID # AP67B
AP-106+AP-107 Composite, Aliquot A

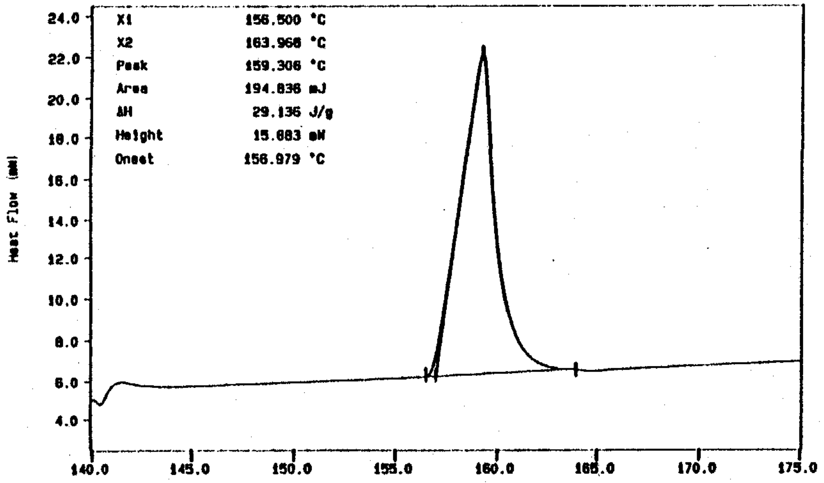
X1	39.666 °C
X2	133.466 °C
Peak	107.445 °C
Area	18461.777 mJ
ΔH	2139.256 J/g
Height	126.283 mW
Onset	87.773 °C

exotherm down, nitrogen purge gas
TEMP1: 35.0 C TIME1: 0.0 min RATE1: 10.0 C/min
TEMP2: 500.0 C

SW Fulton
Westinghouse Hanford Co.
222-S Lab
Wed Apr 12 12:30:35 1995

Curve 1: DSC
File info: IND041101 Tue Apr 11 09:24:19 1995
Sample Weight: 6.687 mg
Indium at 10C/min

X1	156.500 °C
X2	163.968 °C
Peak	159.306 °C
Area	194.836 mJ
ΔH	29.136 J/g
Height	15.883 mW
Onset	156.979 °C



N2 exotherm down
TIMES: 0.0 min RATES: 10.0 C/min

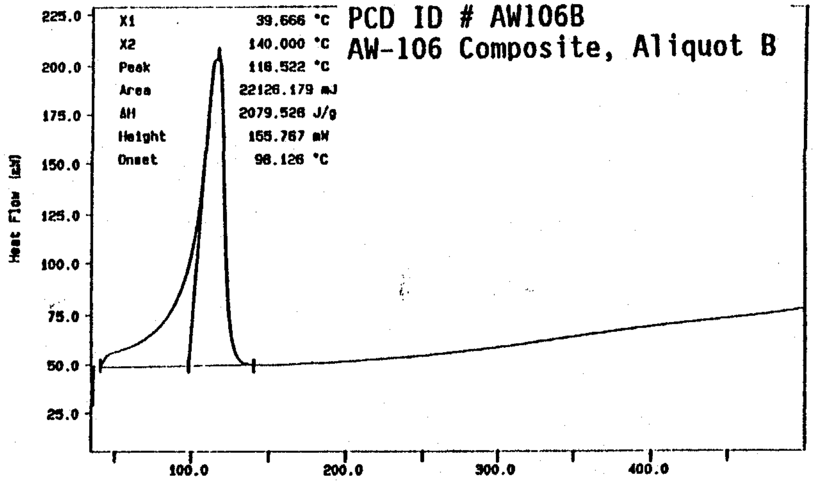
SM FULTON
Westinghouse Hanford Co.
222-S Lab
Tue Apr 11 09:31:13 1995

Susie M Dalton 4/12 95

Curve 1: DSC
File info: SAM041102 Tue Apr 11 13:58:56 1995
Sample Weight: 10.640 mg
J 2417, 10C/min

LAB ID # J2417
PCD ID # AW106B
AW-106 Composite, Aliquot B

X1	39.666 °C
X2	140.000 °C
Peak	116.522 °C
Area	22126.179 mJ
ΔH	2079.528 J/g
Height	165.767 mW
Onset	98.126 °C



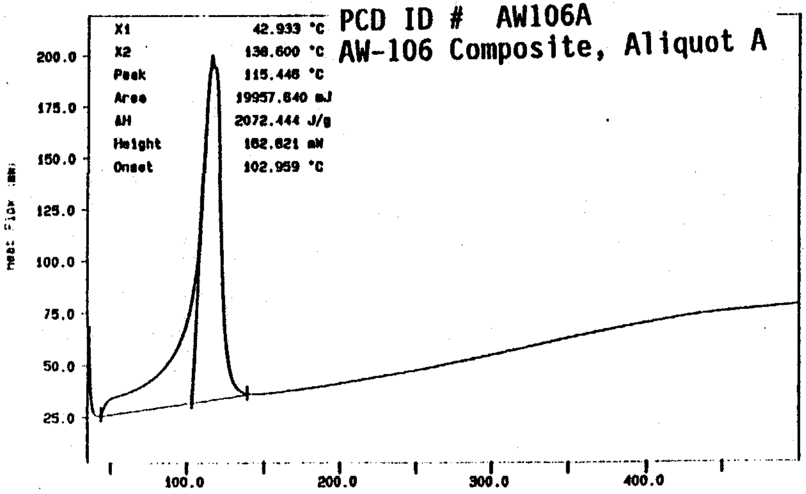
exotherm down, nitrogen purge gas
TIMES: 0.0 min RATES: 10.0 C/min

SM Fulton
Westinghouse Hanford Co.
222-S Lab
Tue Apr 11 14:12:30 1995

Curve 1: DSC
File info: SAM041101 Tue Apr 11 10:33:34 1995
Sample Weight: 9.630 mg
J 2416, 10C/min

LAB ID # J2416
PCD ID # AW106A
AW-106 Composite, Aliquot A

X1	42.933 °C
X2	138.600 °C
Peak	115.446 °C
Area	19957.640 mJ
ΔH	2072.444 J/g
Height	162.621 mW
Onset	102.959 °C

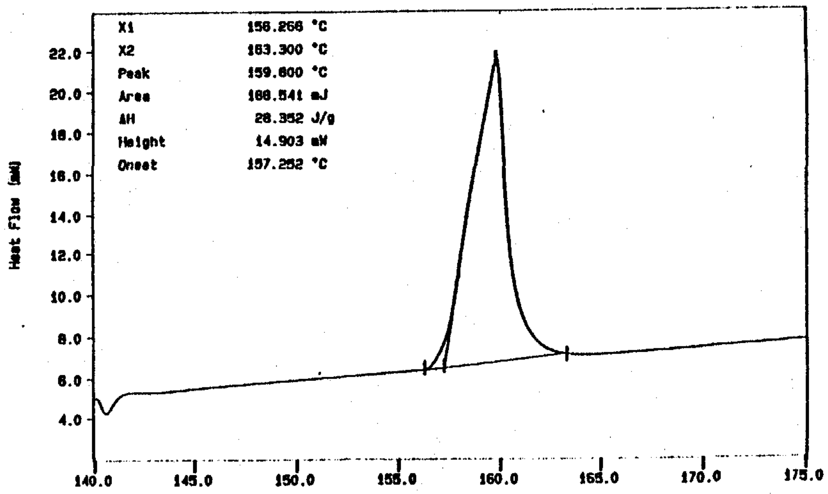


exotherm down, nitrogen purge gas
TIMES: 0.0 min RATES: 10.0 C/min

SM Fulton
Westinghouse Hanford Co.
222-S Lab
Tue Apr 11 13:06:04 1995

Curve 1: DSC
File info: IND041201 Wed Apr 12 09:02:02 1995
Sample Weight: 6.650 mg
Indium at 10C/min

X1	156.266 °C
X2	163.300 °C
Peak	159.800 °C
Area	188.541 mJ
ΔH	28.352 J/g
Height	14.903 mW
Onset	157.252 °C



N2 exotherm down
TIMES: 0.0 min RATES: 10.0 C/min

SM FULTON
Westinghouse Hanford Co.
222 S Lab
Wed Apr 12 09:25:15 1995

This page intentionally left blank.

Westinghouse Hanford Company

Internal Memo

From: Treatment Systems Plant Engineering 71730-95-005
Phone: 373-1800 R1-43
Date: April 10, 1995
Subject: VERIFICATION OF SAMPLE NUMBER FOR TANK 241-AP-106, CAMPAIGN 95-1.

To: R. J. Nicklas R1-43

cc:	M. W. Bowman	R1-52	W. E. Ross	S5-07
	T. A. Campbell	R1-~~43~~	R. D. Schreiber	B2-12
	R. A. Dodd	R2-70	J. A. Sheriff	B1-42
	R. D. Gustavson	R1-51	G. A. Stanton	S7-31
	M. D. Guthrie	R1-43	B. D. Valenzuela	R2-12
	D. S. Haring	R1-43	B. H. Von Bargen	R1-43
	P. G. Johnson	R1-43	RJN File/lb	
	E. Q. Le	R1-43		

Tank 241-AP-106 is scheduled to be processed through the 242-A Evaporator as part of campaign 95-1. This tank had been planned to be used with the grout project and was extensively characterized at that time. The results of this characterization are found in the 222-S Analytical Laboratory 106-AP Grout Feed Tank Report, WHC-SD-WM-DP-049, Rev. 0, September 29, 1993. When the grout project was canceled, this tank became available for feed for the 242-A Evaporator. As a cost savings, the sample data obtained in 1993 was examined to determine which analyses, if any, could be used for 242-A pre-campaign characterization. The analytical criteria applied to the grout characterization of 106-AP was compared to 242-A requirements as specified in the "242-A Evaporator/Liquid Effluent Retention Facility Data Quality Objectives" (DQO), WHC-SD-WM-014, Rev. 0. This comparison revealed that data for many analytes, including most of the primary analytes was acceptable for 242-A applications. Primary analytes requiring further analysis were hydroxide, ammonia, and acetone.

Sampling and analysis of tank 106-AP was performed in accordance with requirements specified in the DQO. Sample results can be found in Analytical Services "Data Package for Analysis and Characterization of Double Shell Tank 241-AP-106", WHC-SD-WM-DP-078, Rev. 0B. A summary of the primary analyte data compiled from both of these data packages is given in Attachment 1.

The raw data obtained from these data packages was tested against rejection criteria as specified in the DQO. The results of this analysis are given in Attachment 2. The data from WHC-SD-WM-DP-078 tended to indicate that the waste in 106-AP tank may be stratified. Sample number 106-AP-1C, -2C and -3C were taken from different depths in the tank with -3C being taken near the bottom, -1C closest to the top, and -2C between the other two. For nearly all analytes, concentrations were significantly higher near the bottom of the tank. This corresponded to a much higher dose rate and lower water content for this sample as compared to the other two. This apparent stratification was not observed in the grout data. As the Q-test applies to samples taken within the same layer, but not to samples from multiple layers, the test was applied to the data from the grout report only. Four data points from the grout report were rejected as a result of this analysis.

Power curve analysis was performed on all accepted data using DQO/DEFT software. With the exception of hydroxide, the number of samples collected met or exceeded the required number of samples as calculated by the power analysis. While the power analysis for hydroxide indicated that additional sampling would be required to verify that the tank is within the required specifications, other indications (pH, past data) support the assumption that the hydroxide concentration is above the 0.01 Molar limit. Results and discussion of the power analyses for each of the primary analytes are given in Attachment 3.

Analysis

With the exception of hydroxide, the number of samples collected met or exceeded the minimum number of samples required per Figure 7-2 of the DQO. Per the strategy defined in the DQO, further evaluation was performed to determine if the hydroxide action limit could be protected using mid-campaign monitoring/sampling and/or processing adjustments. This evaluation concluded that the action limit is not in danger of being exceeded for the following reasons:

1. All three data points are above the 0.01 Molar limit, ranging from five to 85 times the limit. Also, all data points were actually measured and none were reported as "less than" values.

2. Concentration estimates calculated from the pH data ranged from 589 to 2190 ppm, three to thirteen times the minimum limit.

3. Hydroxide levels were measured at 5480 and 5310 ug/ml in 1993 for the grout report, more than 30 times the action limit of 170 ug/ml.

4. Other analyte concentration measurements imply that the tank may be stratified. This could be the cause of the extreme variations in the sample data, which are responsible for the high standard deviation, which is, in turn, responsible for high number of samples suggested by the DQO/DEFT software.

5. Evaporation will tend to increase the concentration of this analyte in the waste, so the concentration is as low now as it will be for the duration of the campaign.

6. Mid-campaign hydroxide concentration are regularly verified through sampling of the feed and slurry streams.

Conclusions

Per Figure 7-2 of the DQO, this tank meets all of the sampling requirements for processing in the 242-A Evaporator. No additional sample collection is recommended.

If you have any questions please feel free to contact me on 373-1800.

Teresa A. Campbell

T. A. Campbell, Engineer
Treatment Systems Plant Engineering

jrt

Attachments

71730-95-005
Attachment 1
Page 1 of 1

AP-106 Raw Data

Sample Number	Hydroxide ug/ml	Ammonia ug/ml	Nitrate ug/ml	Nitrite ug/ml	Sr-90 uCi/ml	Pu-239/40 uCi/ml	Cs-137 uCi/ml	Acetone ug/L
106-AP-1	971	6.4						
106-AP-2	4490	12.8						
106-AP-3	14400	34						
106-AP-1B								410
106-AP-2B								500
106-AP-3B								7300
G386			4890	1150	5.57E-05	1.32E-05	5.99	
G423			4150	1170	0.000148	0.000132	4.29	
G427			3990	1020	8.1E-05	0.000131	4.74	
G428			9480	1330	7.39E-05	0.000133	9.3	
G432			4330	980	4.27E-05	9.01E-05	4.36	
G433			4030	102	0.000224	0.000135	4.64	
G437			4130	985	0.000183	0.000136	4.7	
G438			4650	970	5.79E-05	0.000131	4.64	
Mean	6620.333	17.73333	4956.25	963.375	0.000108	0.000113	5.3325	2736.667
Std Dev	6963.351	14.44622	1854.685	369.9224	6.77E-05	4.29E-05	1.686761	3952.219
RSD %	105.1813	81.46366	37.42113	38.39858	62.52458	38.11182	31.63172	144.4173

71730-95-005
Attachment 2
Page 1 of 1

AP-106 Q-test and Final Retained Data

Test 106-AP-3C Hydroxide for rejection
Range of results = 13429
To nearest neighbor = 9910
Q of sample = 0.737955
Q of table = 0.94
Q sample < Q table = do not reject data point

Test 106-AP-3C Ammonia for rejection
Range of results = 27.6
To nearest neighbor = 21.2
Q of sample = 0.768116
Q of table = 0.94
Q sample < Q table = do not reject data point

Test G428 Nitrate for rejection
Range of results = 5490
To nearest neighbor = 4590
Q of sample = 0.836066
Q of table = 0.47
Q sample > Q table = reject data point

Test G433 Nitrite for rejection
Range of results = 1228
To nearest neighbor = 868
Q of sample = 0.70684
Q of table = 0.47
Q sample > Q table = reject data point

Test G433 Sr-90 for rejection
Range of results = 0.000181
To nearest neighbor = 4.1E-05
Q of sample = 0.226145
Q of table = 0.47
Q sample < Q table = do not reject data point

Test G386 Pu-239/240 for rejection
Range of results = 0.000123
To nearest neighbor = 7.69E-05
Q of sample = 0.626221
Q of table = 0.47
Q sample > Q table = reject data point

Test G428 Cs-137 for rejection
Range of results = 5.01
To nearest neighbor = 3.31
Q of sample = 0.660679
Q of table = 0.47
Q sample > Q table = reject data point

Test 106-AP-3B Acetone for rejection
Range of results = 6890
To nearest neighbor = 6800
Q of sample = 0.985938
Q of table = 0.94
Q sample > Q table. Data point retained as waste may be stratified.

Remaining Data

Sample Number	Hydroxide ug/ml	Ammonia ug/ml	Nitrate ug/ml	Nitrite ug/ml	Sr-90 uCi/ml	Pu-239/40 uCi/ml	Cs-137 uCi/ml	Acetone ug/L
106-AP-1C	971	6.4						
106-AP-2C	4490	12.8						
106-AP-3C	14400	34						
106-AP-1B								410
106-AP-2B								500
106-AP-3B								7300
G386			4890	1150	5.57E-05		5.99	
G423			4150	1170	0.000148	0.000132	4.29	
G427			3990	1020	8.1E-05	0.000131	4.74	
G428				1330	7.39E-05	0.000133		
G432			4330	980	4.27E-05	9.01E-05	4.36	
G433			4030		0.000224	0.000135	4.64	
G437			4130	985	0.000183	0.000136	4.7	
G438			4650	970	5.79E-05	0.000131	4.64	
Mean	6620.333	17.73333	4310	1086.429	0.000108	0.000127	4.765714	2736.667
Std Dev	6963.351	14.44622	339.4113	135.3611	6.77E-05	1.63E-05	0.566623	3952.219
RSD %	105.1813	81.46366	7.874971	12.45927	62.52458	12.86921	11.88958	144.4173

Individual Analyte Analysis

Hydroxide

Parameter	DQO/DEFT Value
Minimum	0.0 ug/ml
Maximum	7000 ug/ml
Action Level	170 ug/ml
Gray Region Boundary (Scenario 1)	6620 ug/ml
Standard Deviation (Scenario 1)	6963 ug/ml
Gray Region Boundary (Scenario 2)	NA
Standard Deviation (Scenario 2)	NA
Minimum No. of Samples (Scenario 1)	7
Minimum No. of Samples (Scenario 2)	NA

Discussion:

DQO/DEFT software calculated a minimum of seven samples to be analyzed for characterization and three were actually pulled. Per DQO Figure 7-2, the tank is not necessarily excluded from processing. However further analysis is required prior to processing. The results of this analysis are reported in the Analysis section of this letter.

Ammonia

Parameter	DQO/DEFT Value
Minimum	0.0 ug/ml
Maximum	5000 ug/ml
Action Level	4930 ug/ml
Gray Region Boundary (Scenario 1)	17.73 ug/ml
Standard Deviation (Scenario 1)	14.45 ug/ml
Gray Region Boundary (Scenario 2)	53.63 ug/ml
Standard Deviation (Scenario 2)	43.71 ug/ml
Minimum No. of Samples (Scenario 1)	2
Minimum No. of Samples (Scenario 2)	2

Discussion:

Both scenarios calculated the minimum number of samples to be two. As three samples were actually analyzed, no further sampling is recommended for this analyte in this tank.

Nitrate

Parameter	DQO/DEFT Value
Minimum	0.0 ug/ml
Maximum	65,000 ug/ml
Action Level	62,000 ug/ml
Gray Region Boundary (Scenario 1)	4310 ug/ml
Standard Deviation (Scenario 1)	339.4 ug/ml
Gray Region Boundary (Scenario 2)	4624 ug/ml
Standard Deviation (Scenario 2)	363.9 ug/ml
Minimum No. of Samples (Scenario 1)	2
Minimum No. of Samples (Scenario 2)	2

Discussion:

Both scenarios calculated the minimum number of samples to be two. As seven samples were analyzed (eight were actually pulled, but one was rejected), no further sampling is recommended for this analyte in this tank.

Nitrite

Parameter	DQO/DEFT Value
Minimum	0.0 ug/ml
Maximum	1500 ug/ml
Action Level	506 ug/ml
Gray Region Boundary (Scenario 1)	1086 ug/ml
Standard Deviation (Scenario 1)	135.36 ug/ml
Gray Region Boundary (Scenario 2)	960.81 ug/ml
Standard Deviation (Scenario 2)	150.96 ug/ml
Minimum No. of Samples (Scenario 1)	2
Minimum No. of Samples (Scenario 2)	2

Discussion:

Both scenarios calculated the minimum number of samples to be two. As seven samples were analyzed (eight were actually pulled, but one was rejected), no further sampling is recommended for this analyte in this tank.

Strontium-90

Parameter	DQO/DEFT Value
Minimum	0.0 uCi/L
Maximum	250,000 uCi/L
Action Level	220,000 uCi/L
Gray Region Boundary (Scenario 1)	0.11 uCi/L
Standard Deviation (Scenario 1)	0.07 uCi/L
Gray Region Boundary (Scenario 2)	0.16 uCi/L
Standard Deviation (Scenario 2)	0.10 uCi/L
Minimum No. of Samples (Scenario 1)	2
Minimum No. of Samples (Scenario 2)	2

Discussion:

Both scenarios calculated the minimum number of samples to be two. As eight samples were analyzed, no further sampling is recommended for this analyte in this tank.

Plutonium-239/240

Parameter	DQO/DEFT Value
Minimum	0.0 uCi/L
Maximum	350 uCi/L
Action Level	310 uCi/L
Gray Region Boundary (Scenario 1)	0.13 uCi/L
Standard Deviation (Scenario 1)	0.02 uCi/L
Gray Region Boundary (Scenario 2)	0.14 uCi/L
Standard Deviation (Scenario 2)	0.02 uCi/L
Minimum No. of Samples (Scenario 1)	2
Minimum No. of Samples (Scenario 2)	2

Discussion:

Both scenarios calculated the minimum number of samples to be two. As seven samples were analyzed (eight were actually pulled, but one was rejected), no further sampling is recommended for this analyte in this tank. Also, it is important to note that Plutonium-239/240 was below the detectable limit in all samples.

Cesium-137

Parameter	DQO/DEFT Value
Minimum	0.0 uCi/ml
Maximum	1000 uCi/ml
Action Level	800 uCi/ml
Gray Region Boundary (Scenario 1)	4.77 uCi/ml
Standard Deviation (Scenario 1)	0.57 uCi/ml
Gray Region Boundary (Scenario 2)	5.29 uCi/ml
Standard Deviation (Scenario 2)	0.63 uCi/ml
Minimum No. of Samples (Scenario 1)	2
Minimum No. of Samples (Scenario 2)	2

Discussion:

Both scenarios calculated the minimum number of samples to be two. As seven samples were analyzed (eight were actually pulled, but one was rejected), no further sampling is recommended for this analyte in this tank.

Acetone

Parameter	DQO/DEFT Value
Minimum	0.0 ug/L
Maximum	90,000 ug/L
Action Level	87,200 ug/L
Gray Region Boundary (Scenario 1)	2736.7 ug/L
Standard Deviation (Scenario 1)	3952.2 ug/L
Gray Region Boundary (Scenario 2)	12555 ug/L
Standard Deviation (Scenario 2)	18129.8 ug/L
Minimum No. of Samples (Scenario 1)	2
Minimum No. of Samples (Scenario 2)	2

Discussion:

Both scenarios calculated the minimum number of samples to be two. As three samples were actually analyzed, no further sampling is recommended for this analyte in this tank.

This page intentionally left blank.

Westinghouse
Hanford Company

Internal
Memo

From: Treatment Systems Plant Engineering
71730-95-007
Phone: 373-1800
Date: April 19, 1995
Subject: VERIFICATION OF SAMPLE NUMBER FOR TANK 241-AP-107, CAMPAIGN 95-1

To:	R. J. Nicklas	R1-43		
cc:	M. W. Bowman	R1-52	W. E. Ross	S5-07
	T. A. Campbell	R1-43	R. D. Schreiber	B2-12
	R. A. Dodd	R2-70	J. A. Sheriff	B1-42
	R. D. Gustavson	R1-51	G. A. Stanton	S7-31
	M. D. Guthrie	R1-43	B. D. Valenzuela	R2-12
	D. S. Haring	R1-43	B. H. Von Bargen	R1-43
	P. G. Johnson	R1-43	RJN File/lb	
	E. Q. Le	R1-43		

Reference: EPA, 1994a, Data Quality Objective Decision Error Feasibility Trials (DQO/DEFT), EPA QA/G-4D, Version 4.0, August 1994 (Final). U. S. Environmental Protection Agency, Washington, D. C.

Tank 241-AP-107 is scheduled to be processed through the 242-A Evaporator as part of Campaign 95-1. Sampling and analysis of tank 107-AP was performed in accordance with requirements specified in the "242-A Evaporator/Liquid Effluent Retention Facility Data Quality Objectives" (DQO), WHC-SD-WM-014, Rev. 0. Final sample results are not available at this time, so the initial verification was performed using preliminary data obtained from the 222-S Laboratory. While it is not anticipated that any sampling requirements will change, a revision to this letter will be issued when the final sample results are obtained. A summary of the primary analyte data is given in Attachment 1.

The raw data obtained from the data package was tested against rejection criteria as specified in the DQO. The results of this analysis are given in Attachment 2. Three data points were rejected as a result of this analysis.

Power curve analysis was performed on all accepted data using DQO/DEFT software (Reference). Results and discussion of the power analyses for each of the primary analytes are given in Attachment 3.

Analysis & Conclusions

Without exception, the number of samples collected met or exceeded the minimum number of samples required per Figure 7-2 of the DQO. In accordance with the strategy defined in the DQO, no further evaluation was necessary to verify that the minimum number of samples had been collected and analyzed. Therefore, no additional sample collection is recommended prior to processing of this tank in the 242-A Evaporator.

If you have any questions please feel free to contact me on 373-1800.

T. A. Campbell, Engineer
Treatment Systems Plant Engineering

jrt

Attachments

71730-95-007
Attachment 1
Page 1 of 1

AP-107 Raw Data

Sample Number	Hydroxide ug/ml	Ammonia ug/ml	Nitrate ug/ml	Nitrite ug/ml	Sr-90 uCi/ml	Pu-239/40 uCi/ml	Cs-137 uCi/ml	Acetone ug/L
107-AP-1	5530	1060	6780	1590	0.338	8.97E-05	23.4	
107-AP-2	5610	1020	6840	1610	<0.0134*	8.34E-05	9.535	
107-AP-3	5250	1010	3590	1570	0.0978	9.19E-05	9.845	
107-AP-4	5390	1040		6050				
107-AP-5	5390	1060		1570				
AP-107-1A								4100
AP-107-2A								3900
AP-107-3A								4000
AP-107-4A								4200
AP-107-5A								4000
Mean	5434	1038	5736.667	2478	0.149733	8.83E-05	14.26	4040
Std Dev	139.5708	22.80351	1859.31	1996.878	0.168416	4.41E-06	7.91699	114.0175
RSD %	2.568472	2.19687	32.41098	80.58424	112.4776	4.994408	55.51886	2.822216

* Analyte was below detection limit.

71730-95-007
Attachment 2
Page 1 of 1

AP-107 Q-test and Final Retained Data

Test 107-AP-4B Nitrate for rejection
Range of results = 3250
To nearest neighbor 3190
Q of sample = 0.981538
Q of table = 0.94
Q sample > Q table = reject data point

Test 107-AP-1C Cesium for rejection
Range of results = 13.865
To nearest neighbor 13.555
Q of sample = 0.977642
Q of table = 0.94
Q sample > Q table = reject data point

Test 107-AP-4B Nitrite for rejection
Range of results = 4480
To nearest neighbor 4440
Q of sample = 0.991071
Q of table = 0.94
Q sample > Q table = reject data point

The No Q-test was performed on Sr-90 data as the point in question would have been one of the two in which the analyte was actually detected. Acceptance of a "less than" value over a higher "measured" value for a maximum limit would be non-conservative.

Remaining Data

Sample Number	Hydroxide ug/ml	Ammonia ug/ml	Nitrate ug/ml	Nitrite ug/ml	Sr-90 uCi/ml	Pu-239/40 uCi/ml	Cs-137 uCi/ml	Acetone ug/L
107-AP-1	5530	1060	6780	1590	0.338	8.97E-05		
107-AP-2	5610	1020	6840	1610	0.0134	8.34E-05	9.535	
107-AP-3	5250	1010		1570	0.0978	9.19E-05	9.845	
107-AP-4	5390	1040						
107-AP-5	5390	1060		1570				
AP-107-1A								4100
AP-107-2A								3900
AP-107-3A								4000
AP-107-4A								4200
AP-107-5A								4000
Mean	5434	1038	6810	1585	0.149733	8.83E-05	9.69	4040
Std Dev	139.5708	22.80351	42.42641	19.14854	0.168416	4.41E-06	0.219203	114.0175
RSD %	2.568472	2.19687	0.623002	1.20811	112.4776	4.994408	2.262158	2.822216

Individual Analyte Analysis

Hydroxide

Parameter	DQO/DEFT Value
Minimum	0.0 ug/ml
Maximum	7000 ug/ml
Action Level	170 ug/ml
Gray Region Boundary (Scenario 1)	5434 ug/ml
Standard Deviation (Scenario 1)	139.57 ug/ml
Gray Region Boundary (Scenario 2)	5260 ug/ml
Standard Deviation (Scenario 2)	144.00 ug/ml
Minimum No. of Samples (Scenario 1)	2
Minimum No. of Samples (Scenario 2)	2

Discussion:

Both scenarios calculated the minimum number of samples to be two. As five samples were actually analyzed, no further sampling is recommended for this analyte in this tank.

Ammonia

Parameter	DQO/DEFT Value
Minimum	0.0 ug/ml
Maximum	5000 ug/ml
Action Level	4930 ug/ml
Gray Region Boundary (Scenario 1)	1038.0 ug/ml
Standard Deviation (Scenario 1)	22.80 ug/ml
Gray Region Boundary (Scenario 2)	1066.3 ug/ml
Standard Deviation (Scenario 2)	23.43 ug/ml
Minimum No. of Samples (Scenario 1)	2
Minimum No. of Samples (Scenario 2)	2

Discussion:

Both scenarios calculated the minimum number of samples to be two. As five samples were actually analyzed, no further sampling is recommended for this analyte in this tank.

Nitrate

Parameter	DQO/DEFT Value
Minimum	0.0 ug/ml
Maximum	65,000 ug/ml
Action Level	62,000 ug/ml
Gray Region Boundary (Scenario 1)	6810.0 ug/ml
Standard Deviation (Scenario 1)	42.43 ug/ml
Gray Region Boundary (Scenario 2)	7191.0 ug/ml
Standard Deviation (Scenario 2)	44.80 ug/ml
Minimum No. of Samples (Scenario 1)	2
Minimum No. of Samples (Scenario 2)	2

Discussion:

Both scenarios calculated the minimum number of samples to be two. As two samples were analyzed (three were actually pulled, but one was rejected), no further sampling is recommended for this analyte in this tank.

Nitrite

Parameter	DQO/DEFT Value
Minimum	0.0 ug/ml
Maximum	1700 ug/ml
Action Level	506 ug/ml
Gray Region Boundary (Scenario 1)	1585.0 ug/ml
Standard Deviation (Scenario 1)	19.15 ug/ml
Gray Region Boundary (Scenario 2)	1554.0 ug/ml
Standard Deviation (Scenario 2)	19.55 ug/ml
Minimum No. of Samples (Scenario 1)	2
Minimum No. of Samples (Scenario 2)	2

Discussion:

Both scenarios calculated the minimum number of samples to be two. As four samples were analyzed (five were actually pulled, but one was rejected), no further sampling is recommended for this analyte in this tank.

Strontium-90

Parameter	DQO/DEFT Value
Minimum	0.0 uCi/ml
Maximum	250 uCi/ml
Action Level	220 uCi/ml
Gray Region Boundary (Scenario 1)	0.15 uCi/ml
Standard Deviation (Scenario 1)	0.17 uCi/ml
Gray Region Boundary (Scenario 2)	0.57 uCi/ml
Standard Deviation (Scenario 2)	0.64 uCi/ml
Minimum No. of Samples (Scenario 1)	2
Minimum No. of Samples (Scenario 2)	2

Discussion:
This analyte was detected in two of three samples analyzed. The detection limit on the sample in which the analyte was not detected was significantly below either of the other two samples and application of the Q-test would have resulted in rejection of the highest measured analyte concentration. As the limit for this analyte is a maximum, it was decided that it would be conservative to retain all data points and not apply rejection criteria.

Both scenarios calculated the minimum number of samples to be two. As three samples were analyzed, no further sampling is recommended for this analyte in this tank.

Plutonium-239/240

Parameter	DQO/DEFT Value
Minimum	0.0 uCi/L
Maximum	350 uCi/L
Action Level	310 uCi/L
Gray Region Boundary (Scenario 1)	0.088 uCi/L
Standard Deviation (Scenario 1)	0.00441 uCi/L
Gray Region Boundary (Scenario 2)	0.0993 uCi/L
Standard Deviation (Scenario 2)	0.00496 uCi/L
Minimum No. of Samples (Scenario 1)	2
Minimum No. of Samples (Scenario 2)	2

Discussion:

Both scenarios calculated the minimum number of samples to be two. As three samples were analyzed, no further sampling is recommended for this analyte in this tank.

Cesium-137

Parameter	DQO/DEFT Value
Minimum	0.0 uCi/ml
Maximum	1000 uCi/ml
Action Level	800 uCi/ml
Gray Region Boundary (Scenario 1)	9.69 uCi/ml
Standard Deviation (Scenario 1)	0.22 uCi/ml
Gray Region Boundary (Scenario 2)	11.66 uCi/ml
Standard Deviation (Scenario 2)	0.26 uCi/ml
Minimum No. of Samples (Scenario 1)	2
Minimum No. of Samples (Scenario 2)	2

Discussion:

Both scenarios calculated the minimum number of samples to be two. As two samples were analyzed (three were actually pulled, but one was rejected), no further sampling is recommended for this analyte in this tank.

Acetone

Parameter	DQO/DEFT Value
Minimum	0.0 ug/L
Maximum	90,000 ug/L
Action Level	87,200 ug/L
Gray Region Boundary (Scenario 1)	4040 ug/L
Standard Deviation (Scenario 1)	114.0 ug/L
Gray Region Boundary (Scenario 2)	4181.5 ug/L
Standard Deviation (Scenario 2)	118.0 ug/L
Minimum No. of Samples (Scenario 1)	2
Minimum No. of Samples (Scenario 2)	2

Discussion:

Both scenarios calculated the minimum number of samples to be two. As five samples were actually analyzed, no further sampling is recommended for this analyte in this tank.

Profile Identification #: Evap95-2
Approval Date: 5/2/95

WASTE STREAM PROFILE SHEET

Follow the attached instructions when filling out this Profile Sheet

I. WASTE SHIPPER INFORMATION

1. DST Customer (Waste Shipper/Generator): 242-A Evaporator
2. Contact: Brian Von Bargen
3. Phone: 373-1829
4. Mail Stop: R1-43

II GENERAL WASTE INFORMATION

1. Waste Generator: 242-A Evaporator
2. Waste Stream Name: Campaign 95-1 Evaporator Slurry
3. Process Generating Waste: Wastes from tanks 106-AP, 107-AP, and 106-AW are concentrated and sent to tanks 102-AW and 106-AW.
4. Anticipated Volume including any flush water: 400,000 gallons.
5. Anticipated shipping frequency: Up to three campaigns per year.
6. Method of shipment (rail car, truck or pipeline): pipeline
7. Was analytical data used to fill out this profile sheet? _X_ Yes ___ No

   If yes, site document which was used as the basis for sampling and analysis (i.e. sampling or waste analysis plan) and attach a complete copy of the latest results.

   Process Control Plan for 242-A Evaporator Campaign 95-1, WHC-SD-WM-PCP-009, Rev. 0.

III WASTE STREAM COMPOSITION

List all major constituents including 40 CFR 261 Appendix VII hazardous constituents

1. Component	2.Concentration Range (units)	3. Average % Must Total 100%*	4. Basis for Composition
Water	100% to 70%	70%	Process knowledge
Soluble salts	0% to 30%	30%	Process knowledge

IV PHYSICAL PROPERTIES

1. Physical state at 70 °F (circle all applicable)

[✓ Liquid] Semisolid Solid

Slurry Sludge Gas

2. Viscosity at 70 °F __X__ < 10 mPa s ____ >10 mPa s

3. Is waste multilayered? Yes ________ No __X__
If yes describe and quantify each layer:

1. (Top) ________________________ %
2. ________________________ %
3. (Bottom) ________________________ %

4. Suspended Solids: _____ < 1% __X__ between 1% and 10% _____ > 10%

5. Flash Point: __X__ > 200 °F _____ between 100 & 200 °F _____ < 100 °F

6. Color: clear yellow

V SPECIFIC ANALYSIS OF WASTE

Fill in the following chart giving maximum, minimum, or averages for each specific analyte. Also state whether this information is based on process knowledge or actual analytical data.

PARAMETER	MINIMUM ((specify units)	MAXIMUM (specify units)	AVERAGE (specify units)	BASIS (Process Knowledge or Analysis)
Aluminum	0.0 (M)	1.0 (M)	1.47E-01 (M)	Analysis
Americium 241	0.0 (uCi/ml)	1.0 (uCi/ml)	3.83E-03 (uCi/ml)	Analysis
Carbonate	0.0 (M)	1.0 (M)	6.90E-01 (M)	Analysis
Cesium 137	0.0 (uCi/ml)	8.00E+02 (uCi/ml)	1.15E+02 (uCi/ml)	Analysis
Chloride	0.0 (M)	<1.0 (M)	7.20E-02 (M)	Process Knowledge
Cooling Curve	NA	NA	NA	NA
Cyanide	0.0 (ug/ml)	<1.00E+03 (ug/ml)	1.50E-02 (ug/ml)	Process Knowledge
Energetics (DSC/TGA)	0.0 (J/g)	0.0 J/g at <335 F	0.0 (J/g)	Analysis
Fluoride	0.0 (M)	<5.0 (M)	1.14 M	Analysis

PARAMETER	MINIMUM ((specify units)	MAXIMUM (specify units)	AVERAGE (specify units)	BASIS (Process Knowledge or Analysis)
Gas Composition	NA	NA	NA	NA
Hydroxide	0.01 (M)	10.0 (M)	3.12 (M)	Analysis
Iron	0.0 (ug/ml)	<1.00E+03 (ug/ml)	4.94E+02 (ug/ml)	Process Knowledge
Moisture, %	70%	100%	70%	Process Knowledge
Nitrate	0.0 (M)	<5.5 (M)	1.67 (M)	Analysis
Nitrite	0.011 (M)	<5.5 (M)	8.56E-01 (M)	Analysis
pH	8.0	14	13.8	Analysis
Phosphate	0.0 (M)	0.10 (M)	4.79E-02 (M)	Analysis
Plutonium 239/240	0.0 (uCi/ml)	1.6E-01 (uCi/ml)	1.69E-03 (uCi/ml)	Analysis
Separable Organic Layer	None	None	None	Analysis

PARAMETER	MINIMUM ((specify units)	MAXIMUM (specify units)	AVERAGE (specify units)	BASIS (Process Knowledge or Analysis)
Sodium	0.0 (M)	8.0 (M)	6.18 (M)	Analysis
Solids, %	0%	30%	2.8%	Process Knowledge
Specific Gravity	0.90	1.41	1.3	Analysis
Strontium 90	0.0 (uCi/ml)	2.2E+02 (uCi/ml)	1.89E-01 (uCi/ml)	Analysis
Sulphate	0.0 (M)	<5.0 (M)	8.21E-02 (M)	Analysis
Total alpha	0.0 (uCi/ml)	1.6E-01 (uCi/ml)	5.28E-02 (uCi/ml)	Analysis
Total Fuel Content	No Exotherm	No Exotherm	No Exotherm	Analysis
Total Organic Carbon	0.0 (g/l)	40 (g/l)	4.8 (g/l)	Analysis
Uranium (S)	0.0 (g/l)	<10 (g/l)	2.30E-02 (g/l)	Analysis

VI REACTIVITY AND STABILITY

1. What are the Reactivity Group Number(s) for this waste? (See Design and Development of Hazardous Waste Reactivity Testing Protocol, "EPA Document No. EPA-600/2-84-057, February 1984.)

   10 and 106

2. Is this material stable? Yes X No ____
   If no, explain:

3. Is this material shock sensitive? Yes ____ No X
   If yes, explain: ____

VII DANGEROUS WASTE INFORMATION

1. Is this waste a dangerous waste as defined by WAC 173-303?
   X Yes ___ No

2. If yes to # 1 above, List the applicable Hazardous and/or Dangerous Waste Number(s) and explain the basis for the number. For example if you assign D001, the reason for selection is that the flash point is less than 140 °F.

Hazardous / Dangerous Waste Number	Reason for Selection
	See attached chart # 1

3. Is waste a mixed waste? Yes X No ________

4. List any CERCLA reportable quantities applicable to the waste (see 40 CFR 302.4).

Constituent	Reportable Quantity
See attached chart # 1	

VIII LAND DISPOSAL RESTRICTION INFORMATION

Fill in the following information for ALL characteristic and listed EPA hazardous waste number(s) (See 40 CFR 268.41, 268.42, and 268.43 and WAC 173-303-140). To list additional waste numbers and categories, use an additional page and attach it to this profile sheet.

Use the following codes for column 4 of the following chart.

A. A restricted waste which requires treatment to a performance based standard.

B. A restricted waste which has been treated to a performance based standard.

C. A restricted waste which requires treatment by a specified technology.

D. A restricted waste which has been treated by a specified technology

E. A restricted waste subject to a variance.

REF #	1. WASTE CODES	2. SUBCATEGORY Enter the subcategory description or enter none	3. APPLICABLE TREATMENT STANDARDS			4. HOW MUST THE WASTE BE MANAGED? Enter the appropriate letter (A-E) from above
			3A. Performance Based (check as applicable)		3B. Specified Technology Enter the 40 CFR 268.42 treatment code(s)	
			268.41(a)	268.43(a)	268.42	
	See attached chart # 2					

IX SUPPLEMENTAL INFORMATION & ACCOUNTABILITY STATEMENT

32. Is there an attachment containing additional information? ☐ No ☒ Yes (list below)

Chart 1 and 2

33. I hereby certify that all information submitted in this and all attached documents contains true and accurate descriptions of this waste. Any sample which was analyzed or submitted was representative as defined in 40 CFR 261 Appendix I or by using an equivalent method. All relevant information regarding known or suspected hazards in the possession of the generator and/or waste shipper has been disclosed.

	Charles H. Mulkey, Env. Eng	5/2/95
Authorized Signature	Name and Title	Date

CERTIFICATION OF CONFORMANCE TO INFORMATION SUBMITTED ON PROFILE SHEET

In regards to the shipment of campaign 95-1 evaporator slurry, described in waste profile sheet #Evap95-2 which is scheduled for transfer to DST system in June, 1995, I hereby certify that the wasteshipment:

1. Matches (except as indicated below) the information contained in the waste profile sheet.

2. The process which generated this waste has not changed since the last shipment of this waste

3. The waste codes and requirements to meet Land Disposal Restriction are the same as those indicated in the waste profile sheet.

Expections to information of waste profile sheet (the only exceptions which are allowed are the elimination of a hazardous wate category: None

B. H. Von Bargen Brian Von Bargen Cog Mgr/TSPE 5/2/95
Name Title Date

242-A Evaporator 373-1151/373-4214
Organization Phone

C. H. Mulkey Principal Scientist 5/2/95
Name Title Date

TWS Environmental Engineering 373-0956
Organization Phone

Chart 1
Evaporator Waste Designation & Reportable Quantities

Constituent	Reason for selection	Reportable Quantity
D001	Receipt of waste with this code	100
D002	Receipt of waste with this code	100
D003	Receipt of waste with this code	100
D004	Receipt of waste with this code	1
D005	Receipt of waste with this code	1000
D006	Receipt of waste with this code	10
D007	Receipt of waste with this code	10
D008	Receipt of waste with this code	10
D009	Receipt of waste with this code	1
D010	Receipt of waste with this code	10

Chart 1 Evaporator Waste Designation & Reportable Quantities		
Constituent	**Reason for selection**	**Reportable Quantity**
D011	Receipt of waste with this code	1
D018	Receipt of waste with this code	10
D019	Receipt of waste with this code	10
D022	Receipt of waste with this code	10
D028	Receipt of waste with this code	100
D029	Receipt of waste with this code	100
D030	Receipt of waste with this code	10
D033	Receipt of waste with this code	1
D034	Receipt of waste with this code	100
D035	Receipt of waste with this code	5000
D036	Receipt of waste with this code	1000
D038	Receipt of waste with this code	1000

Chart 1
Evaporator Waste Designation & Reportable Quantities

Constituent	Reason for selection	Reportable Quantity
D039	Receipt of waste with this code	100
D040	Receipt of waste with this code	100
D041	Receipt of waste with this code	10
D043	Receipt of waste with this code	1
WT01	Receipt of waste with this code	NA
WT02	Receipt of waste with this code	NA
WC02	Receipt of waste with this code	NA
WP01	Receipt of waste with this code	NA
WP02	Receipt of waste with this code	NA
F001	Receipt of waste with this code	10
F002	Receipt of waste with this code	10
F003	Receipt of waste with this code	100

Chart 1
Evaporator Waste Designation & Reportable Quantities

Constituent	Reason for selection	Reportable Quantity
F004	Receipt of waste with this code	100
F005	Receipt of waste with this code	100

Chart 2
Evaporator Land disposal Information

Waste Code	Subcategory	Treatment Standard "mg/kg" unless noted by Technology Code	How the waste must be Managed
D001	Nonwastewater	DEACT	A
D002	Nonwastewater	HLVIT	A
D003	Nonwastewater	DEACT	A
D004	Nonwastewater	HLVT	A
D005	Nonwastewater	HLVT	A
D006	Nonwastewater	HLVT	A
D007	Nonwastewater	HLVT	A
D008	Nonwastewater	HLVT	A
D009	Nonwastewater	HLVT	A
D010	Nonwastewater	HLVT	A
D011	Nonwastewater	HLVT	A
D018	Nonwastewater	10 & 268.48	A
D019	Nonwastewater	6.0 & 268.48	A

Chart 2
Evaporator Land disposal Information

Waste Code	Subcategory	Treatment Standard "mg/kg" unless noted by Technology Code	How the waste must be Managed
D022	Nonwastewater	6.0 & 268.48	A
D028	Nonwastewater	6.0 & 268.48	A
D029	Nonwastewater	6.0 & 268.48	A
D030	Nonwastewater	140 & 268.48	A
D033	Nonwastewater	5.3 & 268.48	A
D034	Nonwastewater	30 & 268.48	A
D035	Nonwastewater	35 & 268.48	A
D036	Nonwastewater	14 & 268.48	A
D038	Nonwastewater	16 & 268.48	A
D039	Nonwastewater	6.0 & 268.48	A
D040	Nonwastewater	6.0 & 268.48	A
D041	Nonwastewater	7.4 & 268.48	A
D043	Nonwastewater	6.0 & 268.48	A
WT01	Nonwastewater	None	NA
WT02	Nonwastewater	None	NA
WC02	Nonwastewater	None	NA
WP01	Nonwastewater	None	NA
WP02	Nonwastewater	None	NA

Chart 2
Evaporator Land disposal Information

Waste Code	Subcategory	Treatment Standard "mg/kg" unless noted by Technology Code	How the waste must be Managed
F001 F002 F003 F004 F005	Nonwastewater	1,1,1-Trichloroethane 6 Acetone 160 Methylyne Chloride 30 Methyl Isobutyl Ketone 33 Methyl Ethyl Ketone 36 o-Cresol 5.6 p-Cresol 5.6	A