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242-A Evaporator Quality Assurance Project Plan		ECN No. 704838

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ENGINEERING CHANGE NOTICE

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1. ECN № 704838

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. Date
Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersedure ☐ Cancel/Void ☐	Tank Farms Environmental Engineering B. J. Tucker, Tank Farms, R1-05, 372-2945	11/3/94

5. Project Title/No./Work Order No.	6. Bldg./Sys./Fac. No.	7. Approval Designator
242-A Evaporator Quality Assurance Project Plan	242-A	Q

8. Document Numbers Changed by this ECN (includes sheet no. and rev.)	9. Related ECN No(s).	10. Related PO No.
WHC-SD-WM-QAPP-009 Rev.0	N/A	N/A

11a. Modification Work	11b. Work Package No:	11c. Modification Work Completed	11d. Restored to Original Condition (Temp. or Standby ECNs only)
☐ Yes (fill out Blk. 11b) ☒ No (NA Blks. 11b, 11c, 11d)	N/A	N/A Cog. Engineer Signature & Date	N/A Cog. Engineer Signature & Date

12. Description of Change

Rev. 0 of the 242-A Evaporator Quality Assurance Project Plan has been replaced with Rev. 1. Rev. 1 provides QA/QC guidance for Sampling and Analysis of candidate feed tank waste and process condensate effluent in accordance with EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA, 1994, WHC-SD-WM-DQO-014, Rev. 0, 242-A Evaporator Liquid Effluent Retention Facility Data Quality Objectives, Von Bargen, 1994, and WHC-SD-WM-EV-060, Rev. 4, 242-A Evaporator Waste Analysis Plan, Basra and Mulkey, 1994.

13a. Justification (mark one)	13b. Justification Details
Criteria Change ☐ Design Improvement ☐ Environmental ☐ As-Found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐	The 242-A Evaporator Quality Assurance Project Plan has been revised to reflect the changes made by the 242-A Data Quality Objectives process and Revision 4 of the 242-A Evaporator Waste Analysis Plan.

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

See Distribution Sheet

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A-7900-013 (06/94)

NO 704838

ENGINEERING CHANGE NOTICE

JKB 11/4/94

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

15. Design Verification Required	16. Cost Impact		17. Schedule Impact (days)
	ENGINEERING	CONSTRUCTION	
☐ Yes	Additional ☐ $	Additional ☐ $	Improvement ☐
☒ No	Savings ☐ $	Savings ☐ $	Delay ☐

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

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

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

Document Number/Revision	Document Number/Revision	Document Number/Revision

20. Approvals

	Signature	Date
OPERATIONS AND ENGINEERING		
Cog. Eng.	Brian J. Tucker	11/3/94
Cog. Mgr.	R.D. Gustavson	11/4/94
QA	Amanda	11/3/94
Safety		
Environ.		11/4/94
Other	Brian VanBergen TSPE Engineering	11/3/94
PM&I		11/2/94

	Signature	Date
ARCHITECT-ENGINEER		
PE		
QA		
Safety		
Design		
Environ.		
Other		
DEPARTMENT OF ENERGY		
Signature or a Control Number that tracks the Approval Signature		
ADDITIONAL		

APPENDIX B

Unreviewed Safety Question Forms

Figure B-1. Unreviewed Safety Question - Changes Screening Form. (1 Sheet)

REFERENCE ITEM # ECN 704838
TITLE 242-A Evaporator Quality Assurance Project Plan, WHC-SD-WM-EV-009, Rev. 1

Does the referenced item:

A. Make PROPOSED CHANGES to the facility or procedures which differ from conditions described in the AUTHORIZATION BASIS documentation?

N/A____ NO x Yes/Maybe____

Basis: ECN 704838 does not make proposed changes to the facility or procedures which differ from conditions described in WHC-SD-WM-SAR-023, "242-A Evaporator/Crystallizer Safety Analysis Report", Rev. 1-B, or WHC-SD-W105-SAR-001, Final Safety Analysis Report 242-A Evaporator Liquid Effluent Retention Facility", Rev. 0-C. This ECN implements the Quality Assurance Project Plan which provides guidance necessary to meet QA/QC requirements for collection and analysis of proposed feed tank and process condensate samples. Implementation of this document has no effect on the accidents described in Table 9-1, "Summary of Radiological Consequences".

B. Make PROPOSED CHANGES that represent conditions that have not been analyzed in the AUTHORIZATION BASIS?

N/A____ NO x Yes/Maybe____

Basis: ECN 704838 does not make proposed changes that represent conditions that have not been analyzed in 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. This ECN implements the Quality Assurance Project Plan which provides guidance necessary to meet QA/QC requirements for collection and analysis of proposed feed tank and process condensate samples. Implementation of this document has no effect on the accidents described in Table 9-1, "Summary of Radiological Consequences".

C. Describe tests or experiments which differ from those described in the AUTHORIZATION BASIS documentation?

N/A____ NO x Yes/Maybe____

Basis: ECN 704838 does not describe any tests of experiments at all. This ECN implements the Quality Assurance Project Plan which provides guidance necessary to meet QA/QC requirements for collection and analysis of proposed feed tank and process condensate samples. Implementation of this document has no effect on the accidents described in Table 9-1, "Summary of Radiological Consequences".

D. Is a change in a TSR, OSR, or compliance plan to OSR involved?
N/A____ NO_x__ Yes/Maybe____
Basis: ECN 704838 does not change any TSR, OSR, or compliance plan to OSR as described in 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. This ECN implements the Quality Assurance Project Plan which provides guidance necessary to meet QA/QC requirements for collection and analysis of proposed feed tank and process condensate samples. Implementation of this document has no effect on the accidents described in Table 9-1, "Summary of Radiological Consequences".

USQE #1 Brian Von Bargen
Print Name
Signature
10/20/94
Date

USQE #2 Elvis Le
Print Name
Signature
10/24/94
Date

RELEASE AUTHORIZATION

Document Number:	WHC-SD-WM-QAPP-009, REV 1
Document Title:	242-A EVAPORATOR QUALITY ASSURANCE PROJECT PLAN
Release Date:	11/4/94

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 — November 4, 1994

JRE 11/4/94

SUPPORTING DOCUMENT

1. Total Pages 38 43

2. Title	3. Number	4. Rev No.
242-A EVAPORATOR QUALITY ASSURANCE PROJECT PLAN	WHC-SD-WM-QAPP-009	1

5. Key Words

242-A Evaporator, Double Shell Tank, Waste Analysis, Quality Assurance, Sampling, Characterization, Data Quality Objectives

KMB 11/4/94 APPROVED FOR PUBLIC RELEASE

6. Author

Name: B. J. Tucker

Brian J. Tucker
Signature

7C420/N1148
Organization/Charge Code

7. Abstract

This Quality Assurance Project Plan (QAPP) provides planning, implementation, and assessment guidance according to the requirements in EPA REQUIREMENTS FOR QUALITY ASSURANCE PROJECT PLANS FOR ENVIRONMENTAL DATA OPERATIONS, EPA QA/R-5, January 1994 for compliance and non-compliance analytes in the candidate feed and process condensate streams.

8. RELEASE STAMP

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DATE NOV 04 1994
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RECORD OF REVISION	(1) Document Number WHC-SD-WM-QAPP-009	Page 1

(2) Title
242-A EVAPORATOR QUALITY ASSURANCE PROJECT PLAN

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
Rev. 1 RS	(7) Replace Rev. 0 with Rev. 1 ECN-704838	BJ Tucker	R.D. Gustavson 11/4/94
0	EDT-158775 4/26/93		

WHC-SD-WM-QAPP-009
Revision 1

242-A EVAPORATOR
QUALITY ASSURANCE PROJECT PLAN

By

Brian J. Tucker
STONE & WEBSTER ENGINEERING CORPORATION

Tejpal S. Basra
WESTINGHOUSE HANFORD COMPANY

November 3, 1994

CONTENTS

LIST OF TABLES AND FIGURES

LIST OF ACRONYMS AND TERMS

ACL	Analytical Chemistry Laboratories
ALARA	As Low As Reasonably Achievable
DST	Double-Shell Tank
DQO	Data Quality Objective
EPA	U.S. Environmental Protection Agency
EQL	Estimated Quantitation Limit
ICP	Inductively Coupled Plasma
LCS	Laboratory Control Standard
MOU	Memorandum of Understanding
MS/MSD	Matrix Spike/Matrix Spike Duplicate
PMI	Program Management and Integration
POP	Plant Operating Procedure
Project	242-A Evaporator Project
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
RCRA	*Resource Conservation and Recovery Act*
RPD	Relative Percent Difference
SDLA	Sample Data Laboratory Administration
TCP	Tank Characterization Plan
TSPE	Treatment System Plant Engineering
TWRS	Tank Waste Remediation System
WHC	Westinghouse Hanford Company

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1.0 PROJECT MANAGEMENT

1.1 PROBLEM DEFINITION/BACKGROUND

The scope of this quality assurance project plan (Plan) is sampling and analytical services including, but not limited to, sample receipt, handling and storage, analytical measurements, submittal of data deliverables, archiving selected portions of samples, returning unneeded sample material to Westinghouse Hanford Company (WHC), and/or sample disposal associated with candidate feed samples and process condensate compliance samples. Sampling and shipping activities are also included within the scope. If tasks are added or deleted later, or if the laboratory makes operating changes or procedural modifications pertinent to this scope, the work authorization document (see paragraph 3 of Section 1.3) must be modified.

The purpose of this project is to provide planning, implementation, and assessment guidance for achieving established data quality objectives' (DQO)(Von Bargen 1994) measurement parameters. This Plan requires onsite and offsite laboratories to conform to that guidance. Laboratory conformance will help ensure that quality data are being generated and therefore, that the 242-A Evaporator is operating in a safe and compliant manner.

The 242-A Evaporator feed stream originates from double-shell tanks (DSTs) identified as candidate feed tanks. The 242-A Evaporator reduces the volume of aqueous waste contained in DSTs by boiling off water and sending it to the Liquid Effluent Retention Facility (LERF) storage basin before further treatment. The slurry product is returned to DSTs and must conform to waste acceptability criteria described in the latest revision of WHC-SD-WM-EV-053, *Double-Shell Tank Waste Analysis Plan.* Evaporation results in considerable savings by reducing the volume of mixed waste for disposal.

There are feed and effluent streams associated with the evaporation process that are sampled to verify that the facility can (for candidate feed) and is operating in a controlled, safe, and environmentally compliant manner. To achieve this, the DQO process in Von Bargen (1994) identified how to determine the numbers of samples that need to be taken from each stream, the parameters to be measured, and the data quality requirements such as precision, accuracy, and practical quantitation limits. The objective of this quality assurance project plan is to provide the planning, implementation, and assessment of sample collection and analysis, data issuance, and validation activities for the candidate feed and process condensate streams. Both environmental compliance, safety, and process control analytes for these two streams are included in this document. The RCRA compliance analytes are the same as those listed in Basra and Mulkey (1994). Quality assurance requirements for the following streams associated with this process are documented as follows:

- Feed, slurry, process condensate, steam condensate, and cooling water samples for process control purposes only - *242-A Evaporator Sample Schedule*, FSS-T-630-00001, Rev. B-4, September 9, 1994.

- Cooling water compliance samples - *Sampling and Analysis Plan* WHC-SD-WM-EV-078
- Steam condensate compliance samples - *Sampling and Analysis Plan* WHC-SD-WM-EV-079
- Vessel vent exhaust samples - guidance document is being written and will be issued prior to future sampling.

1.2 PROJECT/TASK ORGANIZATION

The data obtained from analysis of candidate feed, process condensate, and effluent streams are used by Treatment Systems Plant Engineering (TSPE) and 242-A Evaporator Operations to:

- Determine if tank waste should be processed
- Adjust process conditions
- Prevent exceeding effluent emission limits
- Improve the accuracy of process models and thus our understanding of the operation.

TSPE is responsible for approving all safety and process control data in candidate feed and process condensate streams. Along with Tank Farms Environmental Engineering, they approve all compliance data.

Process condensate compliance data is used by the Effluent Treatment Facility to ensure that the identity and levels of contaminants in the process condensate are within Effluent Treatment Facility design boundaries.

The project quality assurance (QA) manager in Tank Farms Environmental Engineering is responsible for evaluating all compliance sample data from Basra and Mulkey (1994) required analyses. Together with TSPE, Tank Farms Environmental Engineering approve and accept final products and deliverables relating to compliance streams. The QA manager is responsible for ensuring that this Plan is kept up-to-date by incorporating applicable changes in regulations, laboratory capabilities, and DQO developments annually. The QA manager interfaces with the laboratories and operations to ensure there is a mutual understanding of analytical capabilities and program needs. The manager also identifies problems in the sampling and analytical procedures, then works with TSPE and the laboratories to correct these problems. Procedures affected by changes to this Plan shall be updated.

Analytical Services is responsible for critically reviewing WHC sampling operation plans and procedures and ensuring adherence to laboratory program quality assurance/quality control (QA/QC) analysis requirements. The corresponding group of Pacific Northwest Laboratory's Analytical Chemistry Laboratories (ACL) is the Quality Operations and Standard Laboratory. (See more details in Section 2.1 of this Plan).

Program Management and Integration (PMI), a division of Analytical Services, is responsible for laboratory selection and the coordination and scheduling of the analytical services necessary to best meet the analytical requirements specified in Von Bargen (1994), Basra and Mulkey (1994), and this project plan. Sample Data and Laboratory Administration (SDLA), a division of PMI, is responsible for sample and data management and data validation. (See Section 1.3 of this Plan for more details).

Tank Farms Characterization Program receives waste tank data. They instruct the sampling groups and laboratories to collect and analyze tank samples based upon program needs. They keep records of data packages for possible future program needs.

Tank Farm Operations is responsible for all field activities in preparation, collection, packaging, and shipment of the samples. Compliance, Sampling and Support Operations is a division of Tank Farm Operations that handles all field responsibilities of sampling and shipping candidate feed tank samples. Sampling and Mobile Laboratories handles the process condensate sampling and shipping duties.

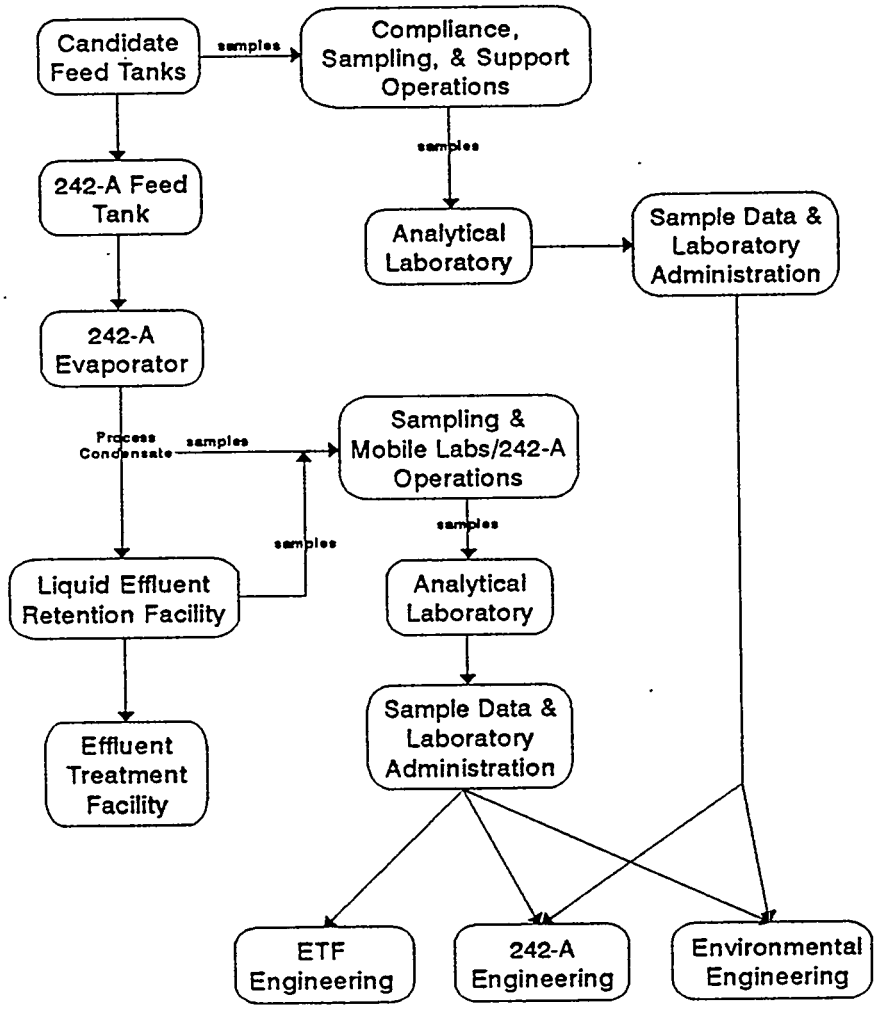
Assessment of laboratory performance is conducted internally by the laboratory or externally using a formal audit system by the Chemical Processing Quality Engineering and Environmental Quality Assurance groups (see Section 3.1 of this report).

Figure 1 is an organization chart displaying the interfaces among these groups regarding the generation and transfer of samples and data. A Memorandum of Understanding (MOU) (O'Rourke, 1994) clarified the interfaces among these groups in response to post start operational readiness evaluation finding number 15. Note that this figure only includes candidate feed and process condensate streams, the two streams within the scope of this Plan.

1.3 PROJECT/TASK DESCRIPTION

This Plan sets forth the instructions and specifications for QA/QC analyses of 242-A Evaporator candidate feed tank and process condensate samples which are taken to comply with requirements specified in the latest editions of Basra and Mulkey (1994) and Von Bargen (1994). Requirements specified in EPA (1994), and Section IIE, Quality Assurance/Quality Control of Butler (1994) and WHC (1993c) were used as the basis for these requirements.

Figure 1. Logic for Candidate Feed Tank Waste and Process Condensate Sample Collection, Analysis, and Validation.



PMI serves as the initial point of contact for all planning, scheduling, and contractual communications associated with the laboratory operations described in this Plan. Based on the needs of the Evaporator Program, sample characteristics, and laboratory availability, PMI determines whether analytical work shall be performed at onsite or offsite laboratories. Offsite laboratories can only analyze process condensate samples due to the high level of radioactivity of candidate feed samples. Onsite laboratories shall be given preference, andthe Office of Quality Assessment verifies that any laboratory is capable of fulfilling the quality assurance requirements stated in Von Bargen (1994), Basra and Mulkey (1994), and this Plan.

A work authorization document must be used as a contractual device to direct onsite laboratories (222-S and ACL) in the performance of analytical work for the Evaporator Program. For feed tank characterization, this document will consist of a tank characterization plan (TCP). For process condensate samples, a MOU will serve as the work authorization document. TSPE shall prepare all MOUs. A MOU or TCP shall include the work scope (i.e., number of samples, field blanks, sampling locations, expected date of arrival at the laboratory, etc.), QA/QC reference document(s), and reporting and deliverable requirements including dates, approval designators (see Section 12.7 of WHC-CM-3-5), and funding sources. The MOU shall be signed by the laboratory(s), PMI, TSPE, amd QA.

If offsite laboratories are selected for process condensate samples, existing administrative procedures and current contracts will be utilized to direct the analytical work. Any modifications to purchase orders with offsite laboratories which are necessary to meet Evaporator Program QA/QC requirements outlined in this Plan will be made by SDLA prior to sample shipment. Sampling and shipping shall be directed by work packages or process memos.

Any deviations from this Plan shall be evaluated and formally documented by letter or internal memorandum by PMI as part of its determination of the laboratories ability to provide satisfactory service.

According to the *Hanford Federal Facility and Consent Order*, (Ecology et al. 1990), Section 9.6.6, Data Delivery Schedules:

> "Laboratory analysis and QA documentation, including validation and transmittal to the regulators, shall be limited to the following schedule:
> Transuranics and hot cell samples, 136 days annual average, not to exceed 176 days;
> Low level and mixed waste (up to 10 mR/hr), 111 days annual average, not to exceed 126 days."

Additional details on the content of the validated data package is provided in Section 1.4 of this Plan.

1.4 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

1.4.1 Uses of the Data

Data and statistical parameters calculated from the data will be used by several groups:

The cognizant process engineer of TSPE uses the candidate feed tank data to statistically determine if analyte concentrations within the process waste are expected to exceed action levels. The results of this determination are documented in a process control plan issued prior to each campaign. TSPE directs 242-A Operations on operating strategies that may be required based upon candidate feed tank waste analyses.

Tank Farms Operations uses the data as an aid for establishing operating parameters to run the plant safely and compliantly.

Tank Farms Environmental Engineering uses the data to determine or predict whether or not the plant is in or will be in compliance.

Statisticians of Analytical Services use the data to update composite power curves and generate new individual power curves for critical analytes within the two streams of interest. Power curves are a tool utilized within the DQO planning process to determine the correct number of samples to collect.

The LERF program can use the data to assess the impact, if any, that process condensate analytes will have on basin liner structural integrity, and to assure safety requirements are met.

Finally, the Effluent Treatment Facility may use the data to evaluate its ability to treat the process condensate.

1.4.2 Measurement Performance Criteria

Continuation of the 242-A Evaporator waste processing is contingent in part upon the ability of the analytical support laboratories and sampling organizations to show internal and external auditors and reviewers that the quality of their work is sufficient to support process control, safety, and compliance decisions (see Section 3.1 for more details). Several criteria are used to measure performance including precision, accuracy, detection limits, representativeness, and comparability.

Precision and accuracy are quantitatively expressed using the definitions given in Section 7.7.2 of Von Bargen (1994) and, for analytes that are not spiked, the relative percent difference (RPD) of duplicate samples. Precision encompasses the variabilities associated with sample collection, preparation, and analysis, including representativeness of collected

samples and subsample aliquots, completeness of sample digestion or extraction, losses during digestion, extraction, and/or transfers, errors in sample or reagent weights and volumes, and instrument response fluctuation. The ability to meet precision criteria will depend in part on the concentration level of the analyte and the heterogeneity of the samples. Accuracy is also defined in Von Bargen (1994) and is a measure of the closeness of the measurement to the true value. The variabilities that characterize precision can also cause inaccurate measurements. However, matrix effects such as interferences can potentially cause large inaccuracies without adversely affecting precision.
Representativeness of candidate feed samples is determined by the sampling design through the use of appropriate subsampling and mixing methods and the use of consistent analytical methods. The sampling design and sampling processes have been reviewed for variability in the tank.

The assumption built in to the power curve construction is that the relative standard deviation of past results is greater than the relative standard deviation of the results that will be obtained from the upcoming campaign sample results. To increase the probability that this will occur, the largest relative standard deviation of past tank results is selected.

The Sample Exchange Evaluation program compares data generated by the 222-S, ACL, and Idaho National Engineering laboratories on identical waste samples. It promotes consistency in sample preparation and analysis procedures by:

- Identifying significant differences and,
- Ensuring that the best procedures are utilized.

Additional details on comparability are provided in Section 3.8 of Moss (1993), Section 10.1.3 of Meznarich (1994), and Section 14.4 and Appendix C of Kuhl-Klinger (1994).

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2.0 MEASUREMENT/DATA ACQUISITION

2.1 SAMPLING PROCESS DESIGN

Prior to an upcoming evaporator operational campaign, candidate feed samples are collected from candidate feed tanks to assess the ability to process waste. During a campaign, process condensate grab samples are collected to evaluate modeling predictions and verify compliance with LERF regulatory limits as established in Basra and Mulkey (1994). Flow proportional or composite process condensate samples can be collected also, if required.

The strategy for determining the number of samples and sample locations for candidate feed tanks is described in Section 5.2, Figure 5-1, and Table 5-1 of Basra and Mulkey (1994), and in Section 7.1 of Von Bargen (1994). Section 6.2 and Figure 6-1 of Basra and Mulkey (1994) and Section 7.2 in Von Bargen (1994) contain similar information (except for sample location) for process condensate. TSPE uses this strategy and tank liquid levels to specify the number of samples and their locations. For a given number of candidate feed samples, sample locations are chosen to provide the most representative sampling for that tank. The number and location of samples will be specified within the work authorization document for each candidate feed tank and for process condensate. Because of the relatively "clean" or benign nature of the process condensate matrix, sampling shall meet EPA (1992) (SW-846) requirements, provided the radioactivity level is sufficiently low that special sample handling is not necessary. If the variability of the samples results does not provide adequate confidence in the decision process, additional samples may have to be collected.

The laboratory coordinator shall assist TSPE, using the Sampling Authorization Form, in the selection of sample handling techniques, sample containers, and sample preservation. Feed tank sampling frequency will be dictated by the 242-A program office consistent with the laboratories' workloads. Process condensate sampling frequency will be determined by the number of samples required by the DQO and campaign duration. Typically, sample collection times for process condensate are equally spaced across the campaign.

2.2 SAMPLE COLLECTION

Environmentally acceptable and compatible bottles that have been certified must be used (Fisher Scientific, 1994). All sample bottles (including blanks) for volatile organics have an open top with a volatile organics free septum. In addition, sample bottles for process condensate are filled so that there is zero headspace. Candidate feed sample bottles for volatile organics cannot be filled with zero headspace due to As Low As Reasonably Achievable (ALARA) concerns.

2.2.1 Candidate Feed Tanks

For each campaign of the 242-A Evaporator, DSTs are selected based on the 242-A Evaporator's ability to process the waste, tank space needs, and program requirements. Samples are to be taken by Compliance Sampling and Support Operations in accordance with the latest revision of Plant Operating Procedure (POP) TO-080-065, *Supernatant or Sludge Sampling of Non-Aging, Non-Watchlist Waste Storage Tanks* (WHC 1994a). It includes safety precautions such as avoiding the area directly above the tank riser, sampling steps, chain-of-custody requirements, how to fill out sample identification forms, sample pickup, and weather conditions under which sampling shall not be conducted. Additional information on documentation, labelling, and sample custody can be found in the Sample Handling and Custody Requirements section. No quality control (QC) verifications are required by this procedure. There are three QC witness points (see WHC CM-4-2) where the QA manager may elect to witness the activity.

- When sample bottle serial number is confirmed to match serial number on Attachment 1 - Sampling Data Sheet (Step 5.3.5)
- When sample is taken at the correct tank depth (Step 5.3.7)
- When sample is placed in correct sample pig (Step 5.3.26)

The POP must be in place before the sampling event. A sampling event is defined as all samples collected from a single tank. Laboratories and sampling organizations shall strive to meet SW-846 holding times. However, adherence to SW-846 holding times is not strictly required if documented cases show that additional time was required to ship, process, and analyze radioactive samples (Morant, 1994). All waste is grab sampled ("bottle-on-a-string") with a sample bottle inserted in the sample bottle holder assembly (see Figure 1 of TO-080-065). At all subsurface sampling locations, four 100 milliliter (mL) nominal dark glass bottles are drawn: two for organics (one for semivolatiles, one for volatiles), one for the boildown and mixing study, and one for inorganics and radionuclides analyses. Samples from one sampling location are used for QC checks (matrix spike (MS) and matrix spike duplicate (MSD)). Duplicate samples are not collected because for most analytes, MS/MSDs are analyzed. The MS/MSDs will provide precision information for analytical testing and possibly for sampling. The latter can only be determined if analytes are present that have analytical uncertainty that is not too large a percentage of the overall uncertainty. MS and MSDs are used when contaminants may not be present and spiking samples with them allows an assessment of the precision. One grab sample is collected from the surface layer of the tank at one of the designated sampling locations to check for the presence of a floating organic layer.

For each tank sampled, three field blanks and two trip blanks are collected. Both are prepared in a manner that simulates the sampling process as closely as possible except that a sample is not actually collected. A field blank provides an indication of contamination from sample collection, transport, preparation or extraction, and analysis. A trip blank is similar

to a field blank except it is not subjected to the sample collection process and is not opened in the field. Typically, it is expected that one set of blanks will be collected per sampling event. If sampling event duration exceeds four days, the program will consider collecting additional blanks.

Two field blanks are taken for organic analysis (two 100 mL bottles, one for semivolatiles, one for volatiles), and one for inorganic/radionuclide analysis (200 mLs total), and the bottles are so marked. Field blank bottles are filled with reagent grade water at the laboratory prior to shipment to the sampling site. Similar to an actual sample, four bottles from the same batch of bottles used for tank waste samples are employed. Each one is installed in the sample holder, then the bottle screw cap is removed and a rubber stopper (part of the sample holder assembly) is inserted. The field blank bottle is lowered approximately one foot into the riser, then the rubber stopper is pulled out, and the assembly is taken out of the riser. The bottle cap is then screwed on.

Two trip blanks are employed, one for volatile organics, the other for semivolatile organics and they are so marked. There is no inorganic/radchem trip blank due to the extremely low probability of inorganic contamination in a trip blank. Trip blank bottles are filled with reagent grade water at the laboratory prior to shipment to the sampling site.

Decontamination instructions are included in **TO-080-065**. A new certified sample bottle and sample holder assembly is employed for each sample collected to avoid cross contamination. After the sample is collected and the bottle capped, the bottle and holder are lowered again into the vapor space and rinsed with deionized water. It is then lifted out and wiped off.

2.2.2 Process Condensate Samples

Process condensate samples are taken in the condenser room at a point just prior to discharge to LERF by 242-A Evaporator Operations and Sampling and Mobile Laboratories (S&ML), in accordance with the latest revisions of POP TO-630-080, *Sample 242-A Ion Exchange Effluent and Flush RC-3 Receiver Carboy and RC-3 Monitoring Pig*, or TO-630-010, *Operate Process Condensate Refrigerated Composite Sampler*, in conjunction with EPA (1982). These procedures require creation of a sample identification record and adherence to chain-of-custody protocol, and describe safety precautions and sampling steps. No QC verifications are required by these procedures. Procedures must be issued before the sampling event. A sampling event for this stream is defined as all sampling during a single campaign.

Each "sample" actually consists of several bottles of condensate, each analyzed for a specific class of chemical compounds or tested for some physical property. Process condensate grab samples are collected at the 242-A Evaporator at a location upstream of the 242-A Evaporator discharge valve that controls process condensate flow to the LERF.

One sample per campaign is spiked for running QC checks. As with candidate feed samples, spiking is not performed until the samples are received by the laboratory and duplicate samples are not collected.

For each process condensate sampling event, three field blanks (one each for volatiles, semivolatiles, and inorganics/radionuclides) and two trip blanks (one for volatiles and one for semivolatiles) are prepared using the same bottle type and size as those used for sampling (see Table 1). The field blanks shall be collected by first rinsing the sampling port and associated sampling equipment with reagent grade water for a few minutes then sampling the reagent grade water.

A new certified clean sample bottle is employed for each sample collected to avoid cross contamination. The sampling assembly is purged with the sample medium for approximately three minutes prior to sampling.

2.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

2.3.1 Candidate feed tanks

Candidate feed tank samples are not preserved (including cooled) because of the additional exposure which might result. It is not practical to cool the bulky sample pigs and shipping containers. Biological activity, which is generally the largest problem in environmental samples, is unlikely due to the high salt content, extreme pH and/or high radioactivity of these tank waste samples. Chemical changes are typically low because of the low organic concentrations.

Candidate feed tank samples are loaded into sample pigs or casks and transported to an onsite laboratory according to the latest revisions of TO-080-075, *Perform Transport of CSSO Samples in the Sample Truck* (WHC 1994c) or TO-080-090, *Load/Transport the Onsite Transfer Cask* (WHC 1994b). The forms and work sheets that are filled out by the Person in Charge, including the chain of custody form, are described in TO-080-065. The exact locations of sample collection are recorded on the Sampling Information Work Sheet. Samples are identified by a unique shipping number or sample number which is written on the shipping tag. Sample labels and/or sample tags must be filled out at the time of sampling and affixed securely to each sample bottle. The labels and tags identify the sample number, collector's signature, date and time of collection, location of sampling point, and sample chain-of-custody procedures to be followed to track and document sample collection, shipment, and laboratory processing.

Upon arriving at the laboratory, pigs are logged and surveyed for radiological control. The sample logging information and any additional observations are recorded on the pigs and the chain of custody form, then placed into a holding area for storage before removal of the sample. Tank Farm Operations decontamination procedures for sample pigs and casks are

contained in the latest revisions of TO-080-075 and TO-080-090. Additional details on receipt and handling of samples by the laboratories is provided in Section 5.0 of Moss (1993) and Section 6.0 of Kuhl-Klinger (1994). Actual sample volumes may vary due to the manner in which samples are collected. There is often just enough volume to perform the required tests, leaving little room for error. If excess sample is available from one sample bottle, following removal of sample for the analyses that are designated to be performed from that sample bottle, it may be used to provide additional material for testing other analytes. Interchangeability is permissible only for samples from the same group of four sample bottles.

2.3.2 Process Condensate

In adherence to EPA (1992)(SW-846, Tables 2-21 and 4-1 of Revision 1, Volume 1A), proper preservation and holding times will be utilized as outlined in Table 1. Process condensate samples are typically preserved by addition of acid and/or cooling on ice. Preservatives are added by Sampling & Mobile Laboratories. Sampling & Mobile Laboratories also measure the pH of the condensate immediately after sample collection. Information pertinent to sampling (such as date, time, sample number and type, etc.) is recorded. Sampling and Mobile Laboratories documentation consist of a controlled field logbook, shipment records, chain of custody form, and sample request form. After samples are logged, they are checked for radioactivity then shipped on ice to comply with EPA (1992) transport requirements and WHC-CM-2-14, *Hazardous Material Packaging and Shipping*. This reduces losses of volatile organics and protects them from biological degradation. Upon arrival of samples in the laboratory, the sample custodian shall check for the presence of leakage, breakage, intact custody seals, and that the samples were shipped on ice. If not, the custodian will note the deviation and the data will be flagged. Small deviations in temperature are not expected to cause degradation of the analytes of concern. Sample(s) will be rejected by offsite laboratories if a surface survey of the sample container shows the sample to be above the allowed radioactivity maximum of 10 mrem/hr. Otherwise, the Sample Custodian shall fill out the chain of custody form in the same manner as for candidate feed tanks samples. Samples shall be maintained in the laboratory at refrigerator temperature (approximately 4°C) until disposal or termination of the project, whichever comes first. Additional details on receipt and handling of samples by the laboratories is provided in Section 5.0 of Moss (1993) and Section 6.0 of Kuhl-Klinger (1994).

2.4 ANALYTICAL METHODS REQUIREMENTS

The performance based extraction and analytical methods are listed in Table 7.3 of Von Bargen (1994) and Tables 2 through 5 of this Plan. Onsite and offsite laboratories, invoked by work authorizations or MOUs, are required to maintain written procedures using these methods for detecting the applicable analytes. In cases where a procedure needs to be modified to attain a lower detection limit or because of low percent recoveries or high

relative percent differences in QC samples, the procedure may be modified to make QC parameters acceptable. These changes will be documented in the case narrative and approved internally by the laboratory and project management. Additional approval is required by Tank Farms Environmental Engineering if the procedure modifications conflict with the methods specified in the latest edition of the 242-A Evaporator Waste Analysis Plan.

Section 5.4 of Basra and Mulkey (1994), Analytical Methods and QA/QC, explains why deviations from SW-846 protocol may be necessary due to the unique nature of candidate feed tank waste. Process condensate samples will be expected to follow SW-846 or equivalent protocol for compliance analytes. If there is a problem in the analytical system, the laboratory employee who recognizes the problem is responsible for initiating appropriate

Table 1. Process Condensate Stream - Sampling containers/volume, holding times, and preservation methods.

Parameter/ analysis	Container[1]/ volume	Preservation	Holding time
Ammonia	P/G 800 mL	H_2SO_4 to pH < 2 cool 4°C	28 Days
Volatile organics - - 1-butanol - 2-butoxyethanol - 2-butanone - acetone - 2-hexanone - methyl isobutyl ketone - 2-pentanone - tetrahydrofuran	Gs* 2 X 40mLs	HCl to pH < 2 Cool 4°C	14 days
Semi-volatile organics - Tributyl phosphate	aG 1000 mLs	Cool 4°C	7 days[2]
TC	aGs 200 mL	Cool 4°C	28 Days
TIC	G 400mL	Cool 4°C	28 days
pH	G/P 100 mL	Cool 4°C	Analyzed immediately
Total Alpha Total Beta	G/P 2x1000 mL	HNO_3 to pH < 2	6 Months
^{14}C, ^{90}Sr, ^{3}H, ^{129}I, ^{99}Tc, and ^{79}Se	G/P 1000 mL	Cool 4°C	6 Months
^{60}Co, ^{94}Nb, ^{106}Ru, ^{134}Cs, ^{137}Cs, ^{144}Ce, ^{154}Eu, ^{155}Eu, ^{226}Ra, ^{237}Np, ^{238}Pu, $^{239/240}Pu$, ^{241}Pu, ^{241}Am, ^{244}Cm, U_{gross}	G/P 2X1000 mL	HNO_3 to pH < 2	6 Months

[1]Container Types:
P = Plastic (Polyethylene)
G = Glass
aG = Amber Glass
aGs = Amber Glass w/septum cap
Gs = Glass w/septum cap
Gs* = Glass w/septum cap; bottle is filled so there is no head space in container

[2]7 Days for Extraction, 40 Days for Analysis

Table 2. Quality Assurance Objectives for Candidate Feed Tank Stream Compliance Analytes.

Analytical category	Analyte of interest	Technology-based analytical methods	Estimated quantitation limit (matrix specific)	Precision (RPD between duplicate spikes), %	Accuracy (% recovery of matrix spike)	Action level[1]
Organics[2]	Acetone	Purge and trap and GC/MS or GC/FID (VOA)	28 mg/L	<25	40-110	>87 mg/L[3]
	1-butanol	Purge and trap GC/MS or GC/FID (semi-VOA or VOA)	20 mg/L	<25	30-110	>226 mg/L[3]
	1-butoxyethanol	Purge and trap GC/MS or GC/FID (semi-VOA or VOA)	30 mg/L	<25	30-110	>95.2 mg/L[3]
	2-butanone (methyl ethyl ketone)	Purge and trap GC/MS or GC/FID (semi-VOA or VOA)	18 mg/L	<25	40-110	>58 mg/L[3]
	2-hexanone	Purge and trap GC/MS or GC/FID (semi-VOA or VOA)	18 mg/L	<25	40-110	No specific limit
	methyl isobutyl ketone (MIBK)	Purge and trap GC/MS or GC/FID (semi-VOA or VOA)	20 mg/L	<25	40-110	No specific limit
	2-pentanone	Purge and trap GC/MS or GC/FID (semi-VOA or VOA)	24 mg/L	<25	40-110	No specific limit
	Tetrahydrofuran (THF)	Purge and trap GC/MS or GC/FID (semi-VOA or VOA)	20 mg/L	<25	30-110	No specific limit
	Tributyl phosphate (TBP)	Solvent Extraction GC/MS (Semi-VOA)	50 mg/L	<25	40-110	>1.015E+4 mg/L[3]
	Ammonia (NH_3)	Kjeldahl distillation/autotitration ion selective electrode	400 µg/ml	<20	75-125	>0.29 Molar (5,000 mg/L)
Other	Exotherm	Differential scanning calorimeter	none	<20[4]	NA	<335 °F absolute value of ratio of exotherm to endotherm >1
	Mixing and compatibility study	Lab specific	NA	NA	NA	Visual: unusual changes in color, temperature, clarity, etc.
	TOC	TIC/TOC analyzer w/coulometric near IR detectors	100 ug/mL	<20	75-125	No specific limit; required for modeling and organic phase check
	TIC	TIC/TOC analyzer w/coulometric near IR detectors	25 ug/mL	<20	75-125	TC - TIC (=TOC) >87 ppm required for modeling
	TC	TIC/TOC analyzer w/coulometric near IR detectors	25 ug/mL	<20	75-125	TC - TIC (=TOC) >87 ppm

1. In deriving the action levels, the ratio of feed flowrate to slurry flowrate (R) is assumed to be 2.
2. Methods technology shall be based on EPA 1992 (SW-846).
3. For individual organic species limits in the candidate feed tanks, the sum of the fractions rule applies (see Table 4A.1 of Von Bargen (1994).
4. Precision is evaluated on the deviation between a sample (unspiked) and sample replicate.

Table 3. Quality Assurance Objectives for Process Condensate Stream Compliance Analytes.

Analytical category	Analyte of interest	Technology-based analytical methods	Estimated quantitation limit (matrix specific)	Precision (RPD between duplicate spikes), %	Accuracy (% rec. of matrix spike)	Action level
Organics[1]	Acetone	Purge and trap, GC/MS or GC/FID, VOA	28 mg/L	<25	40-110	200,000 mg/L[2]
	1-butanol	Purge and trap GC/MS or GC/FID, semi-VOA or VOA	20 mg/L	<25	30-110	500,000 mg/L[2]
	2-butoxyethanol	Purge and trap GC/MS or GC/FID, semi-VOA or VOA	30 mg/L	<25	30-110	2,000 mg/L[2]
	2-butanone (methyl ethyl ketone)	Purge and trap GC/MS or GC/FID, semi-VOA or VOA	18 mg/L	<25	40-110	200,000 mg/L[2]
	Tributyl phosphate (TBP)	Solvent extraction GC/MS as semi-VOA	50 mg/L	<25	40-110	2000 mg/L[2]
	2-hexanone	Purge and trap GC/MS or GC/FID (semi-VOA or VOA)	18 mg/L	<25	40-110	200,000 mg/L[2]
	Methyl isobutyl ketone (MIBK)	Purge and trap GC/MS or GC/FID (semi-VOA or VOA)	20 mg/L	<25	40-110	200,000 mg/L[2]
	2-pentanone	Purge and trap GC/MS or GC/FID (semi-VOA or VOA)	24 mg/L	<25	40-110	200,000 mg/L[2]
	Tetrahydrofuran (THF)	Purge and trap GC/MS or GC/FID (semi-VOA or VOA)	20 mg/L	<25	30-110	2,000 mg/L[2]
	Ammonia (NH_3)	Kjeldahl distillation/autotitration ion selective electrode	400 µg/ml	<20	75-125	> 0.58M (10,000 mg/L)
	Total carbon (TC)	TIC/TOC analyzer w/ coulometric near IR detectors	25 ug/mL	<20	75-125	TC - TIC > 1240 ppm
	Total inorganic carbon (TIC)	TIC/TOC analyzer w/ coulometric near IR detectors	25 ug/mL	<20	75-125	TC - TIC > 1240 ppm
	pH	pH meter	NA	0.1 pH unit	Not available	pH < 2, pH > 12.5

1. Methods technology shall be based on EPA 1992 (SW-846).
2. Limits for LERF liner compatibility were taken from Table 4-3 of 242-A DQO document (WHC-SD-WM-DQO-014, Rev.0, Von Bargen 1994) They are applied using the sum of the fraction technique (WAP, Table 4-3).

Table 4. Quality Assurance Objectives for Evaporator's Candidate Feed Tank Stream Noncompliance Analytes

Analytical category	Analyte of interest	Technology-based analytical methods[a]	Practical quantitation limit (matrix specific)	Precision (RPD between duplicate spikes), %	Accuracy (% rec. of matrix spike)	Action level
Inorganics	Aluminum (Al)	ICP/OES	25μg/L	< 20	75 - 125	No specific limit
	Sodium (Na)	ICP/OES	20μg/L	< 20	75 - 125	>8.0 M (Na_3PO_4 limit)
Ions/anions	Fluoride (F^-)	IC/conductivity or ISE	1μg/mL	< 20	75 - 125	No specific limit
	Hydroxide (OH^-)[b]	Titration	250μg/mL	< 20	N/A	[OH] < 0.01 M, [OH] > 5.0 M
	Phosphate (PO_4^{3-})	IC/conductivity	10μg/mL	< 20	75 - 125	>0.1 M (Na_3PO_4 Limit)
	Sulfate (SO_4^{2-})	IC/conductivity	10μg/mL	< 20	75 - 125	No specific limit
	Nitrate (NO_3^-)	IC/conductivity	10μg/mL	< 25	75 - 125	[NO_2] < 0.011 M, [NO_2] > 5.5 M
	Nitrite (NO_2^-)	IC/Conductivity	10μg/mL	< 20	75 - 125	[NO_3] > 5.5 M
	TOC of surface sample	Combustion/ coulometric autotitration	100 ug/mL	< 20	75 - 125	> 2600 mg/L
Radionuclides	Total beta (β)	Proportional counter	4E-3 μCi/mL	< 20%	70 - 130	NA
	^{241}Am	Ion exchange/ Solvent extraction/ AEA	2E-3 μCi/mL	< 20%	70 - 130	> 1.0 μCi/mL
	^{134}Cs	GEA	3E-4 μCi/mL	< 20%[c]	N/A	> 15 μCi/mL
	^{137}Cs	GEA	4E-4 μCi/mL	< 20%[c]	N/A	> 1500 μCi/mL
	$^{239/240}Pu$[b]	Ion exchange/ solvent extraction/ AEA	1E-3 μCi/mL	< 20%	70 - 130	RST: >0.16 μCi/mL criticality: Pu-239/240 + 1.077E-10 X (U-gross) > 0.0026 g/l
	^{238}Pu[b]	Calculated or ion exchange/ solvent extraction/ AEA	2E-3 μCi/mL	< 25%	NA	>1.3 E-3 μCi/mL
	^{241}Pu	Calculated no procedure	N/A	--	N/A	>15 μCi/mL
	^{106}Ru	GEA	3E-3 μCi/mL	< 25%[c]	N/A	> 53 μCi/mL
	^{3}H	Lachat distillation/ liquid scintillations	2E-5 μCi/mL	< 25%	70 - 130	PC-RST
	^{14}C	Persulfate oxide/liquid scintillation	1E-5 μCi/mL	< 25%	70 - 130	> 0.26 μCi/mL
	^{60}Co	GEA	2E-4 μCi/mL	< 25%[c]	N/A	> 1.2 μCi/mL
	^{79}Se	Anion-cation exchange/ distillation/liquid scintillation	3E-5 μCi/mL	< 25%[c]	N/A	> 7.8E-2 μCi/mL

Table 4. Quality Assurance Objectives for Evaporator's Candidate Feed Tank Stream Noncompliance Analytes

Analytical category	Analyte of interest	Technology-based analytical methods[a]	Practical quantitation limit (matrix specific)	Precision (RPD between duplicate spikes), %	Accuracy (% rec. of matrix spike)	Action level
Radionuclides	^{90}Sr	Separation/beta count-proportional counter	8E-5 μCi/mL	< 20%	75 - 125	> 220 μCi/mL
	^{94}Nb	GEA	2E-4 μCi/mL	< 25%[c]	N/A	> 9.8E-2 μCi/mL
	^{99}Tc	Solvent extraction/liquid scintillation or ion exchange/ beta proportional counting	2E-4 μCi/mL	< 20%	75 - 125	> 2.0 μCi/mL
	^{129}I[b]	Extraction/ precipitation/ GEA	2E-4 μCi/mL	< 20%	75 - 125	> 2.6E-3 μCi/mL
	^{144}Ce	GEA	1E-3 μCi/mL	< 25%[c]	N/A	PC RST
	^{154}Eu	GEA	5E-4 μCi/mL	< 25%[c]	N/A	> 5.0 μCi/mL
	^{155}Eu	GEA	5E-4 μCi/mL	< 25%[c]	N/A	> 7.0 μCi/mL
	^{226}Ra[b]	Calculated or GEA	3E-3 μCi/mL	< 25%[b]	N/A	> 3.3E-2 μCi/mL
	^{237}Np	Extraction/alpha count-proportional counter	2E-4 μCi/mL	< 20%	75 - 125	PC RST
	$^{238}U_{gross}$	Laser fluorimeter or laser induced kinetic phosphorescence	1E-1 μg/mL	< 20%	70 - 130	Criticality: Pu-239/240 + 1.077E-10 X (U-gross): > 0.0026 g/l
	^{244}Cm[b]	Ion exchange/ solvent extraction/ AEA	2E-3 μCi/mL	< 20%[c]	N/A	> 1.3E-2 μCi/mL
	Total alpha (AT)	Proportional counter	2E-5 μCi/mL	< 20%[c]	70 - 130	Transuranics: AT > 100 nCi/g
	Specific gravity	Lab specific	NA	NA	NA	SpG > 1.41
	Appearance	Lab specific	NA	NA	NA	NA
	Boildown study	Lab specific	NA	NA	NA	Visual: unusual changes in color, temperature, clarity, etc.

a. Methods technology shall be based on *Test Methods for Evaluating Solid Waste (SW 846)* (EPA 1986).
b. These analytes have practical quantitation limits that may pose a problem because they are close to, or exceed the action level. See Section 2.5 of this Plan for more details.
c. Precision is evaluated on the deviation between a sample (unspiked) and sample replicate.

Table 5. Quality Assurance Objectives for Evaporator Process Condensate Stream Noncompliance Analytes[a]

Analytical category	Analyte of interest	Technology-based analytical methods[b]	Estimated quantitation limit (matrix specific)	Precision (RPD between duplicate spikes)	Accuracy (% rec. of matrix spike)
Radionuclides	Total beta (β)	Proportional counter	4E-4 μCi/mL	< 20%	70 - 130
	^{241}Am	Ion exchange/ solvent extraction/ AEA	5E-4 μCi/mL	< 20%	70 - 130
	^{134}Cs	GEA	2E-4 μCi/mL	< 20%	N/A
	^{137}Cs	GEA	3E-4 μCi/mL	< 20%	N/A
	$^{239/240}$Pu	Ion exchange/ solvent extraction/ AEA	8E-5 μCi/mL	< 20%	70 - 130
	^{238}Pu	Calculated or ion exchange/ solvent extraction/ AEA	3E-4 μCi/mL	< 25%	NA
	^{241}Pu	Calculated no procedure	N/A	--	N/A
	^{106}Ru	GEA	3E-4 μCi/mL	< 25%[c]	N/A
	^{3}H	Distillation/ liquid scintillations	5E-5 μCi/mL	< 25%	70 - 130
	^{14}C	Persulfate oxidation/liquid scintillation	1E-4 μCi/mL	< 25%	70 - 130
	^{60}Co	GEA	2E-4 μCi/mL	< 25%[c]	N/A

Table 5. Quality Assurance Objectives for Evaporator Process Condensate Stream Noncompliance Analytes[a]

Analytical category	Analyte of interest	Technology-based analytical methods[b]	Estimated quantitation limit (matrix specific)	Precision (RPD between duplicate spikes)	Accuracy (% rec. of matrix spike)
	^{79}Se	Anion-cation exchange/ distillation/liquid scintillation	2E-6 μCi/mL	< 25%[c]	N/A
	^{90}Sr	Separation/ beta count-proportional counter	2E-6 μCi/mL	< 20%	75 - 125
	^{94}Nb	GEA	2E-4 μCi/mL	< 25%[c]	N/A
	^{99}Tc	Solvent extraction/ liquid scintillation	2E-5 μCi/mL	< 20%	75 - 125
	^{129}I	Extraction/ precipitation/ GEA	8E-4 μCi/mL	< 20%	75 - 125
	^{144}Ce	GEA	2E-3 μCi/mL	< 25%[c]	N/A
	^{154}Eu	GEA	5E-4 μCi/mL	< 25%[c]	N/A
	^{155}Eu	GEA	4E-4 μCi/mL	< 25%[c]	N/A
	^{226}Ra	Calculated or GEA	3E-3 μCi/mL	< 25%[c]	N/A
	^{237}Np	Extraction/ alpha count-proportional counter	5E-4 μCi/mL	< 20%	75 - 125
	U_{gross}	Laser fluorimeter or laser induced kinetic phosphorescence	1E-3 μg/mL	< 20%	70 - 130
	^{244}Cm	Ion exchange/ solvent extraction/ AEA	5E-4 μCi/mL	< 20%[c]	N/A
	Total alpha (AT)	Proportional counter	2E-6 μCi/mL	< 20%[c]	70 -130

a. See Table 3A.2 in Von Bargen (1994) for derived concentration guide (DCG) values used with the unity rule to determine the action level
b. Methods technology shall be based on EPA 1992 (SW-846).
c. Precision is evaluated on the deviation between a sample (unspiked) and sample replicate.

Table 6. QC Samples and Acceptance Limits for Candidate Feed Tank and Process Condensate Stream sample analysis.

Analysis	[1]Matrix spikes (MS)	[2]Matrix spike duplicate (MSD)	[3]Prep. blank or method blank	[6]Calib. check (spiked blank)
Organics: acetone 1-butanol 2-butoxyethanol 2-butanone tributylphosphate 2-hexanone methyl isobutyl ketone 2-pentanone tetrahydrofuran	1/SE % rec. 75-125	1/SE RPD ≤ 20	1/batch	1/batch
ICP (Al and Na)	1/SE % rec. 75-125	1/SE RPD ≤ 20	1/batch	1/batch
Total U (U-gross) (by Fluor.)	1/SE % rec. 75-125	1/SE RPD ≤ 20	1/batch	1/batch
Ion Chrom. Anions (F,NO_2,NO_3,SO_4, PO_4)	1/SE % rec. 75-125	1/SE RPD ≤ 20	1/batch	1/batch except F; F % rec. 70-110
pH	N/R	1 sample dup/SE difference < 0.2 pH units duplicate not MSD	N/R	1/batch % rec. 90-110
OH	N/R	1 sample dup/SE RPD ≤ 20 duplicate not MSD	1/batch	1/batch
NH_3	1/SE % rec. 75-125	1/SE RPD ≤ 20	1/batch	1/batch

Table 6. QC Samples and Acceptance Limits for Candidate Feed Tank and Process Condensate Stream sample analysis.

Analysis	[1]Matrix spikes (MS)	[2]Matrix spike duplicate (MSD)	[3]Prep. blank or method blank	[6]Calib. check (spiked blank)
DSC	[4]N/R	[5]1 sample dup/SE RPD ≤ 20	N/R	1/batch
TC/TIC/TOC	1/SE % rec. 75-125	1/SE RPD ≤ 20	1/batch	1/batch
Sp grav.	N/R	1 sample dup/SE RPD ≤ 20	N/R	N/R
*Am^{241}	1/SE % rec. 75-125	1/SE RPD ≤ 20	1/batch	1/batch
H^3	1/SE % rec. 75-125	1/SE RPD ≤ 20	1/batch	1/batch
C^{14}	1/SE % rec. 75-125	1 /SE RPD ≤ 20	1/batch	1/batch
*Cm^{244}	N/R	1 sample dup/batch RPD ≤ 20	1/batch	N/R
*I^{129}	1/SE % rec. 75-125	1 /SE RPD ≤ 20	1/batch	1/batch
Np^{237}	1/SE % rec. 75-125	1 /SE RPD ≤ 20	1/batch	1/batch
*Pu^{238}	N/R	1 sample dup/SE RPD ≤ 20	1/batch	N/R
*Se^{79}	N/R	1 /SE RPD ≤ 20	1/batch	N/R
*Sr^{90}	1/SE % rec. 75-125	1 /SE RPD ≤ 20 not MSD	1/batch	1/batch

Table 6. QC Samples and Acceptance Limits for Candidate Feed Tank and Process Condensate Stream sample analysis.

Analysis	[1]Matrix spikes (MS)	[2]Matrix spike duplicate (MSD)	[3]Prep. blank or method blank	[6]Calib. check (spiked blank)
Tc^{99}	1/SE % rec. 75-125	1/SE RPD ≤ 20 not MSD	1/batch	1/batch
*GEA (Co^{60},Nb^{94},Ru^{106}, Cs^{134},Cs^{137},Ce^{144}, Eu^{154},Eu^{155},Ra^{226})	[4]N/R	1 sample dup/SE RPD ≤ 20	1/batch	1/batch
*$Pu^{239/240}$	1/SE % rec. 75-125	1 Sample Dup/SE RPD ≤ 20	1/batch	1/batch
*Total alpha	1/SE % rec. 75-125	1/SE RPD ≤ 20	1/batch	1/batch
*Total beta	1/SE % rec. 75-125	1/SE RPD ≤ 20	1/batch	1/batch

[1]The Matrix Spike (MS) shall be valid only when the spike concentration is more than 125% of the unspike sample value.

[2]The RPD shall be calculated and reported only when both the sample and the duplicate are >10X the product of the instrument detection limit (IDL) times the dilution factor.

[3]The Blank value shall not exceed either 1) EQL or 2) 5% value of aciton level limit, or 3) 5% value of the mean sample concentration or **whichever is higher.**

[4]Not Required (N/R)

[5]One sample duplicate per sampling event or whenever an exotherm is observed

[6]Control limits will be no greater than either those shown on the standard manufacturer's certificate (i.e. vendor supplied values), or ±3 standard deviations of the average concentration for that standard's historical performances as measured from an active data base.

%Rec. = Percent Recovery
SE = Sampling Event
Batch = A batch is a group of related samples that are analyzed together.
*MS is not possible - Requires either use of carrier or a tracer.

corrective action. Additional details on corrective action are provided in Section IV.B and Morant (1994).

2.5 QUALITY CONTROL REQUIREMENTS

QC checks are made to assess the precision and accuracy of a test measurement. QC checks permit comparison of sample results with acceptable ranges defined in Von Bargen (1994) and provide precision and accuracy estimates to evaluate the confidence of decisions.

Basra and Mulkey (1994) contains lists of the RCRA compliance parameters of interest in Tables 5-2 and 6-1 for candidate feed and process condensate, respectively. Those Tables are recreated in Tables 2 and 3 of this Plan along with the precision, accuracy, and practical quantitation limit (PQL) figures given in Tables 7.3 and 7.5 of Von Bargen (1994). Estimated quantitation limits (EQLs), which are the same as PQLs, will be used in the Plan to be consistent with the DOE (1994) and RCRA. In addition, the QA parameters for noncompliance parameters of interest, from Tables 7.3 and 7.5 of Von Bargen (1994), are given in Tables 4 and 5 of this Plan. Von Bargen (1994) determined that the compliance, process control, and safety parameters listed in these Tables shall be quantified to assure a safe, controlled, and environmentally compliant operation. Analyses must meet the precision and accuracy requirements given in Tables 2 through 6.

Section 7.7 of Von Bargen (1994) expresses precision as the relative percent difference (RPD) between matrix spike and matrix spike duplicate results and accuracy by the percent recovery (%R) of the spike and gives precision and accuracy acceptance criteria in Table 7.5. These requirements were developed to ensure the production of data of sufficiently good quality that correct decisions can be made to comply with process control, safety, and environmental compliance limits stated in Von Bargen (1994). These decisions must occur before the processing of waste can be made. It also gives EQLs that are typically a factor of five greater than the instrument detection limit, where the instrument detection limit is defined as the concentration of analyte (except for radionuclides) within an analytical standard matrix, that will provide a signal to noise (S/N) ratio of 2/1 when analyzed. For radionuclides, the minimum detectable activity is determined at 222S using the latest revision of WHC procedure LA-508002, *Detection Levels for Radioisotopic Counting* and at ACL using Section 10.4.3 of Kuhl-Klinger (1994). EQLs are recommended administrative limits, not strict requirements. They reflect normal laboratory performance capability. EQLs may be exceeded for samples with high ionic strength or interfering analytes. Section 7.7.6 of Von Bargen (1994) identifies analytes whose EQLs may be cause for concern. This would occur when the EQL is greater than the action level, or when the EQL is less than the action level, but the upper 90% confidence level of the analyte mean exceeds the action level. If the laboratory suspects that analyte EQLs will not be met, it must report the discrepancy to the program, who will work with the laboratories to determine what analytical options should be pursued to best meet the needs of the program. The applicability of these EQLs will be evaluated as more campaign data are collected and new EQLs are generated from new data. Von Bargen (1994) also gives guidelines on the use of and control limits for blank spikes, rerun criteria if a blank spike does not meet QC criteria, how blanks are used to estimate the degree of sample contamination, and special QC considerations for organics and radionuclides.

Matrix spikes and matrix spike duplicates containing the analytes listed in Table 7.4 of Von Bargen (1994) are added to one sample per sampling event as chosen by the laboratory, after the samples have been collected and shipped to them. MS/MSDs provide a measure of sample preparation and analysis variability and accuracy. Field duplicate samples are not collected because the sampling variability obtained from analysis of field duplicates is believed to be small relative to tank spatial variability. Laboratory duplicate samples are prepared instead of MS/MSDs for analytes which are not amenable to spiked duplicate analyses (see Von Bargen (1994), Section 7.7.5.2). The spikes are approved standards and are added by a technician overseen by a chemist according to laboratory procedures. The laboratory attempts to spike samples to a level at least 1.25 times the concentration of each analyte in order to reduce the relative error associated with the difference between the sample and sample plus spike results. Spiking at 1.25 times the sample concentration may not be possible when an analyte is present at a high concentration ($> 0.1\%$). Under this condition a sample dilution shall be performed. The relative percent difference between the expected (calculated) concentration of the diluted sample and its observed concentration must not exceed 5 percent. Criteria for spike recovery are not applicable if the spike concentration is too low. Analytes that are and are not spiked are listed in Table 7.4 of Von Bargen (1994). Table 6 of this Plan lists the required frequency of MS/MSD, preparation blank, and blank spike analyses for process condensate and candidate feed analytes. It also gives percent recovery requirements for MS and spiked blanks and RPDs between MS/MSD. Table 6 should be used with Tables 2 through 5 to determine whether a given analyte is spiked into a candidate feed tank sample, process condensate sample, or both. Table 6 is consistent with Table 7.5 of Von Bargen (1994).

Each sample for organic analysis should have a minimum of four surrogate compounds added as an accuracy check (two for volatiles and two for semi-volatiles). Surrogate compounds are chemically similar to certain groups of target compounds, but have a unique mass because they are isotopically labeled. They are therefore distinguishable by the mass spectrometer detector used in organic analysis. Surrogate compounds for volatile organic analytes typically used in environmental protocol analyses are 1,2 - Dichloroethane - d_4 and Bromofluorobenzene with percent recovery QC criteria of 76 to 114 and 86 to 115, respectively. Similarly, surrogate compounds for semi-volatile analytes are typically Nitrobenzene - d_5 and Terphenyl - d_{14} with percent recovery QC criteria of 35 to 114 and 33 to 141, respectively. The laboratory may choose other surrogates if the analytes of concern are different than those found on environmental protocol analyte lists.

Initial calibrations are used to establish the baseline response of an analytical instrument. Continuing calibration checks or instrument calibration verifications are used to verify that instrument response has not fluctuated significantly. These calibrations are procedure specific. Additional details on calibrations, including standards specifications, can be found in Sections 8.2, 8.3, and 8.4 of Kuhl-Klinger, Section 6.7 of Meznarich (1994), and Section 6.0 of Moss (1993).

A blank spike is simply reagent grade water that is spiked with a known amount of standard organic material , then prepared and analyzed in the same manner as a normal sample. It is analyzed once per batch of samples (a group of samples prepared and analyzed during the same period of time) that indicates whether the method is still "in control"; i.e., if the entire method (preparation and measurement) is performing within acceptable limits. It provides another measurement of procedure performance (accuracy/precision) on standard materials.

Analysis of blanks will be the same as regular samples except for radionuclides. For these, total alpha and total beta screening tests will be run initially as per Appendix 3A of Von Bargen (1994). Field Blank contamination shall be evaluated by comparison to a reagent blank or preparation blank run at the same time. The field blank is acceptable if the concentration of each contaminant analyte is less than or equal to:

- 5% of the action level,
- 5% of the average sample result per tank for candidate feed, or per campaign for process condensate blanks, or
- The EQL, whichever is higher.

Trip blanks will only be analyzed if contamination, as defined above, is detected in the field blank, and only for those contaminating analytes detected in the field blank. This strategy implies that trip blanks analyses, if required, may exceed holding times. If holding times are exceeded for trip blanks, the quality of the data should not be impacted. Preparation blanks are laboratory generated blanks that go through the entire sample preparation. They are typically employed for procedures using an extraction, dissolution, or digestion. A reagent blank does not go through the preparation process, and is typically the matrix of the analytical standards. It may be used to subtract from the sample signal during the detection step.

Section 7.7.4 of Von Bargen (1994), Rerun Criteria, discusses how to proceed if blank spikes, reagent, or preparation blanks analyses do not meet QC criteria.

If the "over the top" (5 inches above open pit) dose rate is > 2 rem/hour or 25 rad/hour, samples will be processed within a hot cell and the potential for contamination during sample processing in the hot cells will be determined by a hot cell blank for each sampling event. This will consist of a reagent water rinse of the equipment after it has undergone a standard clean-up performed between samples in the hot cell. The degree to which analytes specified in this project plan appear in the hot cell blank indicates the level of cross contamination from the sample breakdown equipment. The determination of contamination of the hot cell blank is described in Section 7.7.3 of Von Bargen (1994).

Laboratory QC requirements shall be described in QA Plans Moss (1993) for WHC and Kuhl-Klinger (1994) for ACL, and may also be described in individual laboratory procedures.

2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Acceptance testing or calibrations of computer controlled instruments and small equipment, sometimes involving the use of QC standards and reference materials, must be performed as described in Section 6.0 of Moss (1992) and Section 6.7 of Meznarich (1994), and Section 8.4 of Kuhl-Klinger (1994) unless stated otherwise in this Plan. Calibrations must be documented according to the guidelines provided within the applicable procedure.

The final acceptance of the suitability of equipment for operation is determined by the passing of annual internal audits and periodic external audits by Environmental Services Quality Assurance (for WHC) and by Analytical Services (for ACL). (See Section 3.0 of this Plan for additional details.) Resolution of equipment deficiencies is discussed in Section 4.2 of this Plan.

Field sampling groups must implement a preventive maintenance program that will assure the needed availability of sampling equipment. The preventive maintenance program for laboratory instrumentation described in Section 11.0 of Moss (1993), Section 6.8 of Meznarich (1994), and Section 16.0 of Kuhl-Klinger (1994) discusses the preventive maintenance schedule, critical facility equipment (such as fume hoods, electrical, and heating and ventilation), vendor service contracts, keeping of critical spare parts lists, and recording in maintenance logs. Minor maintenance activities are typically listed in the analytical method and/or recommended by the manufacturer. Balance maintenance is addressed in Section 6.9 of Meznarich (1994) and Sections 8.1 and 8.2 of Kuhl-Klinger (1994). Maintenance logs are reviewed by managers on a continuing basis.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

Section 6.0 and Table 5 of Moss (1993) and Section 8.4 of Kuhl-Klinger (1994) summarize the required frequency and calibration method for each analytical technique. The analyst is responsible for confirming that calibrations are satisfactory prior to performing analysis. The laboratory QA plans also cover the preparation, storage, and traceability of standards used to calibrate instruments. Balance calibrations are discussed in Section 6.9 of Meznarich (1994) and Sections 8.1 and 8.2 of Kuhl-Klinger (1994).

3.0 ASSESSMENT/OVERSIGHT

3.1 ASSESSMENTS AND RESPONSE ACTIONS

A QA program can only be effective if systems are in place to continuously monitor or assess the laboratory's or sampling group's ability to conform to program requirements. The goals and responsibilities of the laboratories' QA programs are contained in Moss (1993), Meznarich (1994), and Kuhl-Klinger (1994). General information on assessment activities at the laboratories are located in the following sections of the laboratory quality assurance plans as shown in Table 7.

Surveillances and audits of the 222S laboratory are conducted monthly by WHC Analytical Services Quality Assurance and cover every aspect of laboratory work, including conduct of operations, safety, data validation, and chain of custody (sample control) (see WHC-CM-4-2). The 222-S laboratory is audited by WHC-QA Compliance Assurance Group and assessed by the WHC-AS Office of Quality Assessment. The manager of WHC-AS Operations Assurance and Support reviews all audits, assessments and surveillances. The findings are entered into the QUEST database for tracking of the non-compliant issues. Reports are issued to the responsible managers who shall address the corrective action and report back to the Operations Assurance and Support Manager with information on action taken.

The ACL's internal auditing program is deemed adequate at this time, and will always be subject to review by TWRS Quality Assurance. Presently, surveillances are conducted at least quarterly and sometimes monthly. ACL surveillance conditions and corrective actions are coordinated through ACL's Quality Operations and Standard Laboratory. More detail on the conduct of external and internal audits/assessments and performance evaluations are contained in the procedures and/or policy manuals.

Sampling and Mobile Laboratories process condensate sample collection procedure was written, in part, to conform to the Liquid Effluent QA Project Plan. They are audited quarterly by Engineering and Environmental Quality Assurance.

3.2 REPORTS TO MANAGEMENT

The 242-A Evaporator operations management, Tank Farms Environmental Engineering, and TWRS Quality Assurance shall be placed on distribution to receive the results of audits, surveillances, performance evaluations, and data quality assessments of site laboratories and sampling groups generated by internal laboratory and external quality assurance organizations, as applicable to the program.

Status reports to the program will not be required for this project. The laboratory will develop a schedule dealing with all aspects from sample receipt through delivery of the

Table 7. Laboratory QA Plan Sections Describing Various Assessment Activities.

Assessment Activity	Laboratory Quality Assurance Plan Section		
	Moss (1993)	Meznarich (1994)	Kuhl-Klinger (1994)
Peer review[1]	NA	NA	12.0
Management systems review[1]	NA	NA	14.1
Readiness review[2]	NA	NA	NA
Technical systems audit/surveillance	10.0	10.1.2	14.1, 14.2
Performance evaluation	10.0	10.1.3	14.4 & Appendix C
Audit of data quality	10.0	10.1.1	14.3
Data quality assessment	12.0/Table 7.0	9.0 - 9.5	12.0 & 14.3

[1]Peer review and management reviews of data, instrument performance, quality of standards, and safety regulations are conducted frequently and are considered an essential component of laboratory operations.

[2]Readiness reviews are only performed for a new facility, a major modification to an existing facility, or a change in the safety envelope (see WHC-CM-1-3). For example, proposed construction of new hot cells in the 222-S laboratory has prompted a readiness review.

validated data package. The schedule will be reviewed weekly for progress versus targeted dates. Final data package content will be dictated by the work authorization documents described in Section 1.3 of this Plan.

Resolution of significant quality assurance problems identified in these reports is addressed in Section 4.2 of this Plan.

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4.0 DATA VALIDATION AND USEABILITY

4.1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

Laboratory data management practices are described in Sections 10.1 through 10.5 of Kuhl-Klinger (1994), Sections 8.1 through 8.3 of Moss (1993), and Sections 8.1 through 8.5 and Figure 2 of Meznarich (1994). Data management practices include data reduction and review, report preparation and review, and data transfer and storage.

The 242-A Evaporator candidate feed and process condensate sampling and analysis compliance data, for analytes in Tables 2 and 3 of this Plan, will be validated by SDLA according to the Level B evaluation criteria (Von Bargen, 1994, Section 7.7). Analytes that need to be validated are listed in Tables 2 and 3. This level of validation is intended for use in situations where analytical results are compiled for later use or transmission to the Washington State Department of Ecology or the EPA. The following information must be included in the review:

- Chain of custody
- Requested versus reported analysis
- Holding times
- Analytical blanks
- Matrix spikes
- Matrix spike duplicates
- LCS and surrogate recovery.

The validated data report must be sent to Tank Farms Environmental Engineering and TSPE. A tabulated quantitative data summary for the applicable items in the above list shall be included in the report. All parameters that do not meet the quality assurance objectives in Section 2.5 of this Plan and the Level B validation requirements provided in Section 2.0 of WHC-CM-5-3 must be flagged in the report. Data shall be reported in mg/L (ppm), μg/L (ppb), μg of carbon/L, or μCi/L. All data packages will be converted into supporting documents by Analytical Services.

Statisticians will use the data for critical analytes identified in Von Bargen (1994) to construct new individual and composite power curves for that campaign and all campaigns, respectively. Power curves are a tool to assist the program in selecting the number of samples to be collected in subsequent campaigns.

4.2 CORRECTIVE ACTION

Corrective action must be followed in accordance with the guidelines presented in Section 13.0 of Mos (1993), Section 10.0 of Meznarich (1994), Section 15.0 of Kuhl-Klinger (1994), Morant (1994) and WHC-CM-4-2.

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