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Sampling Strategy for Tank 50 Point of Compliance Transfers to Saltstone

By Edward T. Ketusky

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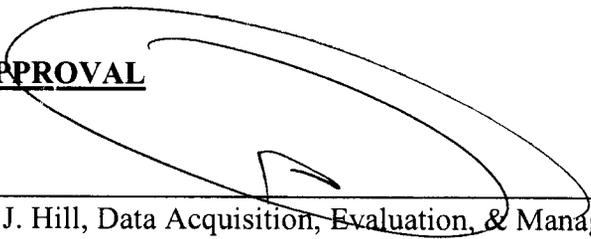
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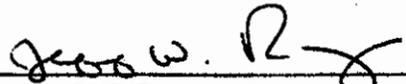
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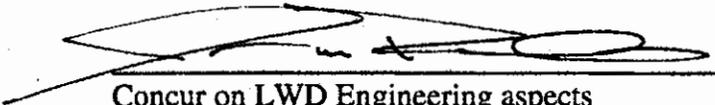
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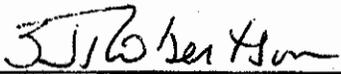
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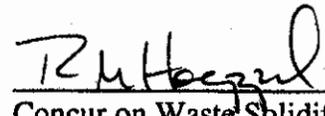

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TABLE OF CONTENTS

TABLE OF CONTENTS	1
LIST OF ACRONYMS	2
GLOSSARY	3
1 INTRODUCTION	6
1.1 Purpose.....	6
1.2 Document Hierarchy	6
1.2 History.....	6
2 BACKGROUND	7
2.1 Tank 50.....	7
2.2 Saltstone	8
2.3 Sampling Requests and Administration	8
2.4 Sample Accountability and Chain of Custody.....	9
3 PULL SAMPLES & SAMPLE FRACTIONS	9
3.1 DDA Pull Sample.....	9
3.1.1 DDA Vault Classification Fraction	10
3.1.2 DDA Grout Qualification and Formulation Fraction	10
3.1.3 DDA TCLP Fraction	11
3.2 GROUT Pull Sample.....	11
3.2.1 Grout Qualification and Formulation Fraction	11
3.2.2 TCLP Fraction.....	12
3.3 OPS Pull Sample	12
3.3.1 Chemistry Sample Fraction.....	12
3.3.2 Radionuclide Fraction	13
3.3.3 Corrosion Control.....	13
3.3.4 Other Sample Fractions	13
4 MATERIAL BALANCE	13
4.1 Updates.....	13
4.2 Material Balance for Characterization.....	14
5 CONCLUSION.....	14
6 REFERENCES	15

LIST OF ACRONYMS

CBU	Closure Business Unit
COC	Chain of Custody
DDA	Deliquification, Dissolution, and Adjustment
DSA	Documented Safety Analysis
ESS	Environmental Services Support (also called Regulatory Support)
DWPF	Defense Waste Processing Facility
ID#s	Identification Numbers (referring to sample Id #s)
ISWLF	Industrial Solid Waste Landfill Facility
IWT	Industrial Wastewater Treatment
LWD	Liquid Waste Division
PIT	Planning Integration Technology
POC	Point of Compliance
RCRA	Resource Conservation and Recovery Act
SAP	Sample Analysis Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SRNL	Savannah River National Lab
TCLP	Toxicity Characteristic Leaching Procedure
TTRs	Technical Task Request
WAC	Waste Acceptance Criteria
WCS	Waste Characterization System
WCP	Waste Compliance Plan
WS	Waste Solidification
WSRC	Westinghouse Savannah River Company

GLOSSARY

CR-OPS -- OPS Pull Sample which considers chemistry and radionuclides.

C-OPS -- OPS Pull Sample which only considers chemistry.

CBU Engineering -- Various engineering organizations within CBU.

DDA Pull Sample -- Pull sample used to obtain permit approval.

Grout Qualification -- Refers to the quality (acceptability) of the final grout product.

Grout Formulation -- Refers to the gel time (acceptability) of the final grout product.

GROUT Pull Sample -- Pull sample used for Grout Qualification & Formation and the Offsite TCLP.

OPS Pull Sample -- Pull sample used to measure the chemical and radiological constituents.

OSR -- A Savannah River Site (legacy) all-forms designator still in use at the SRS.

Pull Sample -- Samples pulled from Tank 50.

Sample Fraction -- A fractionalized part of the pull sample where the chemistry is untreated/unadjusted.

ABSTRACT

For implementation and cost effectiveness, the need for primarily pulling only large multipurpose samples for Tank 50 for Point of Compliance (POC) transfers to Saltstone has become apparent. As part of detailing the Tank 50 Sampling Strategy, this report avoids the use of commonly used terms such as “Regulatory Samples,” “Compliance Samples,” “Primary Samples,” and “Laboratory Samples.”

Instead this report introduces the use of the terms “pull samples and sample fractions.” “Pull samples” refer to large multipurpose samples that are taken from the tank, packaged, and transported to SRNL. After the pull samples are received by SRNL, they will be broken into sample fractions (i.e., fractions of the pull sample without any adjustments/alterations to chemistry) based on sampling purpose/intent/requirements. Differing from past common practice, each of the quarterly taken pull samples performs both regulatory and compliance aspects, while the actual characterization is based on a material balance across Tank 50.

SRNL will perform the bulk of these analyses as specified by the permit.

Table 1 Minimum Samples Needed to Support Tank 50 Transfers to Saltstone

PULL SAMPLES					SAMPLE FRACTIONS ⁶				
Name ¹	Size ²	Freq	Time	Status	Requirement/ Intent	Freq/Pull	Size ²	Rationale	Status
DDA Pull Sample (Complete)	4 liters	1 per 5 yrs or new waste stream	Prior to permit	Pulled, repacked & shipped (For this report, considered complete)	DDA Vault Classification	1/1	1 liter	Required for new waste stream permit. Evaluates landfill requirements & effects on groundwater	Analyses completed & documented ⁵
					DDA grout qualification & formulation	1/1	2.9 liters	Initial verification that grout will meet the quality and processing requirements	Analyses completed & documented ⁵
					DDA TCLP	1/1	100 ml	Initial verification of non-hazardous nature of grout. Made from recommended initial grout formulation	Analyses completed & documented ⁵
GROUT ³ Pull Sample	1 liter per tank for pre-qual; or 3 liters then switching between 3 & 2 liters every quarter	4 per yr	1/quarter & as specified by WS Engineering	Ongoing	Grout qualification & formulation	1/quarter & as specified by WS Engineering	2.9 liter for pre-qual, otherwise 2.9 or 1.9 liters	Verification that the grout will meet the quality and processing requirements (for pre-quals, samples of other tanks feeding Tank 50 to be combined prior to analysis)	Ongoing
					TCLP	1/quarter	100 ml/ tank	Quarterly verification of non-hazardous nature of grout (for pre-quals, samples of other tanks feeding Tank 50 to be combined prior to analysis)	Ongoing
OPS ⁴ Pull Sample	400 ml if chem and rad, 150 ml if chem.	4 per yr	1/quarter	Ongoing	Chemistry	4/4	150 ml	Compliance of liquid/solid chemistry	Ongoing
					Radiological	2/4	250 ml	Compliance of liquid/solid radiological contents	Ongoing

Notes: ¹ Names used in this report are for the purpose of this report only, and should not be confused with HLW Sample ID#s.
² Size refers to the currently planned nominal sample and fraction size and is subject to modification based on sampling requirements, replicates, and analytical methods. Actual sample size will be based on sampling plan.
³ GROUT Variations include: P-GROUT= prequalification sample where the feed tanks and Tank 50 are sampled, 3-GROUT=3 liter sample of Tank 50, or 2-GROUT=2 liter sample of Tank 50.
⁴ OPS Variations include CR-Ops=Chemistry & Radiological fraction, or, C-Ops= Chemistry fraction. In the future entire sample may be combined with GROUT Pull Sample based on SRTC determination.
⁵ Analyses considered to be Completed & Documented but yet to be approved by SCDHEC.
⁶ Sample fraction practices (including fractionalization size) is subject to change based on SRTC continual incorporation of best practices.

In general terms, Waste Solidification Engineering (WS Engineering) will begin by determining what pull samples are needed and complete the necessary Technical Task Requests (TTRs) for SRNL analyses based on the sample fraction requirements/intent which originate from the Waste Acceptance Criteria (WAC). Liquid Waste Division Engineering (LWD Engineering), whom will use this information, will help WS Engineering complete all necessary sample request forms (i.e., all-forms OSR 28-187, Ref. 13) based on the necessary pull samples and sample fractions. As shown in Table 1 there are only two possible ongoing pull samples.

The two ongoing pull samples include: the GROUT Pull Sample (i.e., a large sample taken and performed at least quarterly), and OPS Pull Sample (i.e., the operations or process sample of about 400 ml and performed quarterly). Table 1 also shows that from those two pull samples there are four sample fractions. The other pull sample has been taken, analyzed and document, but has not yet been approved by SCDHEC.

The chemistry performed as part of the OPS Pull Sample (i.e., C-OPS or CR-OPS) will also include the constituents used for evaluating corrosion control, resulting in a small sample savings. Similarly, if other samples are needed the use of the data from other sources, such as OPS Pull Sample, or the GROUT Pull Sample should be considered. Refer to Table 2.

Table 2 Savings from Using the OPS Sample for Additional Purposes

PULL SAMPLE					FRACTION SAMPLE SAVINGS			
Name	Size	Freq	Time	Status	Intent	Size/Freq	Rationale	When
OPS Pull Sample	400 ml	4 /Year	1/ Quarter	Ongoing	Corrosion Control	No increase in size; No increase in freq Provided as part of Chemistry	Compliance of Chemistry to the Tank Corrosion Control Program	Ongoing
					Other	TBD	TBD	As required

Besides considering samples in Table 1 and Table 2, transfers to Tank 50 will be characterized by samples and or process knowledge to ensure Tank 50 meets the WAC requirements during transfers to Saltstone.

Accountability for the samples from the time that they are pulled until the time that they are received by the laboratory is maintained according to Ref. 13 and Ref. 14. As required, the formal SRNL Chain of Custody (COC) program, which covers the sample from point of origin through sample analyses, will be applied [Ref. 15].

Overall, this document provides a basic understanding of the Tank 50 Sample Strategy to support Saltstone. As the details of the Saltstone Acceptance Criteria (WAC), Tank Farm Waste Compliance Plan (WCP) for Saltstone, and the Tank 50 Sampling Plans evolve many of the specifics relating to sampling will become available.

1 INTRODUCTION

1.1 Purpose

This document provides a basic understanding of the Sample Strategy logic to support Tank 50 transfers to Saltstone.

1.2 Document Hierarchy

This Sample Strategy was developed prior to and during the development of the Waste Acceptance Criteria (WAC) to address many of the sampling issues, add clarity and aid in the understanding across various organizations. It is for planning purposes only. After the development of the WAC, a WCP (Waste Compliance Plan) will be written. With the WCP written, a detailed Sample Plan will be finalized. Therefore, although the Sample Strategy and Sample Plan are different documents, once complete the Sample Plan will provide the same type of information, but at much greater level of detail. As time progresses and revisions to sampling protocol occur, the Sampling Plan will be revised to represent the most current information. At the time of such revisions, this Sample Strategy will be superseded by the Sample Plan.

1.2 History

Around December 2004, a draft strategy was first initiated by listing all of the known sample requirements. The first draft showed four different types of quarterly samples being taken, with four different samples being pulled, resulting in 16 quarterly samples.

At that time it was recognized that for implementation and cost effectiveness, the plan and the requirements that formed the plan, had to be closely scrutinized, and samples had to be combined, deleting the many replicate results from different sample methods. As part of that effort Closure Business Unit Engineering began drafting a new Saltstone Waste Acceptance Criteria that distinguished Saltstone operating goals from Saltstone limits. The Environmental Services Support (ESS) and CBU Engineering began reviewing the permit to determine exactly what samples were required to be performed by a SCDHEC Approved/Certified Laboratory. LWD Engineering formed the logic for the blending and mixing requirements, eliminating additional analyses.

In the end to aid in the combining of samples, the pulling of samples had to be disassociated with the 1 to 1 direct relationship to the sampling analyses. Instead large samples had to be scheduled and all the requirements had to be grouped by Intent/Requirements, resulting in only a few samples being pulled. To aid in this effort the use of the word “Primary Sample and Laboratory Sample” had to be avoided, since each means different things to different organizations. Instead the terms “pull sample” and “sample fraction” are used. A “pull sample,” is defined as what is taken from the tanks, while a “sample fraction,” is defined as a non-chemically altered fraction of the pull sample.

For the purposes of clarity (within this report), “pull samples” are also referred to as “samples,” and “sample fractions” are also referred to as “fractions.”

2 BACKGROUND

2.1 Tank 50

Tank 50 is the point of compliance (POC) for waste to be transferred to Saltstone. Possible waste stream influents into Tank 50 currently include, or are anticipated to include, the: Effluent Treatment Process (ETP) effluents; low level waste water from the Highly-Canyon; the Defense Waste Processing Facility recycle; Deliquification, Dissolution, and Adjustment (DDA) solution [Ref. 1], and dissolved salt solution post treatment with the Actinide Removal Process (ARP) and the Modular CSSX Unit (MCU).

To ensure waste entering Saltstone is within the Saltstone Documented Safety Analysis (DSA), Saltstone Facility Performance Assessment, and its Operating Permitted values, the Tank 50 contents must always remain in compliance (with sampling, calculation or process knowledge, as appropriate) within the Saltstone WAC while setup for transfers to saltstone. Figure 1, shows Tank 50 as the point of compliance.

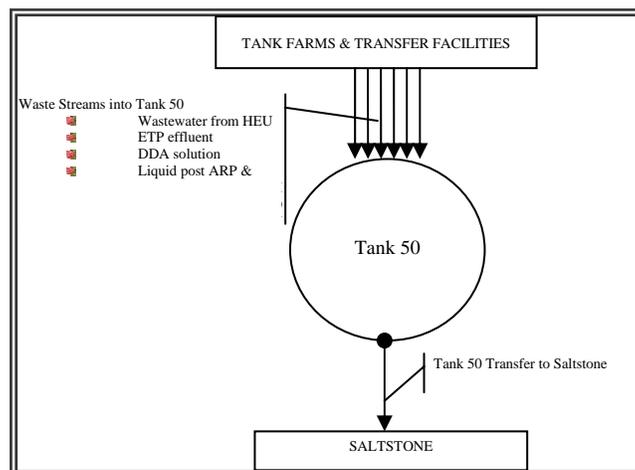


Figure 1 Projected Waste Streams In and Out of Tank 50

2.2 Saltstone

Saltstone is designed as a totally enclosed wastewater treatment facility that converts mixed aqueous waste into a non-hazardous saltstone grout. Saltstone cannot accept waste that will result in the Saltstone grout being classified as hazardous waste.

As part of the permit process for the dissolved salt waste, the Westinghouse Savannah River Company (WSRC) submitted a Sampling and Analysis Plan (SAP) to SCDHEC on September 2003. The SAP and revisions to the SAP, in addition to the Saltstone Industrial Wastewater Treatment (IWT) and Industrial Solid Waste Landfill (ISWLF) Permits provide the details of the Saltstone sampling strategy [Ref. 5, 7, & 11].

2.3 Sampling Requests and Administration

WS Engineering, acting on behalf of Saltstone will begin by determining what pull samples are required and completing the necessary Technical Task Requests for SRNL analyses based on the pull samples and corresponding sample fraction intents. That is, WS Engineering will write the TTR since Saltstone is financially responsible for the laboratory analysis. Completed TTRs will be forwarded to the Liquid Waste Division Engineering, whom, while acting for the Tank Farms, will use the information to complete necessary sample request forms (e.g., OSR 28-187, Ref. 13) based on the pull sample. LWD Engineering will write the Sample Request. Both the TTR and the Sample Request Form (Sections 1 & 2, Ref. 13) should be completed as far in advance as possible, and at least 2 months before the sample is scheduled to be pulled. The financial responsibility for expediting any samples will be determined based on a case by case basis between Saltstone and the Tank Farms.

Exceptions to these responsibilities should be expected for future DDA type pull samples for permits, where ESS assumes the primary responsibility for determining when the samples are required. In this case, however, ESS works closely with WS Engineering. WS Engineering however, will still complete the TTR. It should be noted that the DDA Pull Sample is actually represented by Tank 41 and therefore has been analyzed, results reported, and is considered complete (although awaiting SCDHEC approval). A new sample will be due if the stream substantially changes, or every 5 years, with time zero beginning when processing begins.

2.4 Sample Accountability and Chain of Custody

While onsite, the CST Sample Manual and CST Sample Request program as evidenced by Ref. 13 & 14 define the minimum requirements associated with sample accountability. To initiate pulling a sample, the completed Sample Request Form must first be approved by various levels of review and management. CST Sample Manual first ensures that a unique identifier is applied to each sample. The Sample Request form then accompanies the sample(s) from point of origin to laboratory receipt. At the laboratory, sample accountability is maintained as the sample is received, logged, unique identifier applied, then stored in a secured area. Using Ref. 13, the basic purpose, requirements, characteristics, and sample ownership can easily be determined at all times.

Additionally, the formal SRNL Chain of Custody (COC) program, which covers the sample from point of origin through sample analyses, is applied, as required [Ref. 15]. The chain of custody is part of the formal quality control process used to ensure that the integrity of a sample from the point-of-origin through sample analyses is maintained. It documents possession and sample control. The custody is defined by the following:

- Physical possession of the samples
- Previous physical possession and samples are now in sight
- Previous physical possession and samples have been placed in a secure area (including shipper)
- Previous physical possession and samples are now in a locked container

3 PULL SAMPLES & SAMPLE FRACTIONS

As discussed, Tank 50 is the Saltstone point of compliance for transfers from the Tank Farms. As part of sampling, there are 3 pull samples: They are the DDA Pull Sample, the GROUT Pull Sample, and OPS Pull Sample. Only the GROUT Pull Sample and OPS Pull Sample are ongoing.

3.1 DDA Pull Sample

The DDA Pull Sample is made of: 1) the Vault Classification Sample Fraction, 2) the Initial Toxic Characteristic Leaching Procedure Sample Fraction; and the 3) Initial Grout Qualification & Formulation Sample Fraction. They are grouped this way because they all must be done in advance and all must be mixed with the appropriate amounts of dry grout. The nominal sample size is assumed to be 4 liters. It is only required when the stream substantially changes, or every 5 years. For DDA, the sample has been pulled and the analyses are complete.

WS Engineering, with assistance from ESS, will ensure that the Tank Farms are adequately advised of sample size and when the sample is to be pulled through the use of appropriate sample request forms such as OSR 28-187 [Ref. 13]. For size and date, it is necessary ESS to get agreement from SRNL, because SRNL is responsible to receive and fractionalize the Sample. SRNL will then re-package and ship the required quantities.

Note: All analyses of the DDA Pull Sample and sample fractions are considered complete; however SCDHEC has yet to approve the results.

3.1.1 DDA Vault Classification Fraction

The Vault Classification Sample Fraction has been analyzed as part of the DDA permitting process [Ref. 7].

The South Carolina Department of Health and Environmental Control (SCDHEC) Regulation 61-107.16 [Ref. 6] provides the requirements for Industrial Solid Waste Landfill (ISWLF) facilities. As part of the requirements for ISWLF, the waste stream(s) must be characterized: 1) at least every 5 years; 2) whenever the production process, or raw materials used in the process, changes significantly enough to alter the chemical makeup of the waste; 3) when new streams are proposed for disposal in the industrial waste landfill, or 4) according to an alternate schedule based on the variability or non-variability noted in previous sampling events or other factors affecting the predictability of waste characteristics.

The purpose of the sample fraction is to determine the required vault classification, ensure that the effects of a new waste stream on the groundwater are evaluated, and ensure that the saltstone grout qualifies as a non-hazardous radioactive waste form [Ref. 9]. As described in the SAP, Saltstone grout is prepared by SRNL from a large DDA Pull Sample (i.e., a few liters) and shipped offsite. The samples are analyzed by a SCDHEC certified/approved laboratory. The organization financially responsible for the Vault Classification Sample Fraction is Saltstone, with support from ESS.

Vault classification sample fractions are required every five years or if a new waste stream is to be processed. A vault classification fraction has already been taken and analyzed as part of the DDA waste stream permitting process [Ref. 7]. The results however, have yet to be approved by SCDHEC. Additionally, the SAP has been submitted and is awaiting approval by SCDHEC.

3.1.2 DDA Grout Qualification and Formulation Fraction

Initially the DDA liquid samples are used to test the grout quality and formulation. With the results, Saltstone can modify the grout recipe as needed to compensate for changes in the salt, organic, or solids content of salt solution fed to Saltstone. The initial DDA Grout Qualification and Formulation Sample Fraction has been performed by SRNL and shown to be acceptable. Until recently, such tests could be performed at the Saltstone facility. However, with some of the process changes, the qualification and formulation sample testing fraction are now planned to be performed at SRNL.

It is made from a nominal 2.9 liter DDA sample fraction and some premix grout material by SRNL. It is included here because a baseline was made from the DDA Pull Sample and submitted as part of the permitting process.

3.1.3 DDA TCLP Fraction

The DDA TCLP is used to confirm the initial non-hazardous nature of the grout, based on the RCRA Hazardous Metals, as well as other hazardous constituents. The testing is conducted in accordance with the Saltstone Industrial Solid Waste Landfill (ISWLF) permit. The TCLP is analyzed by a SCDHEC certified/approved laboratory. It is made from a nominal 100 ml DDA sample and some premix grout material by SRNL.

It is included here because a baseline was made from the DDA pull sample and submitted as part of the permitting process.

3.2 GROUT Pull Sample

The Grout Pull Sample is made of the: 1) Grout Qualification and Formation Sample Fraction, and 2) the TCLP sample fraction. The samples are pulled and analyzed quarterly and additionally as requested by SRNL. The size is considered to be a nominal 1 liter per tank if done as part of a pre-qualification test or a nominal alternate 3 and 2 liter sample (starting with 3 liters) if performed using actual Tank 50 material. Pull sample GROUT Variations include P-GROUT representing a prequalification sample, 3-GROUT being the first pull sample (i.e., 3 liters), and then taken semi-annually, and finally the 2-GROUT being the second pull sample (i.e., 2 liters) and then taken semi annually.

3.2.1 Grout Qualification and Formulation Fraction

Periodically, when there are significant volumes of waste planned for transfer into Tank 50, liquid samples will be required so that the Saltstone can modify the grout recipe as needed to compensate for changes in the salt, organic, or solids content of salt solution feed to Saltstone. The Grout Qualification and Formulation Sample Fraction Testing is performed by SRNL.

The Grout Qualification and Formulation testing will be done quarterly and additionally as requested by SRNL. The size is considered to be a nominal 2.9 liter or a 1.9 liter sample. Alternately, prequalification allows for the use of approx. 0.93 liters per tank representing the mix of at least 3 tanks.

3.2.2 TCLP Fraction

The TCLP Testing is used to confirm the non-hazardous nature of the grout, based on the RCRA Hazardous Metals, as well as other hazardous constituents. The testing is conducted in accordance with the Saltstone Industrial Solid Waste Landfill (ISWLF) permit. The TCLP is analyzed by a SCDHEC certified/approved laboratory. It is made from a fraction of the Tank 50 GROUT pull sample and some premix grout material by SRNL. It is planned to be performed quarterly and in addition as specified by SRNL. The needed size of the sample fraction is expected to be a nominal 100 ml.

Note: The TCLP analyses are currently required to be obtained monthly. A request to change the frequency has been submitted to SCDHEC [Ref. 5]

3.3 OPS Pull Sample

This is a nominal 400 ml pull sample potentially consisting of a: 1) Chemistry Sample Fraction, and 2) Radionuclide Sample Fraction, or a 150 ml sample if just chemistry. The chemistry fraction is analyzed quarterly, while the radionuclides are analyzed semi-annually.

3.3.1 Chemistry Sample Fraction

The purpose of the Chemistry Sample Fraction is to help verify compliance of the waste stream chemistry with the SPF IWT permit. As appropriate, process knowledge will also be used. The Saltstone is responsible for specifying the requirements of the TTR, while the WCS material balance will serve as location of the central permit record. The Tank 50 corrosion data will be supplied as part of this data.

The OPS pull sample is taken by each generator prior to transfers to Tank 50 (as applicable). The need and requirements for Tank 50 mixing during sampling is documented in Ref. 16 and 17. OPS pull sample Chemistry Fraction is analyzed by SRNL. Available sample information and process knowledge will be used to determine the sample suites and number of samples that will be taken from the respective tank(s).

Each transfer into Tank 50, normally prior to the actual transfer, are evaluated against the Saltstone WAC requirements by the applicable LWD Engineering or other engineering organization to ensure that Tank 50 will remain within the Saltstone WAC. Sample results and process knowledge can be used as appropriate. It is fractionalized to a nominal 150 ml liquid sample.

3.3.2 Radionuclide Fraction

The purpose of the Radionuclide Sample Fraction is to help assess compliance of the waste stream with the SPF IWT permit tables. As appropriate, process knowledge will also be used. It is fractionalized to a nominal 250 ml liquid sample.

3.3.3 Corrosion Control

The tank chemistry, that is performed as part of the OPS pull sample will include the constituents used for evaluating corrosion control. Although F/H Lab generally performs the Tank Farm Corrosion Control Analyses, while SRNL will perform the Tank 50 C-OPS and CR-OPS analyses, using the OPS Chemistry Fraction results for corrosion will result in a sample savings.

3.3.4 Other Sample Fractions

Similarly, if other samples are “needed” to be taken of Tank 50 (e.g., such as associated with evaluating upstream removal effectiveness and/or solids accumulation) current sample data should first be evaluated for use.

4 MATERIAL BALANCE

A material balance across Tank 50 is maintained, where Tank 50 is maintained compliant with the proposed WAC. Before any transfers into Tank 50 are allowed, it must be shown that the end effect will be that Tank 50 always remains within the WAC. The characterization of the material transferred to Saltstone is maintained by the material balance.

4.1 Updates

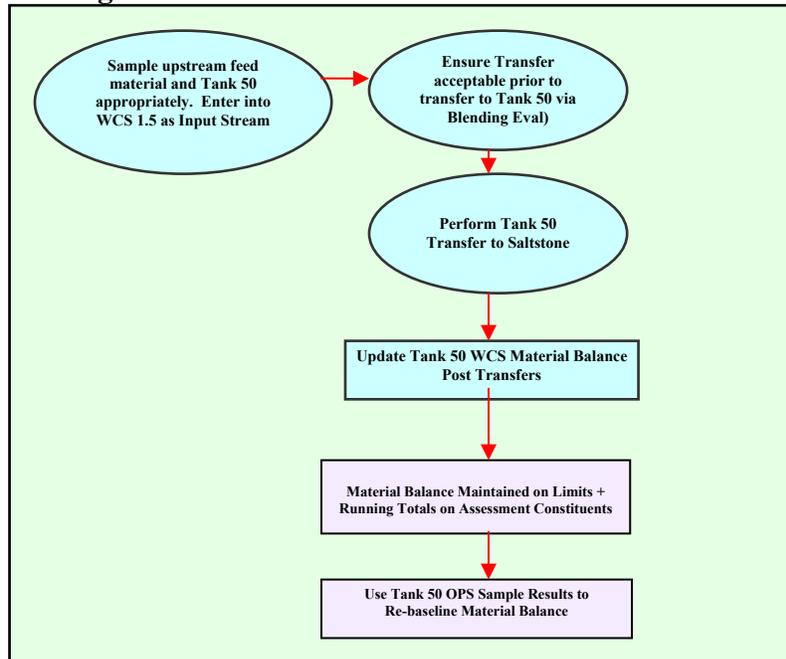
The advantage of using the material balance is that the characterization will be reflective of the waste (as the Tank 50 material balance will be updated monthly), without the need to wait for sample results.

Transfers are characterized and determined to be acceptable prior to transfer to Tank 50 by LWD Engineering to assure that the content will remain within the Saltstone WAC. If however, Tank 50 OPS pull sample results indicate a needed change to the material balance, the material balance will be modified accordingly.

4.2 Material Balance for Characterization

Based on the proposed permit, WAC samples would not need to be pulled from Tank 50 prior to sending material to Saltstone, but the transfers would be characterized from the (WCS 1.5) material balance. Quarterly samples would be pulled and used to re-baseline the results and verify the material balance. Refer to Figure 1.

Figure 1 Characterization with Material Balance



Tank 50 OPS samples, taken quarterly, are considered confirmation samples and will be used to re-baseline the material balance.

5 CONCLUSION

This document provides a basic understanding of the Tank 50 Sample Strategy including the use of pull samples and sample fractions to support Saltstone; recognizing that the Saltstone WAC, Tank Farm WCP for Saltstone, and the Tank 50 Sample Plan will provide a much greater level of detail, as they become finalized.

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