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Revision: 14

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WASTE ACCEPTANCE CRITERIA FOR AQUEOUS WASTE SENT TO THE Z-AREA SALTSTONE PRODUCTION FACILITY (U)

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J. W. Ray, Author, DWPF & Saltstone Facility Engineering — Date: 6/11/15

S. A. Utlak, Reviewer, DWPF & Saltstone Facility Engineering — Date: 6-11-15
Verification Method: Document Review

K. R. Liner, Environmental Support — Date: 6/11/15

E. J. Freed, DWPF & Saltstone Facility Engineering Manager — Date: 06.11.15

W. M. Barnes, DWPF & Saltstone Facility Manager — Date: 6-11-15

K. H. Rosenberger, Waste Disposal Authority — Date: 6-11-15

Implementation:

W. M. Barnes, DWPF & Saltstone Facility Project Manager — Effective Date: 6-18-15

REVISION HISTORY

Revision 9 (July 2009)	Revision bars used - Added Revision History section - Implementation Checklist: Added the Tank Farm WAC as a document to be reviewed for impacts - Table of Contents: Added title for Appendix 1 - Section 5.4.2: Replaced Table 3.6-11 with the Saltstone CHA Appendix D as the basis data for the Saltstone Haz Cat determination - Section 5.4.5: Corrected molecular weights of butanol and isopropanol in Table 4 - Section 7.0: Updated References 10 and 12 - Section 7.0: Removed deleted references and renumbered remaining references - Appendix 1: Provided basis wording for WAC TARGET values for toluene and EDTA - Appendix 1: Corrected tributylphosphate chemical formula
Revision 10 (March 2011)	Revision bars used - Added Low Organics Mode in Keywords section - Section 2.0: Provided note about implementation of Low Organics Mode - Section 3.0: Deleted hazard categorization from TARGET definition - Section 5.4.2: Deleted Hazard Categorization section (due to hazard category change from HC-3 to HC-2) - Section 5.4.7: Added three new chemical SAC LIMITS (nickel hydroxide, phosphate and potassium) - Section 7.0: Deleted Reference 10, updated References 12 and 13, and added Reference 34 - Attachment 8.1: Added nickel hydroxide, phosphate and potassium as chemical SAC LIMITS - Attachment 8.2: Removed potassium as chemical TARGET - Attachment 8.4: Deleted Na-22 and Eu-152 and revised WAC TARGET value for Am-242m (haz cat change) - Appendix 1: Revised to state that Na-22 and Eu-152 no longer have WAC LIMIT/TARGET values (haz cat change) - Appendix 1: Revised basis wording for Al-26 (haz cat change) - Appendix 1: Revised WAC TARGET value for Am-242m to 90% of permit max (haz cat change) - Appendix 1: Changed potassium from WAC TARGET to WAC LIMIT - Appendix 1: Changed nickel hydroxide from “Not Required” to WAC LIMIT

Revision 11 (May 2012)	Revision bars used - Section 2.0: Updated DSA Revision 7 to Revision 8, deleted DDA discussion, and added ELAWD Project Modification and SDU discussion - Section 3.0: Added Performance Assessment (PA) limits for key radionuclides (Tc-99 and I-129) for the LIMIT definition. Added 2009 PA for the TARGET definition - Section 4.0: Added discussion of Saltstone FINAL Calculation - Section 5.1: Updated basis for Tank 50 Samples Needed for Saltstone in Table 1 - Section 5.4.3: Included additional calculation for SDU 2 flammability scenarios - Section 5.4.5: Included additional calculation for SDU 2 flammability scenarios - Section 5.4.7: Removed carbonate, nickel hydroxide, oxalate, phosphate, potassium, selenium, butanol, isopropanol, and phenol as SAC LIMITS based on Rev. 8 DSA Change Package - Section 5.4.9 and 5.4.10: Added 2009 PA basis and UWMQ Process for both Radionuclide LIMITS and TARGETS - Section 5.4.12: Updated Gamma Shielding Requirement and Gamma Source Strength Value for cylindrical SDUs - Section 5.4.13: Added new section for ARP/MCU Processing Requirement as part of the UWMQ critical screening criteria - Section 7.0: Updated References 1, 4, 13, and 23. Replaced and added References 10, 25, 29, 32-41 - Section 8.0: Updated Attachments for Chemical and Radionuclides WAC LIMITS and TARGETS concentration and basis - Updated Appendix 1 for 2009 PA for Radionuclides and DSA Change Package for Chemicals and removed outdated references Other Major Changes - Global: Changed “Vault” to “Saltstone Disposal Unit (SDU)” throughout document - Global: Changed LWO Process Chemistry Program Engineering to LWO Engineering Technology Integration (ETI) due to SRR reorganization
Revision 12 (July 2013)	Revisions bars used - Section 2: Added revision 10 of the DSA. Noted the SDU 3 and 5 were added and the DSA was revised to include only the Low Isopar Mode. - Section 5.4.1: WAC Concentrations of Sr-90, Cs-137, and total alpha were reduced. The reduction was to support SDU3 and 5 shielding and lower the hydrogen generation rate. The Eu-154 WAC concentrations were reduced to be the same as for shielding. A lower IDP results. - Section 5.4.4: Hydrogen generation rate was reduced to 25% of previous value. A listing of the major contributors to the hydrogen generation rate was added. Equation for hydrogen generation modified to add temperature correction to 95°C.

	- Section 5.4.5: Methanol concentration was lowered. This value was lowered so that potential methanol in set retardant could be accommodated without revising flammability calculations. - Section 5.4.12: Cs-137 and Cs-134 concentrations were lowered to reflect shielding requirements for SDUs 3 and 5. Sb-125 and Te-125m were separated to reflect the contribution from both the parent and daughter. Co-60, Sb-125, and Eu-154 were lowered per Ref. 10. - Attachment 8.1: Moved SAC designation from Aluminum to Aluminate to keep consistent with DSA and added footnote 5 for aluminate. Change Isopar concentration to be consistent with Revision 10 of the DSA. - Attachment 8.3: Reflected lower Cs-137, Sr-90, and total alpha concentrations. - Attachment 8.4: Added Ba-137m, Y-90, and Rh-106 (daughter products) as they are major contributors to the hydrogen generation rate. Added Te-125m as it was broken out from its parent Sb-125. Concentrations were revised as appropriate, such as for those bounded by total alpha and Pu-239. - Appendix 1: Revised to include new WAC concentrations and bases. Revised to reflect lower methanol flammability limit from salt solution. Added Next Generation Solvent (NGS components).
Revision 13 (January 2014)	Revision bars used - References updated to include latest revision numbers - Reference S-CLC-Z-00080, Rev. 1 added - SRR-CWDA-2013-00097, Rev. 0, SRR-CWDA-2013-00062, Rev. 0, SRR-CWDA-2013-00141, Rev. 0, SRR-CWDA-2014-00013, Rev. 0, and X-CLC-Z-00033, Rev. 3 added as reference documents - Section 5.4.9.3 was revised to include discussion on FY2013 Special Analysis (SA) - Attachment 8.1: Changed Ammonium, Arsenic, and Phenol to concentrations recommended per X-CLC-Z-00033, Rev. 3. Also changed basis for Ammonium, Arsenic, and Phenol to 91% of DSA value. - Attachment 8.2: Changed Cobalt concentration per X-CLC-Z-00033, Rev. 3. Also changed basis to 91% of DSA value. - Attachment 8.3: Changed Tc-99 to concentration recommended per SRR-CWDA-2014-00013, Rev. 0. Changed I-129 to concentration recommended per SRR-CWDA-2013-00097, Rev. 0. Also removed unneeded footnotes. Added reference number for SRR-CWDA-2013-00097, Rev. 0 in Basis section for I-129. - Attachment 8.4: Changed Cs-135 concentration to concentration recommended per SRR-CWDA-2013-00097, Rev. 0. Added reference number for SRR-CWDA-2013-00097, Rev. 0 in Basis section for Cs-135. - Appendix 1: Revised Tc-99, I-129, Cs-135, Ammonium, Arsenic, and Cobalt WAC LIMIT/TARGET values and bases. Revised Methyl Mercury, Dimethyl Mercury, and Phenol DSA bounding concentrations. Revised Te-125m basis to correct typo on secular

	equilibrium %. - Global: Changed Saltstone Engineering (SS-FE) to DWPF/Saltstone Engineering (D&S-FE) due to SRR reorganization.
Revision 14 June 2015)	Revision bars used - Section 1.0: Added discussion to include Filter-Only option at 512-S - Table 1: Added compliance with Treatment Standards for both the initial TCLP and the quarterly TCLP - Section 5.4.2: Added total mercury, monomethyl mercury and dimethyl mercury to the list of chemicals impacting SDU flammability - Section 5.4.9: Added FY2014 SA discussion - Section 5.4.12: Added new processing requirements subsection for ARP Filter-Only operations - Section 5.4.13: Added new Regulatory Criteria section for RCRA metals including specific criteria for TCLP analyses and total mercury - Section 7.0: Updated references, replaced Reference 55 with basis document for new Tc-99 limit, added Reference 56 supporting Filter-Only operations, added Reference 57 (FY2014 SA), added Reference 58 (Organic Mercury Volatilization), Reference 59 (ESS for Methyl Mercury PISA) and Reference 60 (Mercury Impact on PA/SA) - Attachment 8.1: Added WAC LIMITs for Monomethyl Mercury and Elemental Mercury - Attachment 8.2: Added WAC TARGET for Dimethyl Mercury - Attachment 8.3: Revised Tc-99 LIMIT based on FY2014 SA - Appendix 1: Revised Radionuclide Table header to include reference for permit and DSA values as well as added FY2014 SA - Appendix 1: Corrected permit max concentrations for Cs-134 and Cs-135 as well as updated Tc-99 WAC value and basis - Appendix 1: Added Elemental Mercury to appendix and updated concentrations/bases for Monomethyl Mercury and Dimethyl Mercury

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Requirement: This document meets the Saltstone requirement of the following:

- **Saltstone Specific Administrative Control (SAC) 5.6.2.1**

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1.0 PURPOSE

The Saltstone Facility is designed and permitted to immobilize and dispose of low-level radioactive and hazardous liquid waste (referred to as salt solution) remaining from the processing of radioactive material at the Savannah River Site (SRS). The Saltstone Facility, which is located in Z Area, was originally permitted to treat low-activity wastewater generated by the Effluent Treatment Project (ETP) and the In-Tank Precipitation (ITP) process (Refs. 1 and 34). In 2004 a notification letter (ESH-EPG-2004-00194) was transmitted to South Carolina Department of Health and Environmental Control (DHEC) to allow the Saltstone facility to treat a specific low-level waste stream generated in H Canyon (Ref. 2). In 2005 another notification letter (ESH-EPG-2005-00131) was transmitted to the South Carolina Department of Health and Environmental Control (DHEC) to update the state with regards to the SRS Interim Salt Processing campaign to remove low-level salt waste from high-level waste (HLW) storage tanks as described in the draft Section 3116 Determination of Salt Waste Disposal for SRS (Ref. 3). The low-level salt waste will be treated and disposed of at the Saltstone facility in order to maintain sufficient tank space for continued uninterrupted sludge processing at the Defense Waste Processing Facility (DWPF), to allow staging of salt solution prior to startup of the Salt Waste Processing Facility (SWPF) and to allow SWPF to operate at a higher capacity once it becomes operational.

In the interim period before SWPF begins processing, Decontaminated Salt Solution (DSS), similar in composition to the SWPF effluent, will be fed to Tank 50H and Saltstone through salt processing in the Actinide Removal Process (ARP) and the Modular Caustic Side Solvent Extraction Unit (MCU). The two treatment options for the ARP Facility (a monosodium titanate (MST)-Strike option and a Filter-Only option) are dependent on the salt batch characteristics and whether the strontium and actinide concentrations are less than the Saltstone WAC limits. With the MST-Strike option, the ARP facility removes alpha-emitting and strontium radionuclides from dissolved salt through contacting the salt stream with MST and then removing the precipitated alpha and strontium solids in a crossflow filter at 512-S. For the Filter-Only option, which can only be used when the strontium and actinide concentrations of the salt batch are compliant with the Saltstone WAC, the salt solution is transferred from Tank 49 to 512-S and bypasses the MST strike operation at 241-96H. With both options the resultant filtered salt stream is sent to MCU for cesium removal. After the cesium is removed in MCU, the resultant decontaminated salt solution is transferred to Tank 50H for feed to Saltstone.

The low-activity wastewater streams from ETP, H Canyon and the HLW storage tanks will be stored in Tank 50H until they are pumped to the Saltstone Facility for treatment and disposal. Tank 50H is part of the H-Area Tank Farm. This document describes the Waste Acceptance Criteria that are required for the transfer of low-level aqueous waste from Tank 50H to the Saltstone Facility.

The Saltstone Facility (Z Area) consists of two facility segments: the Saltstone Production Facility (SPF), which receives and treats the salt solution to produce saltstone grout, and the Saltstone Disposal Facility (SDF), which consists of Saltstone Disposal Units (SDUs) used for the final disposal of the saltstone grout. Both the SPF and the SDF are located in Z Area. The SPF is permitted as a wastewater treatment facility per the South Carolina Department of Health and Environmental Control Regulations R.61-67. The SPF is exempted from Resource Conservation and Recovery Act (RCRA) permitting by the state of South Carolina due to the wastewater treatment unit exclusion, as defined by South Carolina Hazardous Waste Management Regulations R.61-79.270.1(c)(2)(v), R.61-79.264.1(g)(6), and R.61-79.265.1(g)(10). The SDF is permitted as a solid waste landfill site, as defined by South Carolina Department of Health and Environmental Control Regulations R61-107.19.

Low-level aqueous waste meeting these WAC can be safely transferred, stored and treated in the SPF for subsequent disposal as saltstone in the SDF.

2.0 SCOPE

These WAC are applicable to any aqueous waste transferred from Tank 50H to the Saltstone Facility through an interarea transfer line that connects Tank 50H to the Salt Feed Tank (SFT) in Z Area during Interim Salt Disposition Project (ISDP) operations. As presently permitted by the SCDHEC, all transfers of aqueous waste to the Saltstone Facility shall come through the jacketed pipeline that connects Tank 50H to the SFT (Ref. 4). Operation of Tank 50H and the interarea transfer line is controlled administratively by H-Area Tank Farm Operations. Saltstone Facility Operations assumes responsibility for the aqueous waste when it enters the SFT.

Except for salt solution transferred from Tank 50H, receipt of waste from outside Z Area is not presently within the scope of Saltstone Facility operations. Any waste treatment or disposal not in the present scope of Saltstone Facility operations requires prior approval by SCDHEC and DOE. Transfer of aqueous waste from onsite or offsite waste generators to Saltstone by any means other than through Tank 50H is not allowed. H-Area Tank Farm Operations is responsible for waste transfers into and from Tank 50H. Waste to be placed into Tank 50H shall meet acceptance criteria specified by H-Area Tank Farm Operations. These WAC should be reviewed by facilities receiving waste prior to accepting transfers, if any portion of the aqueous waste is ultimately sent to the Saltstone Facility for treatment and disposal.

These WAC do not apply to the shipment of aqueous waste from onsite or offsite generators directly to the SDF or to any other SRS facilities for treatment, storage or disposal.

The material in Tank 48H is not presently within the scope of the Saltstone WAC. Transfers of Tank 48 material to Saltstone are prohibited by this WAC.

These WAC do not apply to solid waste (non-radioactive, mixed or LLW) that could be transferred to Z Area for disposal in the SDF. Normally, such waste is not sent to Z Area for disposal, but to E Area. The use of Z-Area SDUs for disposal of solid waste generated outside of Z Area requires an Unreviewed Safety Question (USQ) evaluation, an Unreviewed Waste Management Question (UWMQ) evaluation, and approval of SCDHEC and DOE-SR.

The Saltstone Documented Safety Analysis (DSA) Revision 10 and associated Change Package include the addition of SDUs 3 and 5. The DSA has been revised to reflect only the Low Organics Mode. This WAC revision implements the Low Organics Mode (Isopar L $\leq$ 11 ppm).

3.0 TERMS AND DEFINITIONS

LIMIT: A type of acceptance criteria that, if not satisfied, will have an adverse impact on repository requirements [e.g., SCDHEC wastewater treatment and landfill permit requirements, DSA assumptions and Performance Assessment (PA) limits for key radionuclides Tc-99 and I-129]. Acceptance criteria designated as LIMITS must be met prior to transfer into Tank 50H or by blending in Tank 50H.

TARGET: A type of acceptance criteria that is set as a guideline to protect a LIMIT. Acceptance criteria designated as TARGETS will be monitored on a confirmatory basis (typically, quarterly, semi-annually or each salt batch). TARGETS are used to show compliance with regulatory requirements [maximum expected concentrations in permits, the 2009 PA, SDU flammability, and DSA assumed concentrations] when sample results/calculations/process knowledge indicate a significant margin exists between the maximum expected value and the regulatory requirement.

4.0 RESPONSIBILITIES

4.1 Tank Farm Facility Engineering (TF-FE) is responsible for:

- Reviewing the Saltstone WAC and concurring with the Implementation Checklist.
- Preparing and maintaining a Waste Compliance Plan (WCP) that will ensure compliance with the Saltstone WAC and will serve as an agreement between H-Area Tank Farm Operations and Saltstone Operations for the transfer of aqueous waste from Tank 50H to the SPF.
- Adhering to the principles of minimizing waste generation when designing or modifying a process that treats or produces aqueous waste to be sent to the SPF.
- Developing the Tank 50H Material Balance / Isopar L DSS Blend Calculation and providing monthly updates to the Material Balance / Blend Calculation that will be independently reviewed and approved by DWPF & Saltstone Facility Engineering.
- Supporting the Saltstone FINAL Calculation to ensure that LIMITS / TARGETS are being met in Tank 50H. When required, developing requests for deviations from the requirements of the Saltstone WAC.

4.2 H-Area Tank Farm (HTF) Operations is responsible for:

- Reviewing the Saltstone WAC and concurring with the Implementation Checklist.
- Pulling all samples for wastes transferred to Saltstone; however, ensuring the proper analyses are conducted on the sample depends on the basis of the sample. Analyses which fulfill the requirements of acceptance criteria as well as permit requirements are the shared responsibility of Saltstone Facility Engineering and TF-FE. Analyses which are needed to meet safety-related acceptance criteria not covered in the permit are the responsibility of TF-FE.
- Establishing auditable programs that show compliance with the Saltstone WAC.
- Approving a WCP that serves as an agreement between HTF Operations and Saltstone Operations for the transfer of aqueous waste from Tank 50H to the SPF.
- Financing corrective actions required due to a failure by HTF Operations to conform to this WAC.

4.3 DWPF & Saltstone Facility Engineering (D&S-FE) is responsible for:

- Serving as owner of the Saltstone WAC.
- Reviewing and approving the WCP prepared by TF-FE.
- Independently reviewing and approving that waste transfers meet the Saltstone Facility WAC (e.g., Saltstone FINAL Calculation).
- Reviewing and approving requests for deviations from the requirements of the Saltstone WAC.
- Assuring permit modifications required for continued operation(s) in Z Area are obtained.

4.4 Saltstone Environmental Support is responsible for:

- Reviewing and approving the Saltstone WAC.
- Reviewing and approving requests for deviations from the requirements of the Saltstone WAC.
- Preparing and maintaining notification and certification statement(s) as required by South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.268.9 for continued operations in Z Area.
- Making applicable notifications to SCDHEC.
- Maintaining applicable permits for continued operation(s) in Z Area.

4.5 Saltstone Operations is responsible for:

- Reviewing and approving the Saltstone WAC as well as ensuring compliance with the WAC.
- Meeting conditions for the treatment of salt solution and disposal of resulting saltstone grout, as defined in permits, DOE Orders, etc.
- Reviewing and approving the WCP prepared by TF-FE.
- Reviewing and approving requests for deviations from the requirements of these WAC.
- Accepting aqueous waste for storage, treatment and disposal in Z Area.
- Producing and disposing of saltstone grout safely and efficiently.
- Financing corrective actions due to Saltstone Operations nonconformance with the Saltstone WAC or any permit conditions.

5.0 PROCEDURE

5.1 General Information

The SPF in Z Area is permitted by SCDHEC as a wastewater treatment facility that converts mixed aqueous waste into a saltstone grout that is not classified as hazardous waste. The SDF is a solid waste landfill facility permitted by SCDHEC for the disposal of solid waste. The SDF cannot be used for the disposal of hazardous waste, and the non-hazardous nature of saltstone grout and compliance with Treatment Standards (TSs) for the eight RCRA metals must be certified by an EPA-certified laboratory by testing samples of solid saltstone using the Toxicity Characteristic Leach Procedure (TCLP). Compliance with both the hazardous limit and the corresponding TS for the RCRA metals ensures that the SDF meets the Land Disposal Restrictions (LDR) requirements.

Analyses that are required per the Permit are the responsibility of D&S-FE. Analyses that are required per the Permit and that fulfill other acceptance criteria as well are the shared responsibility of TF-FE and D&S-FE. Analyses that are conducted to meet all other Saltstone waste acceptance criteria are the responsibility of the sending facility. The proposed sampling strategy for samples that will need to be pulled from Tank 50H is provided in Table 1 (Ref. 5).

Grout formulation work to confirm that the Tank 50H salt solution when combined with the premix blend can make acceptable grout will be performed. As given in Table 1, periodic grout formulation samples will be pulled from Tank 50H so that the grout recipe can be modified to compensate for changes in the salt, organic or solids content of the salt solution feed.

NOTE: The Regulatory Compliance samples pulled in Tank 50H should be characterized for both LIMIT and TARGET acceptance criteria in this WAC.

TABLE 1: Tank 50 Samples Needed for Saltstone (Ref. 5)

Sample Size Pulled (Nominal Projection)	Frequency Pulled	Requirement	Sample Size	Basis
4.4 liter	SDU Classification (every 5 yrs) or New Waste Stream (e.g., Tank 48)	SDU Classification	1 liter	Required every 5 years and for the New Waste Stream Permit. Evaluates the landfill requirements and effects on groundwater.
		Initial TCLP	500 ml	Initial Verification of non-hazardous nature of grout and compliance with TSs for RCRA metals by EPA-certified laboratory.
		Initial Grout Formulation	2.9 liter	Initial Verification that the grout will meet the processing requirements.
2 liter	Each Salt Batch (as required by D&S-FE)	Grout Formulation	2 liter	Verification that the grout will meet the processing requirements.
850 mL	Quarterly or Each Salt Batch (as required by D&S-FE)	Regulatory Compliance Liquid - Chemistry	350 mL	Compliance of liquid chemistry with permit tables. Also, used in Saltstone FINAL Calculation that will be used to generate quarterly reports to SCDHEC. 200 mL of 350 mL sample needed for organic analysis. Speciation analysis will be required for the quarterly analysis (e.g., elemental mercury, etc.).
		Offsite TCLP	500 mL	Verification of non-hazardous nature of grout and compliance with TSs for RCRA metals by EPA-certified laboratory.
500 mL	Quarterly or Each Salt Batch (as required by D&S-FE.)	Regulatory Compliance Liquid - Radiological	500 mL	Compliance of liquid radionuclides with permit tables. Also, used in Saltstone FINAL Calculation that will be used to generate quarterly reports to SCDHEC.

These WAC are designed to assure that aqueous waste sent to the Saltstone Facility for treatment and disposal will:

- meet the conditions of acceptance specified in the Saltstone Facility safety basis and all permit conditions for treatment in the SPF and disposal in the SDF;
- produce saltstone that meets TCLP conditions needed to certify saltstone as non-hazardous waste, as required for disposal in the SDF;
- protect workers in the Saltstone Facility from unnecessary radiological and/or chemical hazards; and
- provide near-term and long-term protection of onsite personnel, offsite populations, the environment, and groundwater resources.

5.2 Applicability

These WAC are applicable to any mixed, low-level waste to be sent to the SPF from Tank 50H by current or future onsite or offsite generators of aqueous waste.

Because wastewater is transferred to the SFT through a pipeline that links the SPF to Tank 50H in the H-Area Tank Farm, these WAC always apply to any wastewater pumped into this pipeline.

These WAC do not apply to the production and disposal of failed equipment from Z-Area operations or other waste handling activities related to Z-Area operations. Separate Saltstone Facility procedures cover these operations.

5.3 Prerequisite Programmatic Waste Acceptance Criteria

5.3.1 Waste Characterization

Tank Farm Process Engineering shall have adequate knowledge and supporting documentation to demonstrate compliance with the WAC established in this procedure prior to the transfer of waste to the Saltstone Facility for treatment and disposal. Waste Characterization may be demonstrated by sampling and analysis or process knowledge. All sample results reported to demonstrate compliance must include the analytical uncertainty, and the uncertainty must be used in any subsequent calculations based on those results. If process knowledge is used as the means for compliance, conservatism should be applied to account for any uncertainties in the process knowledge. A means for periodic validation of process knowledge should be specified.

5.3.2 Waste Certification

Appropriate documentation demonstrating compliance with these WAC shall be provided by TF-FE to D&S-FE to support subsequent certification of saltstone as suitable for LLW disposal in the Z-Area SDUs. D&S-FE is responsible for maintaining the records that support certification of saltstone as suitable for disposal at the SDF, as defined in permits and in DOE Orders (Refs. 1, 6, 7, and 33).

5.4 Acceptance Criteria

NOTE: In cases where two or more criteria apply, the most restrictive acceptance criterion shall be met by the Tank Farm (e.g., chemical LIMITS to protect SDU flammability are, in most cases, more restrictive than the chemical LIMITS to protect chemical consequences in the DSA). If the WAC cannot be met, a deviation may be granted if justified by the generator and determined by D&S-FE to be within the safety basis and permit conditions for waste treatment and disposal in Z Area. Instructions for WAC deviations are located in ENG.08 (Ref. 8). Approval by DOE and/or SCDHEC may also be required before such transfers can occur.

5.4.1 Inhalation Dose Potential

5.4.1.1 Criteria: The inhalation dose potential (IDP) for the material to be transferred shall have a total rem/gallon value less than or equal to 1.66E+05 rem/gallon.

5.4.1.2 Criteria Type: LIMIT (**Saltstone TSR SAC - 5.6.2.1**)

5.4.1.3 Computational Technique: The inhalation dose potential is based on the cumulative sum of a mixture of radionuclide dose conversion factors multiplied by the bounding radionuclide concentration.

5.4.1.4 Background: Based on the DSA, the following radionuclides are significant contributors to inhalation dose: Sr-90, Cs-137, Eu-154, Pu-241 and Total α (Ref. 9). In Table 2 below, the WAC IDP concentrations were set at 90% of the IDP curie balance concentrations for Pu-241, 12.6% of the IDP curie balance concentrations for Sr-90, 3% of the IDP curie balance concentrations for Cs-137, and 80% of the IDP curie balance concentration for total alpha. The IDP curie balance for Eu-154 was set equal to the WAC Shielding basis in Section 5.4.11.

TABLE 2: Calculation of Inhalation Dose Potential WAC LIMIT

Radionuclide (Ref. 9)	**IDP Curie Balance Conc. (Ci/gallon) [pCi/mL] (Ref. 9)**	**WAC IDP Conc. (Ci/gallon) [pCi/mL]**	**Dose Conversion Factor (rem/Ci) (Ref. 9)**	**WAC Inhalation Dose Potential (rem/gallon)**
Sr-90	9.46E-02 [2.50E+07]	1.19E-02 [3.15E+06]	9.50E+04	1.13E+03
Cs-137	5.00E-01 [1.32E+08]	1.50E-02 [3.96E+06]	1.90E+04	2.85E+02
Eu-154	9.46E-03 [2.50E+06]	6.11E-06 [1.615E+03]	2.00E+05	1.22E+00
Pu-241	3.52E-03 [9.31E+05]	3.17E-03 [8.38E+05]	3.30E+06	1.05E+04
Total α	1.01E-03 [2.66E+05]	8.08E-04 [2.13E+05]	1.90E+08	1.54E+05
WAC LIMIT				**1.66E+05**

5.4.2 LIMITS for Chemicals Impacting SDU Flammability

5.4.2.1 Criteria: The concentrations of Isopar L, tetraphenylborate (TPB) (including a mass limit), ammonium, total mercury, monomethyl mercury and dimethyl mercury given in Table 3 shall not be exceeded to protect the assumptions used in the SDU explosion credibility calculations.

5.4.2.2 Criteria Type: LIMIT (**Saltstone TSR SAC - 5.6.2.1** – applies to Isopar L limit, TPB mass limit, ammonium limit)

5.4.2.3 Background: In order to protect assumptions associated with flammability in SDUs, the facility has set maximum WAC LIMITS on the following chemicals: Isopar L, TPB ammonia (analyte measured is ammonium), total mercury, monomethyl mercury and dimethyl mercury.

Salt solution from the MCU waste stream will contain Isopar L, which can be released under certain conditions to produce flammable vapors. The Isopar L concentration in salt solution shall be limited by the WAC to be less than or equal to 11 ppm.

The total mass of TPB to be received into the Saltstone Facility shall be limited to 4.24 kg to protect assumptions associated with flammable gas accumulation. Technical Report X-ESR-H-00137 (Ref. 11) estimates the residual mass of KTPB in Tank 50 in April 2008 to be 4.76 kg KTPB, which equates to 4.24 kg of TPB. The TPB limit ensures that no more than 4.15 kg of benzene can be generated. Further additions of TPB into Tank 50H are prohibited. Additionally, the facility has set a WAC LIMIT on the concentration of TPB in the waste feed stream to the TPB detection limit (5.0 mg/L).

Volatile ammonia may be produced and released when slag and fly ash (Saltstone dry feed chemicals) are mixed with salt solution. Additionally, cement and slag have the potential to release ammonia due to the grinding agents used in their production. Maintaining the ammonia concentration in salt solution less than 200 mg/L (or correspondingly, 212 mg/L for ammonium) is required to prevent exceeding ammonia's assumed contribution to Composite Lower Flammability Limit (CLFL).

The bounding case in the Evaluation of the Safety of the Situation – Methyl Mercury PISA (Ref. 59) indicates that establishing a fill height limit of 19.0 feet for SDU 3/5 is adequate to protect 100% CLFL with the addition of flammable mercury species to the flammable species already considered in the SDU 3/5 analysis. As discussed in the ESS, dimethyl mercury, which is the bounding mercury species from a flammability standpoint, may be formed at a rate that depends on the total concentration of mercury present (including total mercury and monomethyl mercury) (Ref. 59).

TABLE 3: Acceptance Criteria LIMITS/TARGETS for Chemical Contaminants Impacting SDU Flammability

Chemical Name	Chemical Formula	Molecular Weight (grams/mole)	WAC Concentrations
Isopar L	----	163	1.10E+01 ppm **[**WAC LIMIT - **SAC]**
Tetraphenylborate (TPB)	$B(C_6H_5)_4^-$	319.22	4.24E+00 kg total mass **[**WAC LIMIT - **SAC]** and 5.00E+00 mg/L
Ammonium	NH_4^+	18.04	2.12E+02 mg/L **[**WAC LIMIT - **SAC]**
Total Mercury	Hg	200.6	3.25E+02 mg/L [WAC LIMIT]
Monomethyl Mercury	CH_3Hg	215.6	3.25E+02 mg/L (WAC LIMIT]
Dimethyl Mercury	$(CH_3)_2Hg$	230.7	1.00E+00 mg/L [WAC TARGET]

5.4.3 Hydrogen Generation Rate

5.4.3.1 Criteria: The hydrogen generation rate for the salt solution to be transferred shall be less than 1.41E-08 ft^3 of hydrogen/hr/gal of salt solution in grout at 95ºC. The following radionuclides (Ref. 47) are to be considered in demonstrating compliance to the hydrogen generation rate:

Ba-137m, Y-90, Total α, Cs-137, Rh-106, Eu-154, Co-60, Sr-90, Sb-125, Cs-134, Tc-99, Pm-147, U-233, U-234, U-236, U-238, U-232, Pr-144, Ru-106, Te-125m

5.4.3.2 Criteria Type: LIMIT (**Saltstone TSR SAC - 5.6.2.1**)

5.4.3.3 Computational Technique: The hydrogen generation rate (HGR) at 95ºC shall be calculated from the radioactive decay heat using the following equation:

$$x_{rad} = \frac{R_{\beta/\gamma}H_{\beta/\gamma}+R_{\alpha}H_{\alpha}}{10^6} \times \frac{95+273.15}{25+273.15}$$

where:
$R_{\beta/\gamma}$ = amount of hydrogen generated per 10^6 British Thermal Unit (BTU) of heat added from beta or gamma decay
$H_{\beta/\gamma}$ = heat generated by beta and gamma decay
R_{α} = amount of hydrogen generated per 10^6 BTU of heat added from alpha decay
H_{α} = heat generated by alpha decay

The values of R_{α} and $R_{\beta/\gamma}$ are dependent on the concentrations of nitrate and nitrite in the waste and are given by the equations:

$$R_{\alpha} = 134.7 - 82.3\cdot(NO_{eff})^{1/3} - 13.6\cdot(NO_{eff})^{2/3} + 11.8\cdot(NO_{eff})$$
$$R_{\beta/\gamma} = 48.36 - 52.78\cdot(NO_{eff})^{1/3} + 14.1\cdot(NO_{eff})^{2/3} + 0.572\cdot(NO_{eff})$$

where:
NO_{eff} = the nitrate concentration plus one-quarter the nitrite concentration

The heat generated by alpha and beta/gamma decay is determined by the equations:

$$H_{\alpha} = \sum_i Q_i * A_i$$
$$H_{\beta/\gamma} = \sum_j Q_j * A_j$$

where:
H_{α} = total heat generated by alpha decay
Q_i = heat generated per curie for each isotope that decays by alpha
A_i = total activity of each isotope that decays by alpha
$H_{\beta/\gamma}$ = total heat generated by beta or gamma decay
Q_j = heat generated per curie for each isotope that decays by beta or gamma
A_j = total activity of each isotope that decays by beta or gamma

5.4.3.4 Background: The HGR for a given waste depends on the radiation dose to the waste and the concentration of any hydrogen scavengers that may be present. Free ions of nitrate (NO_3) and nitrite (NO_2) are scavengers that serve to decrease the overall hydrogen gas. To account for the scavenging effect of both of these ions, the NO_{eff}, equal to the nitrate concentration plus one-half the nitrite concentration, is used in the HGR equation. During the production of Saltstone grout, reactions occur between nitrite and the slag which result in a reduction in the concentration of nitrite in salt solution. Therefore, the NO_{eff} shall be equal to the nitrate concentration plus one-quarter the nitrite concentration.

5.4.4 "Other Organics" Contribution to SDU Flammability

5.4.4.1 Criteria: The volatiles in salt solution other than Isopar L, benzene, ammonia and hydrogen shall contribute less than 10% to the Composite Lower Flammability Limit (CLFL) at peak CLFL concentrations. These "other organics" include butanol, tributylphosphate (TBP) (which decomposes to butanol and dibutylphosphate), isopropanol, methanol and NORPAR 13.

5.4.4.2 Criteria Type: LIMIT (**Saltstone TSR SAC - 5.6.2.1**)

5.4.4.3 Computational Technique: In addition to Isopar L, benzene (via decomposition of TPB) and ammonia, the following organics may be present in the salt solution feed to Saltstone: butanol, TBP, isopropanol, methanol and NORPAR 13. TF-FE must verify that these five volatiles contribute less than 10% to the CLFL at the time the SDU is at its peak percent of CLFL in one of two methods:

(a) Ensure that the concentrations of the five organics are less than the WAC values given in Table 4.

OR

(b) Perform an analysis consistent with S-CLC-Z-00067 for SDU 4 (Ref. 12) or S-CLC-Z-00080 for cylindrical SDU cell design (Ref. 54) to show that the CLFL contribution of the five organics remains below 10%.

TABLE 4: Concentrations of "Other Organics" Impacting SDU Flammability

(Low Organics Mode: Isopar L ≤ 11 ppm)

Chemical Name	Chemical Formula	Molecular Weight (grams/mole)	WAC Concentrations (mg/L)
Butanol	C_4H_9OH	74.12	0.75
Tributylphosphate	$(C_4H_9O)_3PO$	266.32	1.0
Isopropanol	C_3H_7OH	60.09	0.25
Methanol	CH_3OH	32.04	0.05
NORPAR 13	----	187	0.1

5.4.4.4 Background: Calculations S-CLC-Z-00067 (Ref. 12) and S-CLC-Z-00080 (Ref. 54) determined that the "other organics" in the salt solution (i.e., butanol, TBP, isopropanol, methanol and NORPAR 13) do not contribute greater than 10% of the CLFL based on reasonable conservative assumptions. This waste acceptance criterion ensures that the contribution from these five organics remain within the DSA analysis (Ref. 13). Calculations performed to ensure compliance shall be performed consistent with the E7 Manual, which requires verification/checking.

5.4.5 Nuclear Criticality Safety

5.4.5.1 Criteria: The concentrations of U-233, U-235, Pu-241 and Total α given in Attachment 8.3 shall not be exceeded to protect the fissile material inputs in the Saltstone Nuclear Criticality Safety Evaluation (NCSE).

5.4.5.2 Criteria Type: LIMIT (**Saltstone TSR SAC - 5.6.2.1**)

5.4.5.3 Background: The nuclear criticality safety-related LIMITS given in Attachment 8.3 are based on the fissile material activity limits (pCi/mL) for U-233, U-235, Pu-239 and Pu-241 included in the Saltstone NCSE (Ref. 23). (The Pu-239 concentration is bounded by Total α, and therefore Total α is included in Attachment 8.3 to ensure the assumed Pu-239 concentration in the NCSE is met.) As long as these LIMITS in Attachment 8.3 are met, there are no credible criticality scenarios identified for activities involved with the processing and disposal of salt solution at the Saltstone Facility.

5.4.6 Chemical Criteria LIMITS

5.4.6.1 Criteria: The LIMIT concentrations of the chemicals shown in Attachment 8.1 shall not be exceeded. NOTE: Known chemicals not included in Attachments 8.1 and 8.2 but greater than or equal to 0.5 mole per liter shall not be transferred to Saltstone without formal review and authorization by D&S-FE, Saltstone Environmental Support, and Saltstone Operations.

Additionally, the following criteria must be met:

- Only aqueous waste can be transferred to the Saltstone Facility.
- The transfer of waste to the Saltstone Facility that contains or would be capable of generating toxic gases, vapors, or fumes (excluding tritium) in quantities harmful to persons during normal transport, storage, handling, treatment, or disposal operations in Z Area is prohibited.
- The transfer of <u>any</u> waste to the Saltstone Facility that is classified as a listed waste, as designated by South Carolina Hazardous Waste Management Regulations or the EPA, is strictly prohibited unless prior approval by SCDHEC and DOE is granted.
- The transfer of aqueous waste to the Saltstone Facility that would result in the saltstone being classified as hazardous waste, as designated by South Carolina Hazardous Waste Management Regulations or the EPA, is strictly prohibited.

5.4.6.2 Criteria Type: LIMIT (**Saltstone TSR SAC - 5.6.2.1** applies to 5 chemicals whose concentrations are significant to chemical consequences in the DSA accident analyses: aluminate (bounded by aluminum), ammonium, hydroxide, nitrate, and nitrite.)

5.4.6.3 Background: Concentrations of hazardous contaminants, volatile contaminants, and other chemical contaminants listed in Attachment 8.1 shall be at or below the LIMITS specified in order to transfer aqueous waste to the Saltstone Facility (Refs. 1, 13-22, 24, and 33).

Waste known to contain hazardous contaminants, volatile contaminants or chelating agents that are not specifically listed in Attachment 8.1 require formal review and authorization by D&S-FE, Saltstone Environmental Support, and Saltstone Operations, before such waste can be transferred to the Saltstone Facility (Refs. 6, 13, 14, 21, 22, 24).

Formal review and authorization by D&S-FE, Saltstone Environmental Support, and Saltstone Operations is required in order to transfer waste that contains known non-hazardous contaminants that are not listed in Attachments 8.1 and 8.2, if the concentration of a contaminant is greater than or equal to 0.5 mole per liter. These non-hazardous contaminants include, but are not limited to, the following chemicals commonly found in SRS waste streams: formate ($HCOO^-$), cerium (Ce), cesium (Cs), magnesium (Mg), neodymium (Nd), ruthenium (Ru), titanium (Ti), and zirconium (Zr).

*[**NOTE:** The level of 0.5 mole per liter is based on technical judgment for the concentration of a contaminant that is easily detected and could require testing and/or reformulation to assure saltstone is acceptable.]*

The total mercury WAC LIMIT of 325 mg/L protects the "Low Mercury Subcategory" threshold of 260 mg/kg, which equates to 325 mg/L assuming a salt solution aqueous waste density of 1.25 g/mL. Other species of mercury may be present in the waste stream but are considered to be bounded from a chemical consequence perspective by monomethyl mercury, which is also shown in Attachment 8.1 and has the same WAC LIMIT as total mercury (325 mg/L).

5.4.7 Chemical Criteria TARGETS

5.4.7.1 Criteria: The TARGET concentrations of the chemicals shown in Attachment 8.2 shall not be exceeded.

5.4.7.2 Criteria Type: TARGET

5.4.7.3 Background: Exceedance of TARGET chemical concentrations does not require a WAC deviation. However, D&S-FE, Saltstone Environmental Support, and Saltstone Operations shall be notified when the concentration of any chemical contaminant in waste to be transferred exceeds the TARGETS shown in Attachment 8.2.

5.4.8 Radionuclide Criteria LIMITS

5.4.8.1 Criteria: The LIMIT concentrations of the radionuclides shown in Attachment 8.3 shall not be exceeded. NOTE: Known radionuclides not included in Attachments 8.3 and 8.4 but having an activity concentration greater than or equal to 1.25E+04 pCi/mL shall not be transferred to Saltstone without formal review and authorization by D&S-FE, Saltstone Environmental Support, and Saltstone Operations.

5.4.8.2 Criteria Type: LIMIT

5.4.8.3 Background: Appendix 1 provides the bases for the acceptance criteria of radionuclides identified in the Permit (Ref. 2), the Documented Safety Analysis (Ref. 13) and the 2009 Performance Assessment (Refs. 25 and 37). Formal review and authorization by D&S-FE, Saltstone Environmental Support, and Saltstone Operations is required for the transfer of waste known to contain a radionuclide that is not specifically listed in Attachments 8.3 and 8.4, if the radionuclide concentration in the waste stream is greater than or equal to 1.25E+04 pCi/mL (10 nCi/g).

The transfer of aqueous waste to the Saltstone Facility that would produce solid saltstone classified as TRU waste or HLW waste is prohibited (Refs. 1, 6, 13, 14, 27, 33).

The disposal of waste in the Saltstone Disposal Facility SDUs is controlled via the 2009 Performance Assessment document (Ref. 25). The 2009 PA has been updated to establish limits for radionuclides that would potentially provide a dose to the public via groundwater, air, radon or intruder scenarios (Ref. 25). Reference 37 was specifically written to provide radionuclide concentrations for the WAC that will protect the conclusions of the 2009 PA but does not require strict compliance with the projected inventory assumptions found in the 2009 PA. The UWMQ Process will be followed for any radionuclide concentration exceeding a WAC LIMIT (Ref. 29).

As needed, special analyses (SA) are performed to evaluate the significance of new information or new analytical methods on the conclusions reached based on an approved PA. In 2013, an SA was completed and DOE-approved that evaluated new information against the 2009 PA (Ref. 25). The FY2013 SA (Ref. 52) documents the assurance that all applicable performance objectives (per 2009 PA) associated with the operation and closure of the Saltstone Disposal Facility will continue to be met. SRR-CWDA-2013-00097 (Ref. 50) is used in conjunction with the FY2013 SA to provide recommended concentration values for implementing the FY2013 SA. SRR-CWDA-2013-00141 (Ref. 53) documents the assurance that all applicable performance objectives in the 2009 PA are met based on completely filling Saltstone SDUs (excluding SDUs 1 and 4) with saltstone containing radionuclide concentrations as recommended for implementing the FY2013 SA.

In September 2014 the FY2014 SA (Ref. 57) was issued to address the following items: (1) to reflect the change in future disposal unit design from 150-foot diameter future disposal cells to 375-foot diameter SDUs, (2) to update the modeled inventory for all SDUs, (3) to increase the fill height (i.e., no clean cap) for the 150-foot and 375-foot diameter SDUs, and (4) to address remaining DOE review group secondary issues including enhancement to the Tc-99 model. SRR-CWDA-2015-00007 (Ref. 55) specifically addresses the Tc-99 concentration limit change to implement the FY2014 SA. The dose results in the FY2014 SA were presented both deterministically and probabilistically to support that reasonable expectation/assurance exists that all performance objectives in DOE M435.1-1 and 10CFR Part 61 will be met.

Attachments 8.3 and 8.4 show the Saltstone WAC LIMITS and TARGET values that implement the FY2013/FY2014 SA per References 50, 52 and 57.

5.4.9 Radionuclide Criteria TARGETS

5.4.9.1 Criteria: The TARGET concentrations of the radionuclides shown in Attachment 8.4 shall not be exceeded.

5.4.9.2 Criteria Type: TARGET

5.4.9.3 Background: Exceedance of TARGET radionuclide concentrations does not require a WAC deviation. However, D&S-FE, Saltstone Environmental Support, and Saltstone Operations shall be notified when the concentration of any radionuclide contaminant in waste to be transferred exceeds the TARGETS shown in Attachment 8.4.

Consistent with the Radionuclide Criteria LIMITS section, exceedance of a WAC TARGET value will also require the UWMQ Process as described in ENG. 46 (Ref. 29).

5.4.10 General Processing Criteria

5.4.10.1 Criteria: Transfers into the Saltstone Facility shall meet the known processing constraints given in Table 5.

5.4.10.2 Criteria Type: LIMIT

5.4.10.3 Background: See Basis section in Table 5.

TABLE 5: Saltstone Processing Criteria WAC LIMITS

Processing Criterion	Basis
pH > 10	Corrosion Control
2.5 M < [Na^+] < 7.0 M	This range represents a nominal salt concentration in the feed stream. Grout formulation work will be completed on each new salt batch (or as required) and the water-to-premix ratio will be determined during this testing.
10°C < Temperature < 40°C	If the feed material is less than 10°C, then the probability of exceeding the solubility of salt contaminants increases. At feed temperatures above 40°C, grout quality is reduced. Processing with feed below 40°C ensures that the grout mixture does not exceed 95°C (i.e., would create steam cured grout, forms cracks in the saltstone).
Total Insoluble Solids < 1.88E+05 mg/L (15 wt. %)	This suspended solids concentration is the design basis of the Salt Feed Tank agitator.
Homogeneous & Consistent Feed	The Saltstone Facility requires a homogeneous and consistent feed due to the complexity of the grout formulation.

5.4.11 Gamma Shielding

5.4.11.1 Criteria: The specific gamma source strength value of 5.82E+00 mR/hr/gallon shall not be exceeded unless additional RCO controls or shielding is added. Also, the concentration for Cs-137 shall meet the LIMIT set in Attachment 8.3.

5.4.11.2 Criteria Type: LIMIT

5.4.11.3 Computational Technique: The specific gamma source strength value is based on the cumulative sum of a mixture of radionuclide specific gamma dose constants multiplied by the radionuclide concentration.

5.4.11.4 Background: The gamma source strength value provides a common means for comparing the radionuclide distribution assumed in the Saltstone design basis and the variable radionuclide feed being sent to Tank 50H and Saltstone. Significant gamma sources used for Saltstone shielding criteria include Co-60, Sb-125, Te-125m, Cs-134, Cs-137 and Eu-154 (Ref. 10 and 42). Te-125m is in secular equilibrium with 22.9% of its parent, Sb-125, activity (Ref. 43). The concentration of Cs-134 can be calculated using the ratio of 0.0046 Cs-134/Cs-137 as given in Reference 44. Saltstone DSA accident analyses assumed a Cs-137 concentration of 0.5 Ci/gal whereas Saltstone shielding calculations assume 0.03 Ci/gal for SDU cylindrical disposal cells including 2- and 4-pack arrangements and the 210-S Building post-Enhanced Low Activity Waste Disposition (ELAWD) Project modifications (Ref. 10). The SDU 3 and 5 Project is using a Cs-137 concentration of 0.015 Ci/gal (Ref. 42) as a basis for shielding. Verification that the Saltstone WAC LIMITS of 5.82E+00 mR/hr/gal and Cs-137 concentration of 0.015 Ci/gal are met also ensures compliance to the limits assumed in the Saltstone DSA Accident Analyses.

In Table 6, the WAC shielding concentrations were set at 90% of the shielding curie balance concentrations assumed in the Saltstone shielding calculations, with the exception of the Cs-134 and Cs-137.

TABLE 6: Calculation of Gamma Source Strength WAC LIMIT

Radionuclide (Ref. 9)	Shielding Curie Balance Conc. (Ci/gallon) [pCi/mL] (Ref. 10 and 42)	WAC Shielding Conc. (Ci/gallon) [pCi/mL]	Gamma Dose Constant (mR/hr/Ci) (Ref. 34)	WAC Gamma Source Strength (mR/hr/gal)
Co-60	4.10E-06 [1.083E+03]	3.69E-06 [9.747E+02]	1.37E+03	5.06E-03
Sb-125	3.36E-05 [8.876E+03]	3.02E-05 [7.988E+03]	3.80E+02	1.15E-02
Te-125m	7.69E-06 [2.031E+03]	6.92E-06 [1.828E+03]	2.28E+02	1.58E-03
Cs-134	6.90E-05 [1.82E+04]	6.90E-05 [1.82E+04]	9.99E+02	6.89E-02
Cs-137	1.50E-02 [3.96E+06]	1.50E-02 [3.96E+06]	3.82E+02	5.73E+00
Eu-154	6.79E-06 [1.794E+03]	6.11E-06 [1.615E+03]	7.56E+02	4.62E-03
WAC LIMIT				**5.82E+00**

5.4.12 ARP/MCU Processing Requirements

5.4.12.1 Criteria: The following criteria associated with ARP/MCU processing requirements are to protect the critical inputs and assumptions that are used to demonstrate compliance to the 2009 Saltstone PA and the Waste Determination (WD). The two ARP treatment options (MST-Strike and Filter-Only) are provided and are dependent on the salt batch characteristics and whether the strontium and actinide concentrations are less than the Saltstone WAC limits.

For the MST-Strike option at ARP:

1. All material passed through ARP passes through a cross-flow filter (at 512-S) to remove and concentrate the insoluble solids.
2. The concentrated solids heel in the filter feed tank (at 512-S) is washed and filtered to remove soluble sodium salts.
3. If a salt solution is processed through ARP, Monosodium Titanate (MST) strikes are conducted.
4. MST strike tank contents are agitated between 4 and 24 hours.

For the Filter-Only option at ARP:

1. All material passed through ARP passes through a cross-flow filter (at 512-S) to remove and concentrate the insoluble solids.
2. The concentrated solids heel in the filter feed tank (at 512-S) is washed and filtered to remove soluble sodium salts.

5.4.12.2 Criteria Type: LIMIT

5.4.12.3 Background: The UWMQ Requirements Document for the Saltstone Facility is to protect the critical inputs and assumptions used to develop the WD and the 2009 Saltstone PA. SDF personnel will refer to the Requirements Document to ensure all of the Proposed Activities (or New Data) that may impact the PA or WD are reviewed for continued compliance (Ref. 39). Several critical screening criteria listed in Reference 39 can potentially be impacted by salt solution processing through ARP/MCU. Therefore, these requirements listed above must be met prior to transferring from Tank 50H.

For the Filter-Only option at ARP, SRR-CWDA-2014-00114 (Ref. 56) was issued to document that Filter-Only operations will continue to meet all performance objectives as supported by the SDF PA (Ref. 25) and the subsequent Special Analyses (Refs. 52, 57).

5.4.13 Regulatory Criteria

5.4.13.1 Criteria:

A. For the quarterly Tank 50 samples, the toxicity (i.e., hazardous) TCLP limits and TCLP treatment standard (TSs) for the eight RCRA metals shown in Table 7 shall not be exceeded.

B. For the salt batch stream influents into Tank 50H (i.e., DSS or 512-S wash water that bypasses MCU), the salt batch qualification tank (e.g., Tank 21H) TCLP sample shall meet the toxicity and TS limits for mercury given in Table 7 prior to transfer of the new salt batch to the ARP/MCU feed tank (e.g., Tank 49H).

C. For the other low-volume influents to Tank 50H (e.g., ETP and H Canyon streams), the streams shall be characterized for total mercury. Specifically, for ETP transfers to Tank 50H, the ETP Waste Collection Hold Tank (WCHT) shall be sampled and analyzed to confirm the total mercury concentration is less than the ETP total mercury characterization value prior to transfer.

TABLE 7: Regulatory TCLP Limits for RCRA Metals

RCRA Metal	Regulatory Limit		Unit
	Toxicity	TS	
Arsenic (As)	5	5	mg/L
Barium (Ba)	100	21	mg/L
Cadmium (Cd)	1	0.11	mg/L
Chromium (Cr)	5	0.6	mg/L
Lead (Pb)	5	0.75	mg/L
Mercury (Hg)	0.2	0.025	mg/L
Selenium (Se)	1	5.7	mg/L
Silver (Ag)	5	0.14	mg/L

5.4.13.2 Criteria Type: LIMIT

5.4.13.3 Background: During operation, a saltstone solution sample is collected from Tank 50H quarterly and used to prepare a SDF waste form (saltstone) sample. This saltstone sample determines the nonhazardous nature of the grout to meet the requirements of the SCDHEC SCHWMR R.61-79.261.24 and R.61-79.268.48. Additionally, compliance with TSs for the eight RCRA metals must be demonstrated using TCLP. Compliance with both the hazardous limit and the corresponding TSs for the RCRA metals ensures that the SDF meets the Land Disposal Restrictions (LDR) requirements.

A combination of regulatory controls, including TCLP measurements and required total mercury characterization for Tank 50H influent streams, provides confidence that permit requirements will be met. The quarterly Tank 50H TCLP (permit requirement) and the salt batch qualification tank TCLP (an additional control to ensure mercury material balance around Tank 50H is satisfied) are single data points and therefore have no associated uncertainty.

To assess the impact of mercury being disposed within the SDF, SRR-CWDA-2015-00069 (Ref. 60) was issued. This assessment concluded that increasing the mercury inventories (e. g., salt solution concentrations of total mercury up to 700 mg/L) and/or increasing the percentage of organic content does not adversely impact the conclusions previously drawn from the SDF PA (Ref. 25) or the subsequent Special Analyses (Refs. 52, 57).

5.5 Administrative Controls

5.5.1 Waste Forecasts

To assure adequate storage, treatment and disposal capacity will be available for future operation of the Saltstone Facility, the Liquid Waste Planning team will be used to provide projected waste forecasts (Refs. 6, 26).

5.5.2 Waste Compliance Plan

A Waste Compliance Plan (WCP) prepared by TF-FE that describes the controls or procedures imposed by HTF Operations (responsible for Tank 50H operations) to meet these WAC shall be prepared for review and approval by D&S-FE and Saltstone Operations. The WCP serves as the primary agreement between H-Tank Farm and Saltstone to assure waste compositions comply with the WAC (Ref. 6).

5.5.3 Documentation

NOTE: Sufficient information must be included in monthly summaries to enable calculation of the overall waste composition for the total volume of waste transferred to the Saltstone Facility. Concentrations of contaminants may be based on direct analysis of waste in Tank 50H, direct analysis of influents to Tank 50H, calculations combining process knowledge and analysis of influents to a waste generator's process, calculations based on process knowledge, calculations based on transfers into and out of Tank 50H, calculations based on analyses provided by the Saltstone Facility, or any combination of these methods.

As a minimum, TF-FE and/or HTF Operations shall:

- Retain auditable records for at least 3 years of any chemical, radiological and/or calculational analyses that are used to prepare documents that describe the composition of waste transferred to the Saltstone Facility (Refs. 6, 13, 27, 30, 31).
- Provide a Tank 50H Material Balance monthly update to D&S-FE for any month in which a transfer is made to the Saltstone Facility. The volume(s) and composition(s) of all transfers from Tank 50H to the Saltstone Facility that were made within the month shall be covered by the update. Sufficient information shall be provided in the update to demonstrate all individual transfers are in compliance with the acceptance criteria documented in this WAC (Refs. 6, 13, 27, 30, 31).
- Perform an Isopar L Blend Calculation to specify the allowable total volume of DSS that is authorized for transfer from MCU to Tank 50H to ensure that the Isopar L LIMIT will not be exceeded (Ref. 13). Representative batch sampling and analysis at MCU shall occur to support the material balance and blend calculations (Ref. 13).
- Assure, prior to each transfer from Tank 50H, that analyses (sampling, calculation, process knowledge, or combination) of current Tank 50H contents and applicable uncertainties are available to D&S-FE and Saltstone Operations (Refs. 1, 6, 13, 14, 31, and 33).
- Assist D&S-FE and Saltstone Operations in obtaining samples from Tank 50H for analysis associated with LIMIT and TARGET acceptance criteria in this WAC and the confirmatory samples to fulfill permit requirements for saltstone production and disposal (Refs. 1, 13, 14, 33).
- Complete all analyses and/or calculations described in the Waste Compliance Plan.

6.0 RECORDS

Records are generated in accordance with operations procedures and will be considered quality assurance records and maintained in accordance with Procedure Manual 1Q, Quality Assurance Manual, QAP-17-1, "Quality Assurance Records Management" and Procedure Manual 1B, Management Requirements and Procedures.

7.0 REFERENCES

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2. ESH-EPG-2004-00194, Notification of Changes to Waste Influent Concentrations at the Z-Area Saltstone Industrial Wastewater Treatment Facility and Industrial Solid Waste Landfill
3. ESH-EPG-2005-00131, Changes to the Waste Influent Concentrations at the Z-Area Saltstone Industrial Wastewater Treatment Facility and Industrial Solid Waste Landfill
4. Modified Permit for the Savannah River Site (SRS) Z-Area Saltstone Disposal Facility, Facility ID No. 025500-1603, Aiken County (January 23, 2007; May 12, 2011)
5. CBU-PIT-2005-00014, Rev. 0, Sampling Integration Document for Tank 50 Point of Compliance Transfers to Saltstone
6. DOE Order 435.1, Radioactive Waste Management
7. "NESHAP Construction and Operation Permission for DWPF Facilities (S-Area, Z-Area)," U.S. Environmental Protection Agency Region IV, 345 Courtland St., Atlanta, GA 30365 (April 25, 1988)
8. S4-ENG.08, Waste Acceptance Criteria, Waste Compliance Plan, and Special Waste Compliance Plan
9. N-CLC-Z-00012, Rev. 1, Gamma Source Strength and Inhalation Dose Potential for Saltstone Processing
10. N-ESR-Z-00001, Rev. 1, Technical Justification for Shielding Design Basis Values Supporting Salt Disposition Integration (SDI) Modifications at the Saltstone Production Facility (SPF)
11. X-ESR-H-00137, Rev. 0, Estimated Residual Mass of Potassium Tetraphenylborate in the Heel of Tank 50H
12. S-CLC-Z-00067, Rev. 5, Maximum Amount of Isopar L to Remain Below the Lower Flammability Limit
13. WSRC-SA-2003-00001, Rev. 11, Saltstone Facility Documented Safety Analysis
14. WSRC-OX-89-15-001, Rev. 4, Transfer of Salt Solution from Tank 50H to Saltstone
15. DPST-88-372, Recommended Salt Solution Feed Specifications for Z Area (Revised)
16. DPST-88-559, Organics in TCLP Extracts of Saltstone
17. DPST-89-314, Guidance on Z-Area Salt Solution Toxic Metal Concentrations Based on EP Toxicity Tests for Saltstone
18. DPST-89-342, EP Toxicity Results for Simulated Saltstone Made in the Z-Area Plant
19. WSRC-RP-89-1375, Revised Mercury Limit for Z-Area Salt Solution Based on Groundwater Protection Criteria
20. DPST-85-417, Estimated Composition of Decontaminated Salt Solution Feed to Saltstone," Internal Report
21. WSRC-RP-91-262, Setting Properties of DWPF Saltstone Made from Reference Solution Containing Monarch Cleaner
22. WSRC-RP-93-1185, Evaluation of the Effects of Tributylphosphate (Defoaming Agent) in Z-Area Saltstone
23. N-NCS-Z-00001, Rev. 12, Nuclear Criticality Safety Evaluation for Z-Area
24. ESH-FSG-910942, Receipt of Additional Cleaning Agents in the Z-Area Saltstone Manufacturing Facility
25. SRR-CWDA-2009-00017, Rev. 0, Performance Assessment for the Saltstone Disposal Facility at the Savannah River Site
26. CBU-PIT-2005-00013, Rev. 3, Radionuclide Concentrations in Saltstone
27. South Carolina Hazardous Waste Regulation, R.61-79.261
28. Deleted
29. S4-ENG.46, LW Unreviewed Waste Management Question (UWMQ)

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59. U-ESS-Z-00001, Rev. 0, Evaluation of the Safety of the Situation (ESS): Higher than Expected Concentration of Methyl Mercury in Tank 50 (PISA PI-2015-0007), May 2015
60. SRR-CWDA-2015-00069, Rev. 0, Impact Assessment of Mercury Uncertainties within the SDF PA and SDF Special Analyses, May 2015

8.0 ATTACHMENTS

Attachment 8.1: Acceptance Criteria LIMITS for Chemical Contaminants in Aqueous Waste Transferred to Z Area

Chemical Name	Chemical Formula	Mol. Weight (grams/mole)	WAC LIMIT (mg/L)	Basis [2]
Solvated Ions				
Aluminate [5]	$Al(OH)_4^-$	95.02	4.08E+05 **[SAC]**	61.6% of DSA Value
Ammonium [6]	NH_4^+	18.04	2.12E+02 **[SAC]**	91% of DSA Value (Ref. 51)
Carbonate	CO_3^{2-}	60.01	1.20E+05	75% of DSA Value
Chloride	Cl^-	35.45	7.95E+03	75% of DSA Value
Fluoride	F^-	19.00	4.07E+03	75% of DSA Value
Hydroxide	OH^-	17.01	1.58E+05 **[SAC]**	75% of DSA Value
Nitrate	NO_3^-	62.01	4.37E+05 **[SAC]**	75% of DSA Value.
Nitrite	NO_2^-	46.01	2.14E+05 **[SAC]**	75% of DSA Value
Oxalate	$C_2O_4^{2-}$	88.02	2.72E+04	75% of DSA Value
Phosphate	PO_4^{3-}	94.97	2.94E+04	75% of DSA Value
Sulfate	SO_4^{2-}	96.06	5.69E+04	75% of DSA Value
RCRA Hazardous Metals				
Arsenic[6]	As	74.92	2.30E+01	91% of DSA Value (Ref. 51)
Barium	Ba	137.3	6.19E+02	75% of DSA Value
Cadmium	Cd	112.4	3.10E+02	75% of DSA Value
Chromium	Cr	52.00	1.24E+03	75% of DSA Value
Lead	Pb	207.2	6.19E+02	75% of DSA Value
Total Mercury [1, 3]	Hg	200.6	3.25E+02	91% of ESS Value
Elemental Mercury	Hg	200.6	8.92E+01	91% of ESS Value
Selenium	Se	78.96	4.46E+02	90% of DSA Value
Silver	Ag	107.9	6.19E+02	75% of DSA Value
Other Metals				
Aluminum	Al^{3+}	26.98	1.16E+05	75% of DSA Value
Potassium	K	39.10	3.03E+04	75% of DSA Value
Suspended Hydrated-Sludge Solids				
Nickel Hydroxide	$Ni(OH)_2$	92.71	1.17E+03	75% of DSA Value
Organic Compounds				
Butanol [1] & Isobutanol [1]	C_4H_9OH	74.12	7.73E+00	75% of DSA Value
Isopropanol [1]	C_3H_7OH	60.09	1.88E+00	75% of DSA Value
Phenol[6]	C_6H_5OH	94.11	7.50E+02	91% of DSA Value (Ref. 51)
Isopar L [1]	----	163	1.10E+01 ppm [4]	100% of DSA Value
Total Organic Carbon	----	----	5.00E+03	83% of Permit Max.
Tetraphenylborate (TPB) [1]	$B(C_6H_5)_4^-$	319.22	5.00E+00	91% of DSA Value
Monomethyl Mercury	CH_3Hg	215.6	3.25E+02	91% of ESS Value

Footnote 1: The WAC LIMITS given above are based on bounding DSA concentrations for accident consequence analysis. However, to protect assumptions associated with flammable gas accumulation in SDUs, more restrictive concentrations have been set for specific chemicals - see Tables 3 and 4. Additionally, to protect regulatory limits for the final Saltstone grout, additional requirements are being imposed on the influent streams to Tank 50H in Section 5.4.13.1.

Footnote 2: The Permit maximum expected concentrations are concentrations that are not expected to be exceeded. However, exceedance of a Permit Max expected concentration is not a regulatory violation. According to SCDHEC Permit #18,801-IW, Special Condition #2, and the Saltstone Disposal Facility Permit ID No. 025500-1603 General Conditions B.2, B.3, B.4, and B.9, if the influent chemical concentration changes appreciably from those identified in the Permit Engineering Report, SCDHEC must be immediately notified with a follow up report within 30 days addressing the change in the salt solution characteristics and its effect on the Saltstone disposal area (Refs. 1, 4 and 34).

Footnote 3: The total mercury WAC LIMIT of 325 mg/L protects the "Low Mercury Subcategory" threshold of 260 mg/kg, which equates to 325 mg/L assuming a salt solution aqueous waste density of 1.25 g/mL.

Footnote 4: The WAC LIMIT for Isopar L is given in ppm not mg/L.

Footnote 5: Aluminate is not measured. The demonstration of SAC compliance is by meeting the Aluminum concentration as there cannot be more moles of aluminate than moles of aluminum.

Footnote 6: X-CLC-Z-00033, Rev. 3 (Ref. 51) provides recommended concentration for the WAC LIMITS for Ammonium, Arsenic, and Phenol.

Attachment 8.2: Acceptance Criteria TARGETS for Chemical Contaminants in Aqueous Waste Transferred to Z Area

The chemicals listed in this attachment are included in the DSA but are not considered significant contributors to accidents analyzed in the DSA at their current DSA concentrations. The concentrations of these chemicals will be determined on a confirmatory (quarterly) basis in Tank 50H. If a TARGET concentration is exceeded, then D&S-FE will reevaluate the TARGET concentration for the chemical and supply a new TARGET value to ensure the individual chemical concentration limit is protected for the SDU.

Chemical Name	Chemical Formula	Molecular Weight (grams/mole)	WAC TARGET (mg/L)	Basis [4]
Other Metals				
Boron	B	10.81	7.43E+02	75% of DSA Value
Cobalt[5]	Co	58.93	1.75E+02	91% of DSA Value (Ref. 51)
Copper	Cu	63.55	7.43E+02	75% of DSA Value
Iron	Fe	55.85	4.95E+03	75% of DSA Value
Lithium	Li	6.94	7.43E+02	75% of DSA Value
Manganese	Mn	54.94	7.43E+02	75% of DSA Value
Molybdenum	Mo	95.94	7.43E+02	75% of DSA Value
Nickel	Ni	58.70	7.43E+02	75% of DSA Value
Silicon	Si	28.09	1.07E+04	75% of DSA Value
Strontium	Sr	87.62	7.43E+02	75% of DSA Value
Zinc	Zn	65.38	8.03E+02	75% of DSA Value
Organic Compounds				
Benzene [1]	C_6H_6	78.11	3.10E+02	75% of DSA Value
Methanol [2]	CH_3OH	32.04	1.88E+00	75% of DSA Value
Dibutylphosphate (DBP)	$C_8H_{19}O_4P$	210.21	3.47E+02	75% of DSA Value
Tributylphosphate (TBP) [2]	$(C_4H_9O)_3PO$	266.32	7.50E+00	75% of DSA Value
Toluene [3]	$C_6H_5CH_3$	92.13	3.10E+02	75% of DSA Value
EDTA [3]	----	292.25	3.10E+02	75% of DSA Value
NORPAR 13		187	1.0E-01	100% of SDU Flammability Value
Dimethyl Mercury	$(CH_3)_2Hg$	230.7	1.00E+00	91% of DSA Value

Footnote 1: The only source of benzene is from the decomposition of TPB.

Footnote 2: The WAC TARGETS given above are based on bounding DSA concentrations for accident consequence analysis. However, to protect assumptions associated with flammable gas accumulation in SDUs, more restrictive concentrations have been set for methanol and TBP - see Table 4.

Footnote 3: The SDU 4 flammability calculation (S-CLC-Z-00067) or cylindrical SDU flammability calculation (S-CLC-Z-00080) assume no toluene and EDTA in the salt solution. Detection of these two chemicals above the minimum detection level requires immediate notification of D&S-FE.

Footnote 4: The Permit maximum expected concentrations are concentrations that are not expected to be exceeded. However, exceedance of a Permit Max expected concentration is not a regulatory violation. According to SCDHEC Permit #18,801-IW, Special Condition #2, and the Saltstone Disposal Facility Permit ID No. 025500-1603 General Conditions B.2, B.3, B.4, and B.9, if the influent chemical concentration changes appreciably from those identified in the Permit Engineering Report, SCDHEC must be immediately notified with a follow up report within 30 days addressing the change in the salt solution characteristics and its effect on the Saltstone disposal area (Refs. 1, 4, and 33).

Footnote 5: X-CLC-Z-00033, Rev. 3 (Ref. 51) provides recommended concentration for the WAC TARGET for Cobalt.

Attachment 8.3: Acceptance Criteria LIMITS for Radioactive Contaminants in Aqueous Waste Transferred to Z Area

The radionuclides listed in this attachment are limited by the bases listed (i.e., NRC Class, DSA, Permit or NCSE). Material to be transferred to Tank 50H must meet these LIMITS prior to transfer or by blending in Tank 50H. Note: Co-60 will not exceed its NRC limit as long as the Gamma Shielding WAC LIMIT is met – see WAC Section 5.4.1211.

Radionuclide	WAC LIMIT (pCi/mL)	Basis
H-3	5.63E+05	90% of DSA Value & Permit Max. (NRC Class A)
C-14	1.13E+05	90% of DSA Value & Permit Max. (NRC Class A)
Ni-63	1.13E+05	90% of DSA Value & Permit Max. (NRC Class A)
Sr-90	3.15E+06	12.6% of DSA Value and Permit Max.
Tc-99	2.11E+05	SRR-CWDA-2015-00007 (Ref. 55) and SRR-CWDA-2014-00006 (Ref. 57)
I-129	6.30E+01	2009 PA Implementation (Ref. 37), SRR-CWDA-2013-00097 (Ref. 50), and SRR-CWDA-2013-00141 (Ref. 53)
Cs-137	3.96E+06	100% of Cs-137 Conc. Limit in Shielding
U-233	1.13E+04 **[SAC]**	90% of DSA Value (NCSE)
U-235	1.13E+02 **[SAC]**	90% of DSA Value (NCSE)
Pu-241	8.38E+05 **[SAC]**	90% of DSA Value (NRC Class A, NCSE)
Total α [1]	2.13E+05 **[SAC]**	80% of Permit Max. (NRC Class C, NCSE)

Footnote 1: The Total α WAC LIMIT bounds all alpha emitting isotopes (TRU, Radium Isotopes, Uranium Isotopes, Thorium Isotopes, and Protactinium Isotopes) except for U-233 and U-235 which have lower WAC LIMITS due to criticality concerns.

Attachment 8.4: Acceptance Criteria TARGETS for Radioactive Contaminants in Aqueous Waste Transferred to Z Area

Many of the radionuclides listed in this attachment have TARGET acceptance criteria to protect the Performance Analysis (PA) and Special Analysis (SA) Performance Objectives (Ref. 50). Other radionuclides have TARGET concentration levels to protect the DSA and permit values. The basis for each WAC TARGET is given below and is also provided in further detail in Appendix 1.

The concentrations of these radionuclides will be determined on a confirmatory basis in Tank 50H – at least semiannually and currently on a quarterly basis. If a TARGET concentration is exceeded, then D&S-FE will reevaluate the TARGET concentration for the radionuclide to ensure the regulatory requirement is protected.

Radionuclide	WAC TARGET (pCi/mL)	Basis [1]
Al-26	2.88E+03	90% of DSA Value
Co-60	9.747E+02	90% of Co-60 Conc. in Shielding
K-40	1.00E+02	2009 PA Implementation
Ni-59	1.13E+03	2009 PA Implementation
Se-79	1.90E+04	2009 PA Implementation
Y-90	3.15E+06	12.6% of DSA Value and Permit Max.
Zr-93	1.00E+05	2009 PA Implementation
Nb-94	1.53E+02	2009 PA Implementation
Ru-106	1.13E+06	90% of DSA Value & Permit Max.
Rh-106	1.13E+06	90% of DSA Value & Permit Max.
Sb-125	7.988E+03	90% of Sb-125 Conc. in Shielding
Te-125m	1.828E+03	90% of Te-125m Conc. in Shielding
Sn-126	1.80E+04	90% of DSA Value and Permit Max.
Cs-134	1.82E+04	100% of Cs-134 Conc. in Shielding
Cs-135	2.50E+02	2009 PA Implementation and SRR-CWDA-2013-00097 (Ref. 50)
Ba-137m	3.75E+06	6% Permit Max.
Ce-144	1.13E+05	90% of DSA Value
Pm-147	5.63E+06	90% of DSA Value & Permit Max.
Sm-151	2.25E+04	90% of DSA Value & Permit Max.
Eu-154	1.615E+03	90% of Eu-154 Conc. in Shielding
Eu-155	1.13E+04	90% of DSA Value & Permit Max.
Ra-226	1.00E+03	2009 PA Implementation
Ra-228	1.00E+04	2009 PA Implementation
Ac-227	1.00E+04	2009 PA Implementation
Th-229	1.63E+05	2009 PA Implementation
Th-230	6.26E+03	2009 PA Implementation
Th-232	2.88E+03	90% of DSA Value
Pa-231	1.00E+03	2009 PA Implementation
U-232	9.06E+03	5.3% of 2009 PA Implementation
U-234	1.13E+04	90% of DSA Value
U-236	1.13E+04	90% of DSA Value
U-238	1.13E+04	90% of DSA Value
Np-237	1.00E+04	2009 PA Implementation
Pu-238	2.13E+05	80% of DSA Value
Pu-239	2.13E+05	80% of DSA Value
Pu-240	2.13E+05	80% of DSA Value
Pu-242	2.13E+05	80% of DSA Value

Radionuclide	WAC TARGET (pCi/mL)	Basis [1]
Pu-244	7.02E+04	2009 PA Implementation
Am-241	2.13E+05	80% of DSA Value
Am-242m	4.50E+05	90% of Permit Max.
Am-243	2.13E+05	80% of DSA Value
Cm-242	1.13E+04	90% of DSA Value
Cm-244	2.13E+05	80% of DSA Value
Cm-245	2.25E+05	90% of Permit Max.

Footnote 1: The Permit maximum expected concentrations are concentrations that are not expected to be exceeded. However, exceedance of a Permit Max expected concentration is not a regulatory violation. According to SCDHEC Permit #18,801-IW, Special Condition #2**,** and the Saltstone Disposal Facility Permit ID No. 025500-1603 General Conditions B.2, B.3, B.4, and B.9, if the influent radionuclide concentration changes appreciably from those identified in the Permit Engineering Report, SCDHEC must be immediately notified with a follow up report within 30 days addressing the change in the salt solution characteristics and its effect on the Saltstone disposal area (Refs. 1, 4, and 33).

X-SD-Z-00001, Rev. 14

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APPENDIX 1

Bases for Radiological and Chemical WAC, Permit, DSA, and Performance Analysis Criteria at the Saltstone Facility

Note: For references included in this Basis section, see Section 7.0 (References).

Comparison of Radiological Concentrations for Saltstone

Radionuclide NRC Limits in pCi/mL	**WAC LIMIT/TARGET** **pCi/mL**	**Permit Max. Concentration (Ref. 3)** **pCi/mL (nCi/g)**	**DSA Source Term (Ref. 13)** **pCi/mL**	**Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation pCi/mL**	**Basis**
H-3 NRC Class A = 6.26E+07	5.63E+05	6.26E+05 (501)	6.26E+05	5.63E+05	The permit max. concentration and DSA source term for H-3 are set equal to 1% of the NRC Class A landfill limit of 6.26E+07 pCi/mL. The WAC LIMIT is set to a value equal to 90% of the permit max. concentration and DSA value. The recommended H-3 concentration for implementation of the 2009 PA is set at the WAC LIMIT [Ref. 37].
C-14 NRC Class A = 1.25E+06 NRC Class C = 1.25E+07	1.13E+05	1.25E+05 (100)	1.25E+05	1.13E+05	The permit max. concentration and DSA source term for C-14 are set equal to 10% of the NRC Class A landfill limit of 1000 nCi/g (1.25E+06 pCi/mL). The WAC LIMIT is set to a value equal to 90% of the permit max. concentration and DSA value. The recommended C-14 concentration for implementation of the 2009 PA is set at the WAC LIMIT [Ref. 37].
Na-22	Not Required	None	None	N/A	There are no DSA, permit or WAC LIMITS/TARGETS for Na-22. Na-22 does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
Al-26	2.88E+03	None	3.20E+03	2.88E+03	The DSA has an Al-26 limit of 3.20E+03 pCi/mL. Solubility considerations limit Al (as sodium aluminate) to less than 81 mg/mL. As a result, there is no permit max. concentration for Al-26. The WAC TARGET is set to a value equal to 90% of the DSA value. The recommended Al-26 concentration for implementation of the 2009 PA is set at the WAC TARGET [Ref. 37].
Cl-36	Not Required	None	None	2.25E+02	There are no DSA or permit maximum concentrations for Cl-36. The recommended Cl-36 concentration for implementation of the 2009 PA is set at 2.25E+02 pCi/mL [Ref. 37]. A special method presented in Ref. 38 documents that the Cl-36 concentration can be conservatively estimated by multiplying the Sr-90 concentration by 1.0E-05. Therefore, there is no WAC LIMIT/TARGET for Cl-36.
K-40	1.00E+02	None	None	1.00E+02	There are no DSA or permit maximum concentrations for K-40. The WAC TARGET is set at the recommended K-40 concentration for implementation of the 2009 PA of 1.00E+02 pCi/mL. This WAC TARGET value is ~ 100X the 4th Quarter 2011 Tank 50 sample detection limit [Ref. 37].
Co-60 NRC Class A = 1.09E+09	Gamma Shielding WAC LIMIT (TARGET = 9.747E+02)	1.25E+06 (1000)	1.25E+06	1.13E+06	The permit max. concentration and DSA source term for Co-60 are set at a maximum assumed value of 1.25E+06 pCi/mL (1000 nCi/g), which is ~0.1% of the NRC Class A landfill limit of 1.09E+09 pCi/mL. Co-60 has been identified as a significant contributor in the gamma shielding WAC LIMIT [Ref. 10]. The WAC TARGET is set to a value equal to 90% of the Co-60 concentration assumed in the shielding calculations. The recommended Co-60 concentration for implementation of the 2009 PA is set at 90% of the permit max concentration and DSA source term [Ref. 37].

Radionuclide NRC Limits in pCi/mL	**WAC LIMIT/TARGET** **pCi/mL**	**Permit Max. Concentration (Ref. 3)** **pCi/mL (nCi/g)**	**DSA Source Term (Ref. 13)** **pCi/mL**	**Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation pCi/mL**	**Basis**
Ni-59	1.13E+03	1.25E+05 (100)	1.25E+05	1.13E+03	The permit max. concentration and DSA source term for Ni-59 are set at a maximum assumed value of 1.25E+05 pCi/mL (100 nCi/g). The WAC TARGET is set to a value equal to 1/100 of 90% of the permit max. concentration and DSA value. The recommended Ni-59 concentration for implementation of the 2009 PA is set at the WAC TARGET [Ref. 37].
Ni-63 NRC Class A = 5.48E+06 NRC Class C = 1.10E+09	1.13E+05	1.25E+05 (100)	1.25E+05	1.13E+05	The permit max. concentration and DSA source term for Ni-63 are set at a maximum assumed value of 1.25E+05 pCi/mL (100 nCi/g), which is 2.3% of the NRC Class A landfill limit of 5.48E+06 pCi/mL. The WAC LIMIT is set to a value equal to 90% of the permit max. concentration and DSA value. The recommended Ni-63 concentration for implementation of the 2009 PA is set at the WAC LIMIT [Ref. 37].
Se-79	1.90E+04	1.25E+05 (100)	1.25E+05	1.90E+04	The permit max. concentration and DSA source term for Se-79 are set at a maximum assumed value of 100 nCi/g. The recommended Se-79 concentration for implementation of the 2009 PA is set to the same value assumed for the 2005 Special Analysis (SA) in a previous Saltstone WAC revision. The WAC TARGET is set to 1.90E+04 pCi/mL [Ref. 37].
Sr-90 NRC Class A = 6.26E+04 NRC Class C = 1.10E+10	3.15E+06 and IDP WAC LIMIT	2.50E+07 (20,000)	2.50E+07	2.25E+07	The permit max. concentration and DSA source term for Sr-90 are set at a maximum assumed value of 2.50E+07 pCi/mL. This level is about 0.23% of the NRC Class C landfill limit of 1.10E+10 pCi/mL. Sr-90 (assuming the DSA concentration) has been identified as a significant contributor in the IDP acceptance criterion [Ref. 9]. The WAC LIMIT is set to a value equal to 12.6% of the permit max. concentration and DSA value. The recommended Sr-90 concentration for implementation of the 2009 PA was set at the WAC Rev 11 LIMIT [Ref. 37].
Y-90	3.15E+06	2.50E+07 (20,000)	2.50E+07	N/A ($T_{1/2}$ < 5 yrs)	The permit max. concentration and DSA source term for Y-90 are set at a maximum assumed value of 2.50E+07 pCi/mL. . Y-90 is a major contributor to hydrogen generation and such is designated as a target. Y-90 is in secular equilibrium with its parent, Sr-90. Y-90 does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
Zr-93	1.00E+05	None	None	1.00E+05	There are no DSA or permit maximum concentrations for Zr-93. The WAC TARGET is set at the recommended Zr-93 concentration for implementation of the 2009 PA of 1.00E+05 pCi/mL. This WAC TARGET value is ~2500X the 4th Quarter 2011 Tank 50 sample detected value for Nb-93m, which is in secular equilibrium with Zr-93 [Ref. 37].
Nb-93m	Not Required	None	None	1.00E+05	There are no DSA or permit maximum concentrations for Nb-93m. The activity of Nb-93m is bounded by the activity of its parent radionuclide Zr-93. Therefore, there is no WAC LIMIT/TARGET for Nb-93m.

Radionuclide NRC Limits in pCi/mL	**WAC LIMIT/TARGET** **pCi/mL**	**Permit Max. Concentration (Ref. 3)** **pCi/mL (nCi/g)**	**DSA Source Term (Ref. 13)** **pCi/mL**	**Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation pCi/mL**	**Basis**
Nb-94	1.53E+02	None	1.70E+04	1.53E+02	The DSA source term for Nb-94 is set at a maximum assumed value of 1.70E+04 pCi/mL. The WAC TARGET is set to a value equal to 1/100 of 90% of the DSA value. The recommended Nb-94 concentration for implementation of the 2009 PA is set at the WAC TARGET [Ref. 37].
Tc-99 NRC Class A = 4.69E+05 NRC Class C = 4.69E+06	2.11E+05	4.69E+05 (375)	4.69E+06	2.11E+05	The DSA source term is set equal to the NRC Class C landfill limit of 4.69E+06 pCi/mL. The permit max. concentration is set equal to the NRC Class A landfill limit of 4.69E+05 pCi/mL. The WAC LIMIT is based on analyses of the inventories used in the FY2014 SA as documented in SRR-CWDA-2015-00007, Rev. 0 (Refs. 55, 57).
Ru-106	1.13E+06	1.25E+06 (1000)	1.25E+06	N/A ($t_{1/2}$ < 5 yrs)	The permit max. concentration and DSA source term are set at a maximum assumed value of 1.25E+06 pCi/mL (1000 nCi/g). The WAC TARGET is set to a value equal to 90% of the permit max. concentration and DSA value. Ru-106 does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
Rh-106	1.13E+06	1.25E+06 (1000)	Included as part of Ru-106 activity	N/A ($t_{1/2}$ < 5 yrs)	Because the half-life of Rh-106 is so short compared to its parent, the dose of Rh-106 is accounted for in the dose of its parent radionuclide Ru-106. Rh-106 is in secular equilibrium with its parent. It is a major contributor to hydrogen generation and as such is a target. The permit max. concentration is set at a maximum assumed value of 1000 nCi/g. Rh-106 does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
Pd-107	Not Required	None	None	1.00E+03	There are no DSA or permit maximum concentrations for Pd-107. The recommended Pd-107 concentration for implementation of the 2009 PA is set at 1.00E+03 pCi/mL [Ref. 37]. Based on the total soluble inventory in F and H Tank Farm, the expected concentration for Pd-107 is 1.09 pCi/mL [Ref. 38], which is significantly below the 1.00E+03 pCi/mL assumed concentration for PA implementation. Therefore, there is no WAC LIMIT/TARGET for Pd-107.
Sb-125	Gamma Shielding WAC LIMIT (TARGET = 7.988E+03)	2.50E+06 (2000)	2.50E+06	N/A ($t_{1/2}$ < 5 yrs)	The permit max. concentration and DSA source term are set at a maximum assumed value of 2.50E+06 pCi/mL (2000 nCi/g). Sb-125 has been identified as a significant contributor in the gamma shielding acceptance criterion [Ref. 10]. The WAC TARGET is set to a value equal to 90% of the Sb-125 concentration assumed in the shielding calculations. Sb-125 does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
Te-125m	Gamma Shielding WAC Limit (Target = 1.828E+03)	2.50E+06 (2000)	2.50E+06	N/A ($t_{1/2}$ < 5 yrs)	The permit max. concentration and DSA source term are set at a maximum assumed value of 2.50E+06 pCi/mL (2000 nCi/g). . Te-125m is in secular equilibrium with 22.9% of its parent, Sb-125. Te-125m does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).

Radionuclide NRC Limits in pCi/mL	**WAC LIMIT/TARGET** **pCi/mL**	**Permit Max. Concentration (Ref. 3)** **pCi/mL (nCi/g)**	**DSA Source Term (Ref. 13)** **pCi/mL**	**Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation pCi/mL**	**Basis**
Sn-126	1.80E+04	2.00E+04 (16)	2.00E+04	1.80E+04	The permit max. concentration and DSA source term are set at a maximum assumed value of 2.00E+04 pCi/mL (16 nCi/g). The WAC TARGET is set to a value equal to 90% of the permit max. concentration and DSA value. The recommended Sn-126 concentration for implementation of the 2009 PA is set at 90% of the permit max concentration and DSA source term [Ref. 37].
Sb-126	Not Required	2.00E+04 (16)	2.00E+04	N/A ($t_{1/2}$ < 5 yrs)	The permit max. concentration and DSA source term are set at a maximum assumed value of 2.0E+04 pCi/mL (16 nCi/g). Because the half-life of Sb-126 is short compared to its parent, the activity of Sb-126 is bounded by the activity of its parent radionuclide Sn-126. Therefore, no specific WAC LIMIT/TARGET is set for Sb-126. Sb-126 does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
Sb-126m	Not Required	2.00E+04 (16)	2.00E+04	N/A ($t_{1/2}$ < 5 yrs)	The permit max. concentration and DSA source term are set at a maximum assumed value of 2.0E+04 pCi/mL (16 nCi/g). Because the half-life of Sb-126m is short compared to its parent, the activity of Sb-126m is bounded by the activity of its parent radionuclide Sn-126. Therefore, no specific WAC LIMIT/TARGET is set for Sb-126m. Sb-126m does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
I-129 NRC Class A = 1.25E+04 NRC Class C = 1.25E+05	6.30E+01	1.25E+03 (1)	1.25E+05	6.30E+01	The DSA source term is set equal to the NRC Class C landfill limit of 1.25E+05 pCi/mL. The permit max. concentration is set equal to 10% of the NRC Class A landfill limit of 1.25E+04 pCi/mL. The WAC LIMIT is set to a value equal to that recommended in SRR-CWDA-2013-00097, Rev. 0 (Ref. 50).
Cs-134	Gamma Shielding WAC LIMIT (TARGET =1.82E+04)	1.25E+06 (1000)	1.25E+06	N/A ($t_{1/2}$ < 5 yrs)	The permit max. concentration and DSA source term are set at a maximum assumed value of 1.25E+06 pCi/mL (1000 nCi/g). Cs-134 has been identified as a significant contributor in the gamma shielding acceptance criterion [Ref. 10]. The WAC TARGET is set to a value equal to 90% of the Cs-134 concentration assumed in the shielding calculations. Cs-134 does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
Cs-135	2.50E+02	None	1.25E+06	2.50E+02	The DSA source term is set at a maximum assumed value of 1.25E+06 pCi/mL (1000 nCi/g). The WAC TARGET is set at the recommended Cs-135 concentration per SRR-CWDA-2013-00097, Rev. 0 (Ref. 50).

Radionuclide NRC Limits in pCi/mL	**WAC LIMIT/TARGET** **pCi/mL**	**Permit Max. Concentration (Ref. 3)** **pCi/mL (nCi/g)**	**DSA Source Term (Ref. 13)** **pCi/mL**	**Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation pCi/mL**	**Basis**
Cs-137 NRC Class A = 1.56E+06 NRC Class C = 7.20E+09	3.96E+06 and Gamma Shielding and IDP WAC LIMIT	6.25E+07 (50,000)	1.32E+08	4.75E+07	The DSA source term for Cs-137 is set at a maximum assumed value of 0.5 Ci/gal (1.32E+08 pCi/mL), which is about 1.8% of the NRC Class C landfill limit of 7.20E+09 pCi/ml. The permit max. concentration is set at a maximum assumed value of 0.24 Ci/gal (6.25E+07 pCi/mL). Cs-137 has been identified as a significant contributor in both the gamma shielding acceptance criterion (assuming 0.03 Ci/gal) [Ref. 10] and the IDP acceptance criterion (assuming 0.5 Ci/gal) [Ref. 9]. The WAC LIMIT is set to a value equal to 50% of the 0.03 Ci/gal concentration value assumed in the gamma shielding calculation. The recommended Cs-137 concentration for implementation of the 2009 PA is set at the previous Saltstone WAC LIMIT corresponding to the 90% of the 0.20 Ci/gal concentration assumed in the shielding calculations [Ref. 37].
Ba-137m	3.75E+06	6.25E+07 (50,000)	Included as part of Cs-137 activity	N/A ($T_{1/2}$ < 5 yrs)	Because the half-life of Ba-137m is so short compared to its parent, the dose of Ba-137m is accounted for in the dose of its parent radionuclide Cs-137. Ba-137m is in secular equilibrium with 94.6% of the Cs-137 activity. Ba-137m is a major contributor to hydrogen generation and as such has a target value. The permit max. concentration is set to a value of 6.25E+07 pCi/mL (50,000 nCi/g). Ba-137m does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
Ce-144	1.13E+05	None	1.25E+05	N/A ($t_{1/2}$ < 5 yrs)	The DSA source term is set at a maximum assumed value of 1.25E+05 pCi/mL (100 nCi/g). The WAC TARGET is set to a value equal to 90% of the DSA value. Ce-144 does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
Pr-144	Not Required	None	1.25E+05	N/A ($t_{1/2}$ < 5 yrs)	The DSA source term is set at a maximum assumed value of 1.25E+05 pCi/mL (100 nCi/g). Because the half-life of Pr-144 is short compared to its parent, the activity of Pr-144 is bounded by the activity of its parent radionuclide Ce-144. Therefore, no specific WAC LIMIT/TARGET is set for Pr-144. Pr-144 does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
Pm-147	5.63E+06	6.25E+06 (5000)	6.25E+06	N/A ($t_{1/2}$ < 5 yrs)	The permit max. concentration and DSA source term are set at a maximum assumed value of 6.25E+06 pCi/mL (5000 nCi/g). The WAC TARGET is set to a value equal to 90% of the permit max. concentration and DSA value. Pm-147 does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
Sm-151	2.25E+04	2.50E+04 (20)	2.50E+04	2.25E+04	The permit max. concentration and DSA source term are set at a maximum assumed value of 2.50E+04 pCi/mL (20 nCi/g). The WAC TARGET is set to a value equal to 90% of the permit max. concentration and DSA value. The recommended Sm-151 concentration for implementation of the 2009 PA is set at the WAC TARGET [Ref. 37].

Radionuclide NRC Limits in pCi/mL	**WAC LIMIT/TARGET** **pCi/mL**	**Permit Max. Concentration (Ref. 3)** **pCi/mL (nCi/g)**	**DSA Source Term (Ref. 13)** **pCi/mL**	**Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation pCi/mL**	**Basis**
Eu-152	Not Required	None	None	1.21E+08	There is no permit maximum concentration or DSA source term for Eu-152. The recommended Eu-152 concentration for implementation of the 2009 PA is set at 1.21E+08 pCi/mL [Ref. 37]. However, Reference 37 also documents that at this concentration, Eu-152 is not a dose contributor to the 2009 PA. Therefore, there is no WAC LIMIT/TARGET for Eu-152.
Eu-154	Gamma Shielding and IDP WAC LIMITS (TARGET = 1.615E+03)	2.50E+06 (2000)	2.50E+06	2.25E+06	The permit max. concentration and DSA source term are set at a maximum assumed value of 2.50E+06 pCi/mL (2000 nCi/g). Eu-154 has been identified as a significant contributor in both the gamma shielding [Ref. 10] and IDP acceptance criteria [Ref. 9]. The WAC TARGET is set to a value equal to 90% of the Eu-154 concentration assumed in the shielding calculations, which is more restrictive than the concentration assumed in the IDP calculation. The recommended Eu-154 concentration for implementation of the 2009 PA is set at 90% of the permit max concentration / DSA source term [Ref. 37].
Eu-155	1.13E+04	1.25E+04 (10)	1.25E+04	N/A ($t_{1/2}$ < 5 yrs)	The permit max. concentration and DSA source term are set at a maximum assumed value of 1.25E+04 pCi/mL (10 nCi/g). The WAC TARGET is set to a value equal to 90% of the permit max. concentration and DSA value. Eu-155 does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
Pt-193	Not Required	None	None	1.00E+09	There are no DSA or permit maximum concentrations for Pt-193. The recommended Pt-193 concentration for implementation of the 2009 PA is set at 1.00E+09 pCi/mL [Ref. 37]. Based on the total soluble inventory in F and H Tank Farm, the expected concentration for Pt-193 is 3.0E+02 pCi/mL [Ref. 38], which is significantly below the 1.00E+09 pCi/mL assumed concentration for PA implementation. Therefore, there is no WAC LIMIT/TARGET for Pt-193.
Ra-226 (α)	1.00E+03	None	None	1.00E+03	There are no DSA or permit maximum concentrations for Ra-226. The WAC TARGET is set at the recommended Ra-226 concentration for implementation of the 2009 PA of 1.00E+03 pCi/mL. This WAC TARGET value is ~166X the 4th Quarter 2011 Tank 50 sample detection limit [Ref. 37].
Ra-228	1.00E+04	None	None	1.00E+04	There are no DSA or permit maximum concentrations for Ra-228. The WAC TARGET is set at the recommended Ra-228 concentration for implementation of the 2009 PA of 1.00E+04 pCi/mL. This WAC TARGET value is set at the requested detection limit [Ref. 37].
Ac-227	1.00E+04	None	None	1.00E+04	There are no DSA or permit maximum concentrations for Ac-227. The WAC TARGET is set at the recommended Ac-227 concentration for implementation of the 2009 PA of 1.00E+04 pCi/mL. This WAC TARGET value is set at the requested detection limit [Ref. 37].

Radionuclide NRC Limits in pCi/mL	WAC LIMIT/TARGET pCi/mL	Permit Max. Concentration (Ref. 3) pCi/mL (nCi/g)	DSA Source Term (Ref. 13) pCi/mL	Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation pCi/mL	Basis
Th-229 (α)	1.63E+05	None	None	1.63E+05	There are no DSA or permit maximum concentrations for Th-229. The recommended Th-229 concentration for implementation of the 2009 PA is set to the same value assumed for the 2005 Special Analysis (SA) in a previous Saltstone WAC revision. The WAC TARGET is set to 1.63E+05 pCi/mL [Ref. 37].
Th-230 (α)	6.26E+03	None	None	6.26E+03	There are no DSA or permit maximum concentrations for Th-230. The recommended Th-230 concentration for implementation of the 2009 PA is set to the same value assumed for the 2005 Special Analysis (SA) in a previous Saltstone WAC revision. The WAC TARGET is set to 6.26E+03 pCi/mL [Ref. 37].
Th-232 (α)	2.88E+03	None	3.20E+03	2.88E+03	The DSA source term is set at a maximum assumed value of 3.20E+03 pCi/mL. The WAC TARGET is set to a value equal to 90% of the DSA value. The recommended Th-232 concentration for implementation of the 2009 PA is set at the WAC TARGET [Ref. 37].
Pa-231 (α)	1.00E+03	None	None	1.00E+03	There are no DSA or permit maximum concentrations for Pa-231. The WAC TARGET is set at the recommended Pa-231 concentration for implementation of the 2009 PA of 1.00E+03 pCi/mL. This WAC TARGET value is ~100X the 4th Quarter 2011 Tank 50 sample detection limit [Ref. 37].
U-232 (α)	9.06E+03	None	None	1.71E+05	There are no DSA or permit maximum concentrations for U-232. The recommended U-232 concentration for implementation of the 2009 PA is set to the same value assumed for the 2005 Special Analysis (SA) in a previous Saltstone WAC revision. [Ref. 37]. The WAC TARGET is set to 9.06E+03 pCi/mL.
U-233 (α)	1.13E+04	None	1.25E+04	1.13E+04	The DSA source term is set at a maximum assumed value of 1.25E+04 (10 nCi/g) to protect the NCSE [Ref. 23]. The WAC LIMIT is set to a value equal to 90% of the DSA value. The recommended U-233 concentration for implementation of the 2009 PA is set at the WAC LIMIT [Ref. 37].
U-234 (α)	1.13E+04	None	1.25E+04	1.13E+04	The DSA source term is set at a maximum assumed value of 1.25E+04 pCi/mL(10 nCi/g). The WAC TARGET is set to a value equal to 90% of the DSA value. The recommended U-234 concentration for implementation of the 2009 PA is set at the WAC TARGET [Ref. 37].
U-235 (α)	1.13E+02	None	1.25E+02	1.13E+02	The DSA source term is set at a maximum assumed value of 1.25E+02 (0.1 nCi/g) to protect the NCSE [Ref. 23]. The WAC LIMIT is set to a value equal to 90% of the DSA value. The recommended U-233 concentration for implementation of the 2009 PA is set at the WAC LIMIT [Ref. 37].
U-236 (α)	1.13E+04	None	1.25E+04	1.13E+04	The DSA source term is set at a maximum assumed value of 1.25E+04 pCi/mL (10 nCi/g). The WAC TARGET is set to a value equal to 90% of the DSA value. The recommended U-236 concentration for implementation of the 2009 PA is set at the WAC TARGET [Ref. 37].

Radionuclide NRC Limits in pCi/mL	**WAC LIMIT/TARGET** **pCi/mL**	**Permit Max. Concentration (Ref. 3)** **pCi/mL (nCi/g)**	**DSA Source Term (Ref. 13)** **pCi/mL**	**Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation pCi/mL**	**Basis**
U-238 (α)	1.13E+04	None	1.25E+04	1.13E+04	The DSA source term is set at a maximum assumed value of 1.25E+04 pCi/mL (10 nCi/g). The WAC TARGET is set to a value equal to 90% of the DSA value. The recommended U-238 concentration for implementation of the 2009 PA is set at the WAC TARGET [Ref. 37].
Np-237 (α) ($t_{1/2}$ > 5 yr)	IDP WAC LIMIT (TARGET = 1.00E+04)	2.50E+05 (200)	Bounded by Pu-239	1.00E+04	The dose contribution due to Np-237 in the DSA accident analysis is bounded by setting the [Pu-239] at 2.66E+05 pCi/mL (213 nCi/g). Np-237 concentration is bounded by the total alpha term in the IDP WAC LIMIT. The permit max. concentration is set at a maximum assumed value of 2.50E+05 pCi/mL (200 nCi/g), which is 94% of the NRC Class C limit for total alpha. The WAC TARGET is set at the recommended Np-237 concentration for implementation of the 2009 PA of 1.00E+04 pCi/mL. This WAC TARGET value is ~500X the 4th Quarter 2011 Tank 50 sample detection limit [Ref. 37].
Pu-238 (α) ($t_{1/2}$ > 5 yr)	IDP WAC LIMIT (TARGET =2.13E+05)	2.50E+05 (200)	Bounded by Pu-239	2.50E+05	The dose contribution due to Pu-238 in the DSA accident analysis is bounded by setting the [Pu-239] at 2.66E+05 pCi/mL (213 nCi/g). Pu-238 concentration is bounded by the total alpha term in the IDP WAC LIMIT. The permit max. concentration and the WAC Rev 11 TARGET were set at a maximum assumed value of 2.50E+05 pCi/mL (200 nCi/g), which is 94% of the NRC Class C limit for total alpha. The recommended Pu-238 concentration for implementation of the 2009 PA was set at the WAC Rev 11 TARGET [Ref. 37]. The new WAC value reflects the lower total α value.
Pu-239 (α) ($t_{1/2}$ > 5 yr)	IDP WAC LIMIT (TARGET =2.13E+05)	2.50E+05 (200)	2.66E+05	2.50E+05	The DSA source term for Pu-239 is set equal to 2.66E+05 pCi/mL (213 nCi/g, the NRC Class C limit for total alpha) in order to bound the consequences of all transuranic alpha emitters. This value also protects the NCSE. Pu-239 concentration is bounded by the total alpha term in the IDP WAC LIMIT. The permit max. concentration and the WAC Rev 11TARGET were set at a maximum assumed value of 2.50E+05 pCi/mL (200 nCi/g), which is 94% of the NRC Class C limit for total alpha. The recommended Pu-239 concentration for implementation of the 2009 PA was set at the WAC Rev 11 TARGET [Ref. 37]. The new WAC value reflects the lower total α value.
Pu-240 (α) ($t_{1/2}$ > 5 yr)	IDP WAC LIMIT (TARGET =2.13E+05)	2.50E+05 (200)	Bounded by Pu-239	2.50E+05	The dose contribution due to Pu-240 in the DSA accident analysis is bounded by setting the [Pu-239] at 2.66E+05 pCi/mL (213 nCi/g). Pu-240 concentration is bounded by the total alpha term in the IDP WAC LIMIT. The permit max. concentration and the WAC Rev 11 TARGET were set at a maximum assumed value of 2.50E+05 pCi/mL (200 nCi/g), which is 94% of the NRC Class C limit for total alpha. The recommended Pu-240 concentration for implementation of the 2009 PA was set at the WAC Rev 11 TARGET [Ref. 37]. The new WAC value reflects the lower total α value.

Radionuclide NRC Limits in pCi/mL	**WAC LIMIT/TARGET** **pCi/mL**	**Permit Max. Concentration (Ref. 3)** **pCi/mL (nCi/g)**	**DSA Source Term (Ref. 13)** **pCi/mL**	**Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation pCi/mL**	**Basis**
Pu-241 NRC Class A = 9.31E+05 NRC Class C = 9.31E+06	8.38E+05 and IDP WAC LIMIT	9.31E+05 (745)	9.31E+05	8.38E+05	The permit max. concentration and DSA source term for Pu-241 are set equal to the NRC Class A landfill limit of 9.31E+05 pCi/mL (745 nCi/g). This Pu-241 concentration is assumed in the NCSE [Ref. 23] as well as in the IDP calculation [Ref. 9], where Pu-241 is a significant contributor. The WAC LIMIT is set to a value equal to 90% of the DSA value to protect these bases. The recommended Pu-241 concentration for implementation of the 2009 PA is set at the WAC TARGET [Ref. 37].
Pu-242 (α) ($t_{1/2}$ > 5 yr)	IDP WAC LIMIT (TARGET =2.13E+05)	2.50E+05 (200)	Bounded by Pu-239	2.50E+05	The dose contribution due to Pu-242 in the DSA accident analysis is bounded by setting the [Pu-239] at 2.66E+05 pCi/mL (213 nCi/g). Pu-242 concentration is bounded by the total alpha term in the IDP WAC LIMIT. The permit max. concentration and the WAC Rev 11 TARGET were set at a maximum assumed value of 2.50E+05 pCi/mL (200 nCi/g), which is 94% of the NRC Class C limit for total alpha. The recommended Pu-242 concentration for implementation of the 2009 PA was set at the WAC Rev 11 TARGET [Ref. 37]. The new WAC value reflects the lower total α value.
Pu-244 (α) ($t_{1/2}$ > 5 yr)	7.02E+04	None	None	7.02E+04	There are no DSA or permit maximum concentrations for Pu-244. The recommended Pu-244 concentration for implementation of the 2009 PA is set to the same value assumed for the 2005 Special Analysis (SA) in a previous Saltstone WAC revision. The WAC TARGET is set to 7.02E+04 pCi/mL [Ref. 37].
Am-241 (α) ($t_{1/2}$ > 5 yr)	IDP WAC LIMIT (TARGET =2.13E+05)	2.50E+05 (200)	Bounded by Pu-239	2.50E+05	The dose contribution due to Am-241 in the DSA accident analysis is bounded by setting the [Pu-239] at 2.66E+05 pCi/mL (213 nCi/g). Am-241 concentration is bounded by the total alpha term in the IDP WAC LIMIT. The permit max. concentration and the WAC Rev 11 TARGET were set at a maximum assumed value of 2.50E+05 pCi/mL (200 nCi/g), which is 94% of the NRC Class C limit for total alpha. The recommended Am-241 concentration for implementation of the 2009 PA was set at the WAC Rev 11 TARGET [Ref. 37]. The new WAC value reflects the lower total α value.
Am-242m	4.50E+05	5.00E+05 (400)	None	4.50E+05	The permit max. concentration is set at a maximum assumed value of 5.00E+05 pCi/mL (400 nCi/g). The WAC TARGET is set to a value equal to 90% of the permit maximum concentration. The recommended Am-242m concentration for implementation of the 2009 PA is set at the WAC TARGET [Ref. 37].
Am-243 (α) ($t_{1/2}$ > 5 yr)	IDP WAC LIMIT (TARGET =2.13E+05)	None	Bounded by Pu-239	2.50E+05	The dose contribution due to Am-243 in the DSA accident analysis is bounded by setting the [Pu-239] at 2.66E+05 pCi/mL (213 nCi/g). Am-243 concentration is bounded by the total alpha term in the IDP WAC LIMIT. The WAC Rev 11 TARGET was set at a value of 2.50E+05 pCi/mL (200 nCi/g), which is 94% of the NRC Class C limit for total alpha. The recommended Am-243 concentration for implementation of the 2009 PA was set at the WAC Rev 11 TARGET [Ref. 37]. The new WAC value reflects the lower total α value.

Radionuclide NRC Limits in pCi/mL	WAC LIMIT/TARGET pCi/mL	Permit Max. Concentration (Ref. 3) pCi/mL (nCi/g)	DSA Source Term (Ref. 13) pCi/mL	Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation pCi/mL	Basis
Cm-242 (α) NRC Class A = 5.32E+06 NRC Class C = 5.32E+07	1.13E+04	5.00E+05 (400)	1.25E+04	N/A ($t_{1/2}$ < 5 yrs)	The DSA source term is set at a maximum assumed value of 1.25E+04 pCi/mL (10 nCi/g). The permit max. concentration for Cm-242 is set equal to approximately 10% of the NRC Class A landfill limit of 5.32E+06 pCi/mL. The WAC TARGET is set to a value equal to 90% of the DSA value. Cm-242 does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
Cm-243 (α) ($t_{1/2}$ > 5 yr)	Not Required	None	None	7.00E+02	There are no DSA or permit maximum concentrations for Cm-243. The recommended Cm-243 concentration for implementation of the 2009 PA is set at 7.00E+02 pCi/mL [Ref. 37]. Based on the total soluble inventory in F and H Tank Farm, the expected concentration for Cm-243 is 0.11 pCi/mL [Ref. 38], which is significantly below the 7.00E+02 pCi/mL assumed concentration for PA implementation. Therefore, there is no WAC LIMIT/TARGET for Cm-243.
Cm-244 (α) ($t_{1/2}$ > 5 yr)	IDP WAC LIMIT (TARGET =2.13E+05)	2.50E+05 (200)	Bounded by Pu-239	2.50E+05	The dose contribution due to Cm-244 in the DSA accident analysis is bounded by setting the [Pu-239] at 2.66E+05 pCi/mL (213 nCi/g). Cm-244 concentration is bounded by the total alpha term in the IDP WAC LIMIT. The permit max. concentration and the WAC Rev 11 TARGET were set at a maximum assumed value of 2.50E+05 pCi/mL (200 nCi/g), which is 94% of the NRC Class C limit for total alpha. The recommended Cm-244 concentration for implementation of the 2009 PA was set at the WAC Rev 11 TARGET [Ref. 37]. The new WAC value reflects the lower total α value.
Cm-245 (α) ($t_{1/2}$ > 5 yr)	2.25E+05	2.50E+05 (200)	None	2.25E+05	In the 2005 SA, Cm-245 is listed as a potential radionuclide in the SRS high-level waste. The permit max. concentration is set at a maximum assumed value of 2.50E+05 pCi/mL (200 nCi/g), which is 94% of the NRC Class C limit for total alpha. The WAC TARGET is set at a value equal to 90% of the permit max concentration. The recommended Cm-245 concentration for implementation of the 2009 PA is set at the WAC TARGET [Ref. 37].
Cm-247 (α) ($t_{1/2}$ > 5 yr)	Not Required	None	None	1.25E-09	There are no DSA or permit maximum concentrations for Cm-247. The recommended Cm-247 concentration for implementation of the 2009 PA is set at 1.25E-09 pCi/mL [Ref. 37]. Based on the total soluble inventory in F and H Tank Farm, the expected concentration for Cm-247 is 2.1E-11 pCi/mL [Ref. 38], which is significantly below the 1.25E-09 pCi/mL assumed concentration for PA implementation. Therefore, there is no WAC LIMIT/TARGET for Cm-247.
Cm-248 (α) ($t_{1/2}$ > 5 yr)	Not Required	None	None	1.30E-07	There are no DSA or permit maximum concentrations for Cm-248. The recommended Cm-248 concentration for implementation of the 2009 PA is set at 1.30-E07 pCi/mL [Ref. 37]. Based on the total soluble inventory in F and H Tank Farm, the expected concentration for Cm-248 is 2.2E-11 pCi/mL [Ref. 38], which is significantly below the 1.30E-07 pCi/mL assumed concentration for PA implementation. Therefore, there is no WAC LIMIT/TARGET for Cm-248.
Bk-249	Not Required	None	None	N/A ($t_{1/2}$ < 5 yrs)	There are no DSA, permit or WAC LIMITS/TARGETS for Bk-249. Bk-249 does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).

Radionuclide NRC Limits in pCi/mL	**WAC LIMIT/TARGET** **pCi/mL**	**Permit Max. Concentration (Ref. 3)** **pCi/mL (nCi/g)**	**DSA Source Term (Ref. 13)** **pCi/mL**	**Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation pCi/mL**	**Basis**
Cf-249 (α) ($t_{1/2}$ > 5 yr)	Not Required	None	None	7.20E-09	There are no DSA or permit maximum concentrations for Cf-249. The recommended Cf-249 concentration for implementation of the 2009 PA is set at 7.20E-09 pCi/mL [Ref. 37]. Based on the total soluble inventory in F and H Tank Farm, the expected concentration for Cf-249 is 1.20E-10 pCi/mL [Ref. 38], which is significantly below the 7.20E-09 pCi/mL assumed concentration for PA implementation. Therefore, there is no WAC LIMIT/TARGET for Cf-249.
Cf-251 (α) ($t_{1/2}$ > 5 yr)	Not Required	None	None	2.50E-10	There are no DSA or permit maximum concentrations for Cf-251. The recommended Cf-251 concentration for implementation of the 2009 PA is set at 2.50E-10 pCi/mL [Ref. 37]. Based on the total soluble inventory in F and H Tank Farm, the expected concentration for Cf-251 is 4.13E-12 pCi/mL [Ref. 38], which is significantly below the 2.50E-10 pCi/mL assumed concentration for PA implementation. Therefore, there is no WAC LIMIT/TARGET for Cf-251.
Cf-252 (α)	Not Required	None	None	N/A ($t_{1/2}$ < 5 yrs)	There are no DSA, permit or WAC LIMITS/TARGETS for Cf-252. Cf-252 does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
Total Alpha Emitters ($t_{1/2}$ > 5 yr) NRC Class A = 2.66E+04 NRC Class C = 2.66E+05 (NRC Limits apply to TRU total alpha)	2.13E+05	2.66E+05 (213)	None	None	The permit max. concentration is set at a value of 213 nCi/g. This value is equal to 100% of the NRC Class C limit. The WAC LIMIT is set to a value equal to 80% of the permit max. concentration. The total alpha WAC LIMIT protects the assumed Pu-239 concentration in the NCSE [Ref. 23] as well as assumptions in the DSA accident analyses that the total transuranic alpha-emitter concentration in the salt solution is $\leq$213 nCi/g.

Comparison of Chemical Concentrations for Saltstone

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA/ESS Source Term (Refs. 13, 59) (mg/L)	Basis
Solvated Ions				
Aluminate $[Al(OH)_4^-]$	4.08E+05	6.62E+05	6.62E+05	Aluminate is not measured. The demonstration of SAC compliance is by meeting the Aluminum concentration as there cannot be more moles of aluminate than moles of aluminum.
Ammonium $[NH_4^+]$	2.12E+02	None	2.33E+02	There is no established ground-water standard and its concentration is expected to be well below 0.5M, so no maximum permit concentration is specified. The WAC LIMIT for accident chemical consequence is set at 2.12E+02 mg/L (Ref. 51) (see Attachment 8.1). This is the same value to protect SDU flammability (see Table 3).
Carbonate $[CO_3^{2-}]$	1.20E+05	1.93E+05	1.60E+05	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration.
Chloride $[Cl^-]$	7.95E+03	1.29E+04	1.06E+04	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration.
Formate $[HCOO^-]$	Not Required	None	8.5E+03	The DSA bounding concentration is a factor of 4.25 greater than a maximum assumed concentration of 2000 mg/L. There is no established ground-water standard and its concentration is expected to be well below 0.5M, so no waste acceptance criterion or maximum permit concentration is specified.
Fluoride $[F^-]$	4.07E+03	6.58E+03	5.43E+03	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration.
Hydroxide $[OH^-]$	1.58E+05	2.55E+05	2.10E+05	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration.

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA/ESS Source Term (Refs. 13, 59) (mg/L)	Basis
Solvated Ions (cont.)				
Nitrate [NO_3^-]	4.37E+05	7.05E+05	5.82E+05	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration.
Nitrite [NO_2^-]	2.14E+05	3.45E+05	2.85E+05	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration.
Oxalate [$C_2O_4^{2-}$]	2.72E+04	None	3.63E+04	There is no established ground-water standard and its concentration is expected to be well below 0.5M so no maximum permit concentration is specified. The WAC LIMIT is set at 75% of the DSA value.
Phosphate [PO_4^{3-}]	2.94E+04	None	3.92E+04	There is no established ground-water standard and its concentration is expected to be well below 0.5M so no maximum permit concentration is specified. The WAC LIMIT is set at 75% of the DSA value.
Sulfate [SO_4^{2-}]	5.69E+04	9.19E+04	7.58E+04	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration.
RCRA Hazardous Metals				
Arsenic [As]	2.30E+01	1.00E+03	2.53E+01	The highest Tank Farm Arsenic concentration was recorded at 1.44 mg/L from Tank 23. The limiting concentration based on detection limit was established from Tank 29, 19 mg/L (Ref. 32). The WAC LIMIT is set to a value equal to 91% of the DSA value (Ref. 51).
Barium [Ba]	6.19E+02	1.00E+03	8.25E+02	The WAC LIMIT is set to a value equal to 75% of the DSA value.

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA/ESS Source Term (Refs. 13, 59) (mg/L)	Basis
RCRA Hazardous Metals (cont.)				
Cadmium [Cd]	3.10E+02	5.00E+02	4.13E+02	Based on experimental data (DPST-89-314), in order for the saltstone to pass TCLP, the maximum allowed cadmium concentration in the salt solution is 500 mg/L. The WAC LIMIT is set to a value equal to 75% of the DSA value.
Chromium [Cr]	1.24E+03	2.00E+03	1.65E+03	The WAC LIMIT is set to a value equal to 75% of the DSA value.
Lead [Pb]	6.19E+02	1.00E+03	8.25E+02	The WAC LIMIT is set to a value equal to 75% of the DSA value.
Total Mercury [Hg]	3.25E+02	5.00E+02	3.58E+02	The WAC LIMIT is set to a value equal to 91% of the Evaluation of the Safety of the Situation (ESS) value for total mercury (Ref. 59).
Elemental Mercury [Hg]	8.92E+01	None	9.80E+01	There is no permit max. concentration. The WAC LIMIT is set to a value equal to 91% of the ESS value for elemental mercury (Ref. 59).
Selenium [Se]	4.46E+02	5.00E+02	4.95E+02	Based upon experimental data (DPST-89-314), the selenium concentration must be < 600 mg/L in order for the grout to pass TCLP. The permit maximum concentration is set at 500 mg/L to protect this value. The WAC LIMIT is set to a value equal to 90% of the DSA bounding concentration.
Silver [Ag]	6.19E+02	1.00E+03	8.25E+02	The WAC LIMIT is set to a value equal to 75% of the DSA value.
Other Metals				
Aluminum [Al]	1.16E+05	1.88E+05	1.55E+05	The WAC LIMIT is set to a value equal to 75% of the DSA value.

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA/ESS Source Term (Refs. 13, 59) (mg/L)	Basis
Other Metals (cont.)				
Boron [B]	7.43E+02	1.20E+03	9.90E+02	The permit maximum concentration is a factor of 4.0 greater than the maximum assumed concentration of 300 mg/L. The WAC TARGET is set to a value equal to 75% of the DSA value.
Calcium [Ca]	Not Required	None	3.13E+03	There is no established ground-water standard and its concentration is expected to be well below 0.5M, so no waste acceptance criterion or maximum permit concentration is specified.
Cerium [Ce]	Not Required	None	1.02E+03	The DSA bounding concentration is a factor of 3.4 greater than a maximum assumed concentration of 300 mg/L. There is no established ground-water standard and its concentration is expected to be well below 0.5M, so no waste acceptance criterion or maximum permit concentration is specified.
Cesium [Cs]	Not Required	None	1.02E+03	The DSA bounding concentration is a factor of 3.4 greater than a maximum assumed concentration of 300 mg/L. There is no established ground-water standard and its concentration is expected to be well below 0.5M, so no waste acceptance criterion or maximum permit concentration is specified.
Cobalt [Co]	1.75E+02	1.20E+03	1.93E+02	The permit maximum concentration is a factor of 4.0 greater than the maximum assumed concentration of 300 mg/L. The WAC TARGET is set to a value equal to 91% of the DSA value (Ref. 51).
Copper [Cu]	7.43E+02	1.20E+03	9.90E+02	The permit maximum concentration is a factor of 4.0 greater than the maximum assumed concentration of 300 mg/L. The WAC TARGET is set to a value equal to 75% of the DSA value.
Iron [Fe]	4.95E+03	8.00E+03	6.60E+03	The permit maximum concentration is a factor of 4.0 greater than a maximum assumed concentration of 2000 mg/L. The WAC TARGET is set to a value equal to 75% of the DSA value.
Potassium [K]	3.03E+04	None	4.04E+04	The WAC LIMIT is set to a value equal to 75% of the DSA value.
Lithium [Li]	7.43E+02	1.20E+03	9.90E+02	The permit maximum concentration is a factor of 4.0 greater than the maximum assumed concentration of 300 mg/L. The WAC TARGET is set to a value equal to 75% of the DSA value.

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA/ESS Source Term (Refs. 13, 59) (mg/L)	Basis
Other Metals (cont.)				
Magnesium [Mg]	Not Required	None	1.02E+03	There is no established ground-water standard and its concentration is expected to be well below 0.5M, so no waste acceptance criterion or maximum permit concentration is specified.
Manganese [Mn]	7.43E+02	1.20E+03	9.90E+02	The permit maximum concentration is a factor of 4.0 greater than the maximum assumed concentration of 300 mg/L. The WAC TARGET is set to a value equal to 75% of the DSA value.
Molybdenum [Mo]	7.43E+02	1.20E+03	9.90E+02	The permit maximum concentration is a factor of 4.0 greater than the maximum assumed concentration of 300 mg/L. The WAC TARGET is set to a value equal to 75% of the DSA value.
Neodymium [Nd]	Not Required	None	1.02E+03	The DSA bounding concentration is a factor of 4.0 greater than a maximum assumed concentration of 300 mg/L. There is no established ground-water standard and its concentration is expected to be well below 0.5M, so no waste acceptance criterion or maximum permit concentration is specified.
Nickel [Ni]	7.43E+02	1.20E+03	9.90E+02	The permit maximum concentration is a factor of 4.0 greater than the maximum assumed concentration of 300 mg/L. The WAC TARGET is set to a value equal to 75% of DSA value.
Ruthenium [Ru]	Not Required	None	1.02E+03	There is no established ground-water standard and its concentration is expected to be well below 0.5M, so no waste acceptance criterion or maximum permit concentration is specified.
Silicon [Si]	1.07E+04	None	1.42E+04	The WAC TARGET is set to a value equal to 75% of the DSA value.
Sodium [Na]	Processability WAC LIMIT 2.5M<[Na]<7.0M	4.56E+05	1.77E+05	In order to meet saltstone processability restraints, the maximum sodium WAC LIMIT is set at 7.0 moles/L, while the minimum sodium WAC LIMIT is set at 2.5 moles/L. The permit maximum concentration is a factor of 3.0 greater than the maximum-expected value.
Strontium [Sr]	7.43E+02	1.20E+03	9.90E+02	The permit maximum concentration is a factor of 4.0 greater than the maximum assumed concentration of 300 mg/L. The WAC TARGET is set to a value equal to 75% of the DSA value.

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA/ESS Source Term (Refs. 13, 59) (mg/L)	Basis
Other Metals (cont.)				
Titanium [Ti]	Not Required	None	1.02E+03	The DSA bounding concentration is a factor of 3.4 greater than a maximum assumed concentration of 300 mg/L. There is no established ground-water standard and its concentration is expected to be well below 0.5M, so no waste acceptance criterion or maximum permit concentration is specified.
Zinc [Zn]	8.03E+02	1.30E+03	1.07E+03	The permit maximum concentration is a factor of 4.0 greater than the maximum recorded WCS value. The WAC TARGET is set to a value equal to 75% of the DSA value.
Zirconium [Zr]	Not Required	None	1.02E+03	The DSA bounding concentration is a factor of 3.4 greater than a maximum assumed concentration of 300 mg/L. There is no established ground-water standard and its concentration is expected to be well below 0.5M, so no waste acceptance criterion or maximum permit concentration is specified.
Suspended Hydrated-Sludge Solids				
Aluminum hydroxide [$Al(OH)_3$]	Not Required	None	1.93E+04	There is no permit maximum concentration or waste acceptance criterion.
Barium sulfate [$BaSO_4$]	Not Required	None	1.59E+02	There is no permit maximum concentration or waste acceptance criterion.
Chromium (III) hydroxide [$Cr(OH)_3$]	Not Required	None	1.59E+02	There is no permit maximum concentration or waste acceptance criterion.
Iron (III) hydroxide [$Fe(OH)_3$]	Not Required	None	1.26E+04	There is no permit maximum concentration or waste acceptance criterion.
Lead carbonate [$PbCO_3$]	Not Required	None	1.59E+02	There is no permit maximum concentration or waste acceptance criterion.
Lead sulfate [$PbSO_4$]	Not Required	None	3.19E+02	There is no permit maximum concentration or waste acceptance criterion.

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA/ESS Source Term (Refs. 13, 59) (mg/L)	Basis
Suspended Hydrated-Sludge Solids (cont.)				
Manganese dioxide [MnO_2]	Not Required	None	1.57E+03	There is no permit maximum concentration or waste acceptance criterion.
Mercuric oxide [HgO]	Not Required	None	3.86E+02	There is no permit maximum concentration or waste acceptance criterion.
Nickel hydroxide [$Ni(OH)_2$]	1.17E+03	None	1.56E+03	The WAC LIMIT is set to a value equal to 75% of the DSA value.
Silicon dioxide [SiO_2]	Not Required	None	3.19E+03	There is no permit maximum concentration or waste acceptance criterion.
Silver (I) hydroxide [AgOH]	Not Required	None	1.59E+02	There is no permit maximum concentration or waste acceptance criterion.
Uranyl hydroxide [$UO_2(OH)_2$]	Not Required	None	2.71E+02	There is no permit maximum concentration or waste acceptance criterion.
Total Insoluble Solids	1.88E+05 (15 wt%)	1.88E+05 (15 wt%)	None	The permit maximum concentration and the WAC LIMIT were selected based upon the design capacity of the SFT agitator and operational experience.
Organic Compounds				
Benzene [C_6H_6]	3.10E+02	None	4.13E+02	The DSA benzene concentration was set at 413 mg/L to bound the chemical consequences in the accident analysis. The source of benzene is from the decomposition of TPB. The WAC TARGET is set to a value equal to 75% of the DSA value.
Butanol & Isobutanol [C_4H_9OH]	"Other Organics" Contrib. to SDU Flammability WAC LIMIT (Butanol TARGET = 7.5E-01)	None	1.03E+01	The WAC LIMIT for accident chemical consequence is set at 7.73E+00 mg/L (Attachment 8.1), which is 75% of the DSA value. However, there is a more restrictive WAC TARGET for butanol to protect SDU flammability of 7.5E-01 mg/L (see Table 4).

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Bounding Concentration (mg/L)	Basis
Organic Compounds (cont.)				
Isopropanol [C_3H_7OH]	"Other Organics" Contrib. to SDU Flammability WAC LIMIT (TARGET = 2.5E-01)	None	2.50E+00	The DSA concentration reflects the original bounding concentration in the Saltstone JCO. The WAC LIMIT for accident chemical consequence is set at 1.88E+00 mg/L (Attachment 8.1), which is 75% of the DSA value. However, there is a more restrictive WAC TARGET to protect SDU flammability of 2.5E-01 mg/L (see Table 4).
Methanol [CH_3OH]	"Other Organics" Contrib. to SDU Flammability WAC LIMIT (TARGET = 5E-02)	None	2.50E+00	The DSA concentration reflects the original bounding concentration in the Saltstone JCO. The WAC TARGET for accident chemical consequence is set at 1.88E+00 mg/L (Attachment 8.2), which is 75% of the DSA value. However, there is a more restrictive WAC TARGET to protect SDU flammability of 5E-02 mg/L (see Table 4).
Phenol [C_6H_5OH]	7.50E+02	None	8.25E+02	The DSA concentration reflects the original bounding concentration in the Saltstone JCO. Experience has shown that this value adequately bounds the organic concentration in the salt solution. The WAC LIMIT is set to a value equal to 91% of the DSA value (ref. 51).
Tetraphenylborate [$B(C_6H_5)_4^-$]	4.24E+00 kg total mass and 5.00E+00 mg/L	7.00E+02	5.50E+00	The WAC LIMIT for accident chemical consequence is set at 5.00E+00 mg/L (Attachment 8.1), which is 91% of the DSA value. In order to protect assumptions associated with SDU flammable gas accumulation, there is a mass WAC LIMIT of 4.24 kg on the total mass of TPB to be disposed of in SDUs (see Table 3). Additionally, the facility has set a WAC LIMIT on the concentration of TPB in the waste feed stream to the TPB detection limit (5.0 mg/L).
Toluene [$C_6H_5CH_3$]	3.10E+02	None	4.13E+02	A bounding DSA value of 413 mg/L was selected to equal the bounding concentration selected for benzene. There is no permit maximum concentration. The WAC TARGET is set to a value equal to 75% of the DSA value.
Dibutylphosphate [$C_8H_{19}O_4P$]	3.47E+02	None	4.62E+02	There is no permit max. concentration. The WAC LIMIT is set at 75% of the DSA value.
Tributylphosphate [$(C_4H_9O)_3PO$]	"Other Organics" Contrib. to SDU Flammability WAC LIMIT (TARGET = 1.0E+00)	None	1.00E+01	The WAC TARGET for accident chemical consequence is set at 7.50E+00 mg/L (Attachment 8.2), which is 75% of the DSA value. However, there is a more restrictive WAC TARGET to protect SDU flammability of 1.0E+00 mg/L (see Table 4).

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA/ESS Source Term (Refs. 13, 59) (mg/L)	Basis
Organic Compounds (cont.)				
EDTA	3.10E+02	None	4.13E+02	There is no permit maximum concentration. The WAC TARGET is set to a value equal to 75% of the DSA value.
Total Organic Carbon (minus formate & oxalate)	5.00E+03	6.00E+03	None	The permit maximum concentration (6.00E+03 mg/L) was selected based upon operational experience and discussions with SRNL personnel. The WAC LIMIT is set to a value equal to ~ 83% of the permit max. concentration.
Isopar L	1.10E+01 ppm (not mg/L)	None	1.10E+01 ppm (not mg/L)	There is no permit max concentration. The WAC LIMIT to protect SDU flammability of 1.10E+01 ppm (see Table 3). This WAC LIMIT applies to Low Organics Mode.
NORPAR 13	"Other Organics" Contrib. to SDU Flammability WAC LIMIT (TARGET = 1.0E-01)	None	1.00E+00	There is a DSA value (related to accident chemical consequence) of 1.00E+00 mg/L. There is no permit maximum concentration. However, NORPAR 13 has been identified as a volatile organic that could impact SDU flammability and therefore a WAC TARGET of 0.1 mg/L has been established (see Table 4).
BOBCalixC6 or MaxCalix or blend	Not Required	None	2.00E+02	There is no permit maximum concentration. BOBCalixC6, the extractant found in the MCU solvent, has a molecular weight of 1149.53 g/mol and has no detectable vapor pressure. Given the low mole fraction of the solvent, 0.166%, and the absence of a measurable vapor pressure, the flammability contribution is insignificant (Ref. 40). MCU is incorporating the Next Generation Solvent (NGS) into the process. NGS replaces the extractant with MaxCalix. For some period of the time, both BOBCalixC6 and MaxCalix may be presented until the BOBCalixC6 has been deleted from the system. MaxCalix has a molecular weight of approximately 955.31 g/mole and has no measureable vapor pressure. Given the low mole fraction of the solvent, 0.12%, and the absence of a measurable vapor pressure, it will have no influence on the flammability of the vapor space (Ref. 48). There is little or no degradation of MaxCalix due to expected radiation dose to the solvent (ref. 48). For chemical consequences, it has been determined that maximum source terms to remain within the Chemical PAC limits for MaxCalix are considered to be equivalent for those established for BOBCalixC6 (Ref. 49). MCU is anticipated to transfer up to 150 ppm of organic solvents of which ~ 70 wt% to 75 wt% will be Isopar L (Ref. 41 and 49). The WAC LIMIT of 1.10E+01 ppm for Isopar L to protect SDU Flammability provides reasonable assurance the suppressor limit is met. In addition the 200 mg/L provides significant margin over the expected extractant concentration based on the actual composition of the solvent. Therefore, there is no WAC LIMIT/TARGET for BOBCalixC6 or MaxCalix. (Ref. 49)

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA/ESS Source Term (Refs. 13, 59) (mg/L)	Basis
Organic Compounds (cont.)				
Cs7SB	Not Required	None	2.00E+02	There is no permit maximum concentration. The modifier found in the MCU solvent has a molecular weight of 338.35 g/mol and has a very low vapor pressure. The boiling point for Cs7SB is approximately 375 °C. Given the low vapor pressure and a relatively high boiling point, the flammability contribution is insignificant (Ref. 40). MCU is anticipated to transfer up to 150 ppm of organic solvents of which ~ 70 to 75 wt% will be Isopar L (Ref. 41 and 49). The WAC LIMIT of 1.10E+01 ppm for Isopar L to protect SDU Flammability provides reasonable assurance that Cs7SB limit is met. In addition the 200 mg/L provides significant margin over the expected modifier concentration based on the actual composition of the solvent. Therefore, there is no WAC LIMIT/TARGET for Cs7SB. (Ref. 49)
TOA (Trioctylamine) or TiDG (Tris(isodecyl)guanidine) or mixture	Not Required	None	2.00E+02	There is no permit maximum concentration. The suppressor found in the MCU solvent has a molecular weight of 353.69 g/mol. Given the high boiling point similar to Cs7SB, ~ 367 °C, TOA is expected to be insignificant to flammability (Ref. 40). MCU is incorporating the Next Generation Solvent (NGS) into the process. NGS replaces the suppressor with TiDG. For some period of the time, both TOA and TiDG may be presented until the TOA has been deleted from the system. TIDG has a molecular weight of 516.3 g/mol. TiDG has a low vapor pressure and low volatility. The TiDG will be stable at the anticipated Saltstone temperatures (<95 °C). TIDG will not impact flammability in Saltstone (Ref. 48). For chemical consequences, it has been determined that maximum source terms to remain within the Chemical PAC limits for TiDG are considered to be equivalent for those established for TOA (Ref. 49). MCU is anticipated to transfer up to 150 ppm of organic solvents of which ~ 70 wt% to 75 wt% will be Isopar L (Ref. 41 and 49). The WAC LIMIT of 1.10E+01 ppm for Isopar L to protect SDU Flammability provides reasonable assurance the suppressor limit is met. In addition the 200 mg/L provides significant margin over the expected suppressor composition based on the actual concentration in the solvent. Therefore, there is no WAC LIMIT/TARGET for TOA or TiDG. (Ref. 49)

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA/ESS Source Term (Refs. 13, 59) (mg/L)	Basis
Organic Compounds (cont.)				
Monomethyl Mercury [CH_3Hg]	3.25E+02	None	3.58E+02	There is no permit max concentration. The ESS monomethyl mercury concentration (358 mg/L) has been set equal to the ESS total mercury concentration (358 mg/L) from a chemical consequence perspective. Testing has demonstrated that the majority of mercury in Tank 50H is in the form of monomethyl mercury, and monomethyl mercury compounds have been shown to not be volatile due to low vapor pressures, low Henry's Laws coefficients and water solubility (Refs. 58, 59). The WAC LIMIT is set to a value equal to 91% of the ESS value for monomethyl mercury.
Dimethyl Mercury [$(CH_3)_2Hg$]	1.00E+00	None	1.10E+00	There is no permit max. concentration. Dimethyl mercury is the bounding mercury species from a flammability standpoint, and the flammability concentration limit is set equal to the chemical consequence concentration limit of 1.10 mg/L in the DSA/ESS (Refs. 13, 59). The dimethyl mercury contribution to the lower flammability limit bounds all other dialkyl species (diethyl, dipropyl and dibutyl) as well as the unidentified mercury species (Refs. 58, 59). Based on speciation analyses, the maximum concentration recorded at Tank Farm has been at least an order of magnitude below the 1.10E+00 mg/L DSA/ESS concentration (Ref. 58). The WAC TARGET is set to a value equal to 91% of the DSA/ESS value.