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Revision: 18

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

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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 50H 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 SDU 3 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
Revision 15 (December 2015)	Revision bars used

	- Global / Section 5.3.1: Modified acceptance criteria sections to specify whether it is required to include analytical uncertainty or if there is sufficient conservatism to use nominal values - Section 5.1: Introduced the term Toxicity Characteristic used to certify the RCRA non-hazardous nature of the Saltstone grout. Deleted Treatment Standards (TS) and added discussion that SPF mixing process has been approved as a treatment technology to meet Land Disposal Restrictions (LDR) requirements - Table 1: Removed the Sampling Strategy table which was outdated and renumbered all succeeding tables - Section 5.4.6: Revised text to state that 325 mg/L Hg WAC LIMIT protects the mercury RCRA Toxicity Characteristic limit of 0.2 mg/L and provided references - Section 5.4.13: Deleted TS column and set WAC LIMITS to 50% of Toxicity values. Deleted salt batch qualification tank TCLP requirement - Section 7.0: Deleted Reference 5 that was the basis for the deleted Sampling Strategy Table (formerly Table 1) and added new LDR memo (SRR-ESH-2015-00071). Also, added four new references. - Attachment 8.1: Revised Note 3 to state that 325 mg/L Hg WAC LIMIT protects the mercury RCRA Toxicity Characteristic limit of 0.2 mg/L and provided references - Appendix 1: Corrected permit max concentration for Total Mercury - Global: Spelled out acronyms during their first use in the document.
Revision 16 (March 2016)	Revision bars used - Global: Changed Low Organics Mode to Low Isopar L Operation - Sections 2.0 and 5.2: Added Salt Solution Receipt Tanks (SSRTs) - Section 4.0: Deleted responsibility of Tank Farm Engineering and Operations concurring with the WAC Implementation Checklist. Deleted reference to Saltstone FINAL Calculation. - Section 5.4.2: Deleted specificity of SDU flammability. Removed PISA/ESS compensatory measures and revised monomethyl mercury WAC Limit. - Section 5.4.4: Revised the “other organics” discussion and deleted the specific 10% contribution. Removed discussion related to SDU 4 and added SFT and SSRT flammability. Revised NORPAR 13 WAC concentration. - Sections 5.4.6 and 5.4.7: Added discussion that ionic/metal limits protect the chemical compound concentration limits given in DSA

	- Section 5.4.10: Revised the processing criteria temperature limits to be inclusive - Section 5.4.14: Added new SAC temperature limit for salt solution to protect flammability assumptions in DSA - Section 7.0: Updated DSA and X-CLC-Z-00033 references, deleted ESS reference, deleted S-CLC-Z-00067 reference and added new Safety Analysis Input references - Attachment 8.1: Revised the elemental mercury and monomethyl mercury WAC Limits and added new ethyl mercury WAC Limit. Renamed isobutanol and isopropanol for consistency with DSA. - Attachment 8.2: Revised the NORPAR 13 WAC Target and added chemical formulas for EDTA and NORPAR 13 - Appendix 1 (Chemical Concentrations): Updated appendix to support changes made to WAC Limits and Targets. Added new chemical compound column that provides the potential chemical compound form for each ion/metal consistent with X-CLC-Z-00033 and DSA Table 3.6-7. Removed list of Suspended Hydrated-Sludge Solids since these chemicals are bounded by ionic limits. Modified dimethyl mercury discussion to state chemical is a negligible contributor to flammability.
Revision 17 (February 2017)	Revision bars used: - Section 5.4.4: Updated to include SDU 6 calculation for SDU flammability - Section 5.4.8: Deleted Reference 53 and related discussion since this information is incorporated in the FY2014 SA - Section 5.4.11: Updated to include SDU 6 shielding calculation for Gamma Shielding - Section 5.4.15: Added new SDU 6 Liner / Coating Chemical Resistance section to ensure that SDU 6 liner and coating is protected - Section 7.0: Updated References 4, 13, 33, and 51; added References 45, 46, 69, 70, 71, 72 and 73; and deleted References 30 and 53 - Attachment 8.2: Added SDU 6 flammability calculation to Footnote 4 - Attachment 8.3: Deleted Reference 53 from I-129 Basis - Appendix 1 (Chemical Concentrations): Updated appendix to include new chemical WAC Targets for three cations and eight anions related to SDU 6 liner and coating chemical resistance.
Revision 18 (October 2018)	Revision bars used: - Revision performed for 2017 Annual Update of Saltstone DSA/TSR in support of resolution of PISA PI-2017-0002 [Effects of Organics on Hydrogen Generation Rates (HGRs) in Saltstone]

	- Section 2.0: Added to Scope section that flushing of the interarea transfer line with inhibited water must be evaluated to ensure WAC compliance - Section 3.0: Clarified definition of WAC TARGET - Section 5.4.1: Expanded list of analytes important to IDP to include Co-60, Y-90, Tc-99, Ru-106, Pm-147, U-232, U-233, U-234, U-236, and U-238. Increased IDP Limit to 1.78E+05 rem/gal based on the expanded list of analytes. - Section 5.4.3: Updated HGR calculation methodology to include the additional $f_{organic}$ term for radiolytic HGR and included a combined TOC and Aluminum contribution criterion to protect a new thermolytic HGR LIMIT. Added Table 2a to document the derivation of the radiolytic HGR limit and updated the background section. - Section 5.4.4: Added requirement and background for evaluation of new chemicals in Tank 50H for flammability of SDUs 3 and 6, SFT and SSRTs - Section 5.4.11: Updated text and references in the background section of gamma shielding - Section 7.0: Updated References 13, 23, 39, 41, 44, 47, 51, 64, 66, 67 and 68. Added References 74, 75, 76 and 77. Deleted References 9 and 43. - Section 8.0: Revised tables in Attachments 8.1, 8.2, 8.3, and 8.4 for consistency with the 2017 Annual Update DSA changes. Added new chemical TARGET chemical values for aluminum, TOC and formate. Also added new radionuclide TARGET values for Pr-144, U-233 and total alpha. - Appendix 1: Revised radionuclide and chemical tables to include updated DSA concentration values as well as identified in the Basis section what concentration was most limiting for the radionuclide where applicable (e.g., gamma shielding, IDP, radiolytic HGR)

TABLE OF CONTENTS

APPENDIX 1

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

- **Saltstone Technical Safety Requirements (TSR) 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 (SCDHEC) to allow the Saltstone Facility to treat a specific low-level waste (LLW) stream generated in H Canyon (Ref. 2). In 2005 another notification letter (ESH-EPG-2005-00131) was transmitted to SCDHEC 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 LLW stream 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 the Saltstone Facility 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 Waste Acceptance Criteria (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 49H 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 DSS is transferred to Tank 50H for feed to the Saltstone Facility.

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 (HTF). This document describes the waste acceptance criteria that are required for the transfer of LLW 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 SCDHEC Regulation 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 (SCHWM) Regulation R.61-79. The SDF is permitted as a solid waste landfill site, as defined by SCDHEC Regulation R61-107.19.

LLW 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 Solution Receipt Tanks (SSRTs) or alternatively to the Salt Feed Tank (SFT) in Z Area during Interim Salt Disposition Project (ISDP) operations. As presently permitted by SCDHEC, all transfers of aqueous waste to the Saltstone Facility shall come through the jacketed pipeline that connects Tank 50H to the SSRTs (or the SFT) (Ref. 4). Operation of Tank 50H and the interarea transfer line is controlled administratively by HTF Operations. Saltstone Facility Operations assumes responsibility for the aqueous waste when it enters the SSRTs (or the SFT). If flushing of the interarea transfer line to the SFT or the SSRTs is required, an evaluation of the inhibited water addition must be completed by TF-FE and reviewed and approved by D&S-FE to ensure compliance with the Saltstone WAC.

Except for salt solution transferred from Tank 50H, receipt of waste from outside of 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 the Department of Energy (DOE).

Transfer of aqueous waste from onsite or offsite waste generators to the Saltstone Facility by any means other than through Tank 50H is not allowed. HTF Operations is responsible for waste transfers into and from Tank 50H. Waste to be placed into Tank 50H shall meet acceptance criteria specified by HTF 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 48H material to the Saltstone Facility 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.

This WAC revision applies to Low Isopar L Operation (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/regulatory 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 (e.g., quarterly). A WAC deviation is not required if an individual TARGET (radionuclide/chemical) that has been used in the derivation of a LIMIT (IDP, HGR, Gamma Shielding, Other Organics – Flammability) has been exceeded as long as the waste generator can demonstrate that the LIMIT is still met. TARGETS are also used to show compliance with regulatory requirements [maximum expected concentrations in permits, the 2009 PA, 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.
- Preparing and maintaining a Waste Compliance Plan (WCP) that will ensure compliance with the Saltstone WAC and will serve as an agreement between HTF 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 (D&S-FE).
- Developing requests for deviations from the requirements of the Saltstone WAC (when required).

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

- Reviewing the Saltstone WAC.
- Pulling all samples for wastes transferred to the Saltstone Facility; 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 D&S-FE 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 the 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 WAC.
- 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 SCHWM Regulation R.61-79.
- Making applicable notifications to SCDHEC.
- Maintaining applicable permits for continued operation(s) in Z Area.

4.5 Saltstone Operations/Facility Management 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 uses a simple mixing process, which blends the aqueous waste stream with dry materials consisting of slag, flyash, and cement. SPF treatment renders the waste stream RCRA non-hazardous for disposal at the SDF. 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 RCRA hazardous waste. The Toxicity Characteristic of the waste is tested by the Toxicity Characteristic Leaching Procedure (TCLP) and is performed by an Environmental Protection Agency (EPA)-certified laboratory. The Toxicity Characteristic measurement is used to certify the RCRA non-hazardous nature of the saltstone for disposal in the SDF. The SPF mixing process has been approved by SCDHEC as a site-specific specified technology to treat the salt solution from Tank 50H in order to meet the Land Disposal Restriction (LDR) requirements, assuming that the LDRs apply to the SDF (Refs. 5 and 28).

Analyses that are required per the permits are the responsibility of D&S-FE. Analyses that are required per the permits 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 WAC are the responsibility of the sending facility.

Grout formulation work to confirm that the Tank 50H salt solution when combined with the premix blend can make acceptable grout will be performed when necessary. Additionally, 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 quarterly Regulatory Compliance samples pulled in Tank 50H should be characterized for both LIMIT and TARGET acceptance criteria in this WAC.

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 Toxicity Characteristic conditions needed to certify saltstone as RCRA 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 or LLW 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 SSRTs (or the SFT) through a pipeline that links the SPF to Tank 50H in HTF, 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

TF-FE 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. When sample results are utilized to demonstrate compliance, the individual acceptance criteria in the WAC will specify whether analytical uncertainty shall be included or not. If required, the uncertainty shall be used in any subsequent calculations based on those results. Analytical uncertainty is not required for concentrations reported at minimum detection limits (Ref. 13). 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 flammability are, in most cases, more restrictive than the chemical LIMITS to protect chemical consequences in the DSA). If the WAC LIMIT 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 (IDP)

5.4.1.1 Criteria: The IDP for the material to be transferred shall have a total rem/gallon value less than or equal to 1.78E+05 rem/gallon accounting for analytical uncertainty.

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

5.4.1.3 Computational Technique: IDP 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: The following radionuclides are significant contributors to inhalation dose: Co-60, Sr-90, Y-90, Tc-99, Ru-106, Cs-137, Pm-147, Eu-154, U-232, U-233, U-234, U-236, U-238, Pu-241, and Total α (Ref. 47). In Table 1 below, the WAC IDP concentrations were set at 25% of the IDP curie balance concentrations for Sr-90 and Y-90; 80% of the IDP curie balance concentration for total alpha; and 90% of the IDP curie balance concentrations for Co-60, Ru-106, Pm-147, Eu-154, Eu-155, U-232, U-233, U-234, U-236, U-238, and Pu-241. The IDP curie balance for Cs-137 was set equal to 100% of the WAC Shielding basis in Section 5.4.11. The WAC IDP curie balance for Tc-99 was set equal to the recommended concentration for the 2009 PA in Appendix 1.

An analytical uncertainty of 2 Sigma shall be accounted for in sample analyses used to determine IDP compliance (Ref. 13).

TABLE 1: Calculation of IDP WAC LIMIT

Radionuclide (Ref. 47)	**IDP Curie Balance Conc. (Ci/gallon) [pCi/mL] (Ref. 47)**	**WAC IDP Conc. (Ci/gallon) [pCi/mL]**	**Dose Conversion Factor (rem/Ci) (Ref. 47)**	**WAC IDP (rem/gallon)**
Co-60	4.73E-03 [1.25E+06]	4.26E-03 [1.13E+06]	1.15E+05	4.90E+02
Sr-90	3.97E-02 [1.05E+07]	9.93E-03 [2.62E+06]	8.88E+04	8.81E+02
Y-90	3.97E-02 [1.05E+07]	9.93E-03 [2.62E+06]	5.55E+03	5.51E+01

Radionuclide (Ref. 47)	IDP Curie Balance Conc. (Ci/gallon) [pCi/mL] (Ref. 47)	WAC IDP Conc. (Ci/gallon) [pCi/mL]	Dose Conversion Factor (rem/Ci) (Ref. 47)	WAC IDP (rem/gallon)
Tc-99	1.78E-02 [4.69E+06]	7.99E-04 [2.11E+05]	1.48E+04	1.18E+01
Ru-106	4.73E-03 [1.25E+06]	4.26E-03 [1.13E+06]	2.44E+05	1.04E+03
Cs-137	2.00E-01 [5.28E+07]	1.50E-02 [3.96E+06]	1.70E+04	2.55E+02
Pm-147	2.37E-02 [6.26E+06]	2.13E-02 [5.63E+06]	1.85E+04	3.95E+02
Eu-154	9.46E-03 [2.50E+06]	8.51E-03 [2.25E+06]	1.96E+05	1.67E+03
U-232	3.43E-05 [9.06E+03]	3.09E-05 [8.15E+03]	1.37E+08	4.23E+03
U-233	4.73E-05 [1.25E+04]	4.26E-05 [1.13E+04]	3.55E+07	1.51E+03
U-234	4.73E-05 [1.25E+04]	4.26E-05 [1.13E+04]	3.48E+07	1.48E+03
U-236	4.73E-05 [1.25E+04]	4.26E-05 [1.13E+04]	3.22E+07	1.37E+03
U-238	4.73E-05 [1.25E+04]	4.26E-05 [1.13E+04]	2.96E+07	1.26E+03
Pu-241	3.52E-03 [9.31E+05]	3.17E-03 [8.38E+05]	3.33E+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				**1.78E+05**

5.4.2 LIMITS/TARGETS for Chemicals Impacting 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 2 shall not be exceeded to protect the assumptions used in flammability calculations accounting for analytical uncertainty.

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

5.4.2.3 Background: In order to protect assumptions associated with flammability, the facility has set maximum WAC LIMITS/TARGETS 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 potassium TPB (KTPB) in Tank 50H 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 Facility 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).

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 (Ref. 59).

An analytical uncertainty of 2 Sigma shall be accounted for in sample analyses used to determine flammability compliance (Ref. 13).

TABLE 2: Acceptance Criteria LIMITS/TARGETS for Chemical Contaminants Impacting 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	3.50E+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 (HGR)

5.4.3.1 Criteria:

a. The radiolytic HGR for the salt solution to be transferred shall be less than or equal to 1.41E-08 ft^3 of hydrogen/hr/gal of salt solution in grout at 95°C.

b. The thermolytic HGR for the salt solution to be transferred shall have a combined TOC and aluminum contribution less than or equal to 0.05 wt%.

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

5.4.3.3 Computational Technique:

a. Radiolytic HGR at 95ºC shall be calculated from the radioactive decay heat using the following equation (Ref. 74):

$$x_{rad} = \frac{R_{\beta/\gamma}H_{\beta/\gamma}+R_{\alpha}H_{\alpha}}{10^6} \times \frac{95+273.15}{0+273.15}$$

where:

x_{rad} = radiolytic hydrogen generation rate
$R_{\beta/\gamma}$ = 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:

$$R_{\alpha} = 134.7 - 82.3\cdot(NO_{eff})^{1/3} - 13.6\cdot(NO_{eff})^{2/3} + 11.8\cdot(NO_{eff}) + 25.48\cdot f_{organic}$$

$$R_{\beta/\gamma} = 48.36 - 52.78\cdot(NO_{eff})^{1/3} + 14.1\cdot(NO_{eff})^{2/3} + 0.572\cdot(NO_{eff}) + 54.73\cdot f_{organic}$$

where:

NO_{eff} = the nitrate concentration plus one-quarter the nitrite concentration
$f_{organic}$ = the fraction of hydrogen radicals that react with organics to produce H_2
= 2.1E+08· $[CHOO^-]$ / (2.1E+08· $[CHOO^-]$ + 2.2E+07· $[OH^-]$ + 1.4E+06· $[NO_3^-]$ + 7.10E+08· $[NO_2^-]$ ·0.5) (concentration in mol/L)

where:

$[CHOO^-]$ = the concentration of formate (mol/L)
$[OH^-]$ = the concentration of hydroxide (mol/L)
$[NO_3^-]$ = the concentration of nitrate (mol/L)
$[NO_2^-]$ = the concentration of nitrite (mol/L)

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:
Q_i = heat generated per curie for each isotope that decays by alpha
A_i = total activity of each isotope that decays by alpha
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

b. Thermolytic HGR at 95°C shall be demonstrated using the following equation (Ref. 75):

Combined TOC and Al Contribution = $\{TOC\} * \{Al\}^{0.4}$

where:

$\{TOC\}$ = TOC concentration (wt%)
$\{Al\}$ = Al concentration (wt%)

and

$$\{TOC\} = \frac{TOC\left(\frac{mg}{L}\right)\left(\frac{1\,g}{1000\,mg}\right)}{\rho_{SS}\left(\frac{g}{mL}\right)\left(\frac{1000\,mL}{1\,L}\right)} \times 100\%$$

$$\{Al\} = \frac{Al\left(\frac{mg}{L}\right)\left(\frac{1\,g}{1000\,mg}\right)}{\rho_{SS}\left(\frac{g}{mL}\right)\left(\frac{1000\,mL}{1\,L}\right)} \times 100\%$$

where
ρ_{SS} = salt solution density (g/mL)

5.4.3.4 Background:

a. Radiolytic HGR for a given waste depends on the radiation dose to the waste, the presence of organics, 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.

In Table 2a, below, the concentrations for the HGR-significant radionuclides from Reference 47 have been reduced to 25% of the original DSA Curie Balance concentrations documented in Reference 47 to allow for a higher filled height in SDU cells (Ref. 74). The radiolytic HGR limit corresponding to this reduction in the DSA concentration is 1.41E-08 ft^3/hr/gal.

TABLE 2a: Calculation of HGR WAC Limit*

Species	HGR Curie Balance Conc. (Ci/gal) [pCi/mL]	WAC HGR Curie Conc. (Ci/gal) [pCi/mL]	Heat Rate Curie Balance (BTU/hr/gal)	WAC Heat Rate (BTU/hr/gal)	R-Value ($ft^3/10^6$ BTU)	WAC HGR Concentration @ 95°C (ft^3/hr/gal)
Co-60	4.73E-03 [1.25E+06]	1.18E-03 [3.12E+05]	2.49E-04	6.22E-05	6.83	5.73E-10
Sr-90	3.97E-02 [1.05E+07]	9.93E-03 [2.62E+06]	1.57E-04	3.93E-05	6.83	3.62E-10
Y-90	3.97E-02 [1.05E+07]	9.93E-03 [2.62E+06]	7.51E-04	1.88E-04	6.83	1.73E-09
Tc-99	1.78E-02 [4.70E+06]	4.45E-03 [1.18E+06]	3.04E-05	7.59E-06	6.83	6.99E-11
Ru-106	4.73E-03 [1.25E+06]	1.18E-03 [3.12E+05]	9.61E-06	2.40E-06	6.83	2.21E-11
Rh-106	4.73E-03 [1.25E+06]	1.18E-03 [3.12E+05]	3.06E-04	7.65E-05	6.83	7.04E-10
Sb-125	9.46E-03 [2.50E+06]	2.73E-03 [7.21E+05]	1.09E-04	2.72E-05	6.83	2.51E-10
Te-125m	2.17E-03 [5.73E+05]	5.43E-04 [1.43E+05]	6.43E-06	1.62E-06	6.83	1.49E-11
Cs-134	9.20E-04 [2.43E+05]	2.30E-04 [6.08E+04]	3.20E-05	8.00E-06	6.83	7.37E-11
Cs-137	2.00E-01 [5.28E+07]	5.00E-02 [1.32E+07]	6.90E-04	1.72E-04	6.83	1.59E-09
Ba-137m	1.89E-01 [4.99E+07]	4.73E-02 [1.25E+07]	2.55E-03	6.36E-04	6.83	5.86E-09
Pr-144	4.73E-04 [1.25E+05]	1.18E-04 [3.12E+04]	1.19E-05	2.96E-06	6.83	2.73E-11
Pm-147	2.37E-02 [6.26E+06]	5.93E-03 [1.57E+06]	2.96E-05	7.41E-06	6.83	6.82E-11
Eu-154	9.46E-03 [2.50E+06]	2.37E-03 [6.25E+05]	2.93E-04	7.33E-05	6.83	6.75E-10
U-232	3.43E-05 [9.06E+03]	8.35E-06 [2.21E+03]	3.68E-06	9.21E-07	38.72	4.80E-11
U-233	4.73E-05 [1.25E+04]	1.18E-05 [3.12E+03]	4.61E-06	1.15E-06	38.72	6.02E-11
U-234	4.73E-05 [1.25E+04]	1.18E-05 [3.12E+03]	4.57E-06	1.14E-06	38.72	5.96E-11
U-236	4.73E-05 [1.25E+01]	1.18E-05 [3.12E+03]	4.30E-06	1.07E-06	38.72	5.61E-11
U-238	4.73E-05 [1.25E+04]	1.18E-05 [3.12E+03]	4.02E-06	1.01E-06	38.72	5.25E-11
Total α	1.01E-03 [2.67E+05]	2.53E-04 [6.68+04]	1.28E-04	3.21E-05	38.72	1.67E-09
WAC Limit						**1.41E-08**

* The HGR limit is calculated assuming an $f_{organic}$ value of 0. For compliance calculations, a calculated $f_{organic}$ value shall be applied to meet the limit provided in Section 5.4.3.1.a.

b. Reference 75 reduces the thermolytic HGR equation in X-ESR-Z-00037 based on TOC and Al concentrations along with temperature, to be solely dependent on temperature by choosing conservative TOC and Al concentrations and salt solution density from past sampling in Tank 50H. Reference 75 derived the 0.05 wt% waste acceptance criteria limit using a maximum TOC value of 750 mg/L (based on a Tank 50H 3Q12 sample), a maximum Al value of 7000 mg/L (based on a Tank 50H 1Q17 sample), and a minimum salt solution density of 1.20 g/mL (based on a Tank 50H 3Q12 sample).

Both radiolytic and thermolytic HGR calculations can use nominal radionuclide concentrations without adding analytical uncertainty. For radiolytic HGR, this is based on conservative R-values used in determining the generation rate and the calculation of $f_{organic}$ which incorporates the impacts of organics on the radiolytic generation of hydrogen. For thermolytic HGR, this is based on the reactivity coefficient for organic species being conservatively taken as 1, as well as the conservative derivation of the salt solution density and TOC and Al concentrations utilized, which are based on the combined most conservative value of each component (Ref. 13).

5.4.4 "Other Organics" Contribution to Flammability

5.4.4.1 Criteria: The volatiles in salt solution other than Isopar L, benzene, ammonia and hydrogen shall not exceed the concentrations given in Table 3 accounting for analytical uncertainty or, if concentrations are higher, shall be evaluated using existing flammability methodology to demonstrate DSA compliance. These "other organics" include butanol, tributylphosphate (TBP) (which decomposes to butanol and dibutylphosphate), isopropanol, methanol and NORPAR 13.

If a new flammable chemical is identified in the Tank 50H vapor space or in the Tank 50H salt solution, an evaluation shall be performed to determine its contribution to flammability of the SDUs 3 and 6, SFT and SSRTs prior to receiving additional transfers from Tank 50H. If the result is greater than 0.5% contribution to CLFL, the new flammable species is not considered to be within the existing safety analysis. If the evaluation result is less than 0.5% contribution to CLFL, no further action is required.

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 the Saltstone Facility: butanol, TBP, isopropanol, methanol and NORPAR 13. TF-FE must demonstrate compliance using one of two methods:

(a) Ensure that the concentrations of the five organics are less than the WAC values given in Table 3.

OR

(b) Perform an engineering evaluation to demonstrate that the cumulative contribution to flammability from all five remain less than or equal to the cumulative value from all five organic concentrations given in Table 3. Flammability impacts to the SDUs, SFT and SSRTs must be considered.

TABLE 3: Concentrations of "Other Organics" Impacting Flammability

(Low Isopar L Operation: 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
Propanol	C_3H_7OH	60.09	0.25
Methanol	CH_3OH	32.04	0.05
NORPAR 13	----	187	0.75

Reference 76 provides the methodology for conservatively determining the flammability input of a new chemical found in the Tank 50H vapor space or the Tank 50H salt solution. As an example, Reference 77 provides the flammability evaluation for trimethylamine (TMA).

5.4.4.4 Background: The flammability methodology to be used in the engineering evaluation (if required) is documented in calculation S-CLC-Z-00080 (Ref. 54) for SDUs 2, 3, and 5, calculation S-CLC-Z-00115 (Ref. 69) for SDU 6, calculation S-CLC-Z-00055 (Ref. 66) for the SFT, and calculations S-CLC-Z-00073 (Ref. 67) and S-CLC-Z-00089 (Ref. 68) for the SSRTs. 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.

For analysis of new flammable species in SDUs 3 and 6, SFT and SSRTs, a threshold of 0.5% is appropriate as it has minimal impact to overall results of safety analyses (Ref. 76). For the SDUs, flammability measurements made while pouring into a cell, following pouring, and for a full cell indicate there is a significant margin to even approaching a CLFL condition. SDUs 2, 4, and 5 have actual measurement data supporting their flammability basis and will not be reevaluated because SDUs 2 and 5 are operationally filled and the SDU 4 grout transfer line is disconnected. Due to limiting tank temperatures in the SFT and SSRTs, there is also sufficient margin in approaching a CLFL condition in the SFT and SSRTs. Because of this minimal impact, allowance for cumulative additions of species less than 0.5% of the LFL is not required.

An analytical uncertainty of 2 Sigma shall be accounted for in sample analyses used to determine Flammability compliance (Ref. 13).

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) accounting for analytical uncertainty.

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.

An analytical uncertainty of 2 Sigma shall be accounted for in sample analyses used to determine criticality safety compliance (Ref. 13).

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 accounting for analytical uncertainty. These chemicals and their associated LIMITS are provided in ionic/metal form. A complete list of the potential chemical compounds generated from these ions/metals is provided in Appendix 1. Individual chemical compound concentrations which are bounded by the ionic/metal concentrations given in Attachment 8.1 can be found in References 13, 51 and 65.

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 the Saltstone Facility 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 RCRA listed waste, as designated by the SCHWM Regulation 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 RCRA hazardous waste, as designated by the SCHWM Regulation or the EPA, is strictly prohibited.

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

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, and 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 ($HCOO^-$), calcium (Ca), 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 ensure saltstone is acceptable.]*

The total mercury WAC LIMIT of 325 mg/L protects the mercury RCRA Toxicity Characteristic limit of 0.2 mg/L assuming a salt solution aqueous waste density of 1.25 g/mL (Refs. 61, 62 and 63). Other species of mercury may be present in the waste stream and are addressed in Appendix 1.

An analytical uncertainty of 2 Sigma shall be accounted for in sample analyses used to determine chemical LIMITS compliance (Ref. 13).

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 accounting for analytical uncertainty. These chemicals and their associated TARGETS are provided in ionic/metal form. A complete list of the potential chemical compounds generated from these ions/metals is provided in Appendix 1. Individual chemical compound concentrations which are bounded by the ionic/metal concentrations given in Attachment 8.2 can be found in References 13, 51 and 65.

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.

An analytical uncertainty of 2 Sigma shall be accounted for in sample analyses used to determine chemical TARGETS compliance (Ref. 13).

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 accounting for analytical uncertainty. 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 the Saltstone Facility 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 DSA (Ref. 13) and the 2009 PA (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 transuranic (TRU) waste or HLW waste is prohibited (Refs. 1, 6, 13, 14, 27, and 33).

The disposal of waste in the SDF SDUs is controlled via the 2009 PA 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 Fiscal Year (FY) 2013 SA (Ref. 52) documents the assurance that all applicable performance objectives (per 2009 PA) associated with the operation and closure of the SDF 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.

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.

An analytical uncertainty of 2 Sigma shall be accounted for in sample analyses used to determine radionuclide LIMITS compliance (Ref. 13).

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 accounting for analytical uncertainty.

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).

An analytical uncertainty of 2 Sigma shall be accounted for in sample analyses used to determine radionuclide TARGETS compliance (Ref. 13).

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 4.

5.4.10.2 Criteria Type: LIMIT

5.4.10.3 Background: See Basis section in Table 4. Nominal values can be used without adding analytical uncertainty to the Table 4 criteria (e.g., Na, solids).

TABLE 4: 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 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 at or 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 Radiological Control Operations (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 shielding design basis calculations and the variable radionuclide feed being sent to Tank 50H and the Saltstone Facility. Significant gamma sources used for Saltstone shielding criteria include Co-60, Sb-125, Cs-134, Cs-137 and Eu-154 (Refs. 10 and 42). 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 assume a Cs-137 concentration of 0.2 Ci/gal whereas the Saltstone Facility shielding calculations assume 0.03 Ci/gal for SDU 2 cylindrical disposal cells (Refs. 10 and 46). The SDU 3 and 5 Project along with the SDU 6 Project are using a Cs-137 concentration of 0.015 Ci/gal as the basis for shielding during ARP/MCU operations (Refs. 42 and 46).

In Table 5, the WAC shielding concentrations were set at 90% of the shielding curie balance concentrations assumed in the Saltstone shielding calculations, with the exception of Cs-134 and Cs-137, which were set at 100% of the shielding curie balance concentrations.

The shielding basis is part of the overall Radiation Protection Program – nominal radionuclide concentrations can be used without adding analytical uncertainty.

TABLE 5: Calculation of Gamma Source Strength WAC LIMIT

Radionuclide (Ref. 10)	**Shielding Curie Balance Conc. (Ci/gallon) [pCi/mL] (Refs. 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 [1.08E+03]	3.69E-06 [9.75E+02]	1.37E+03	5.06E-03
Sb-125	3.36E-05 [8.88E+03]	3.02E-05 [7.99E+03]	3.80E+02	1.15E-02
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 [1.79E+03]	6.11E-06 [1.62E+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, 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 2009 Saltstone PA (Ref. 25) and the subsequent SAs (Refs. 52, 57).

5.4.13 Regulatory Criteria

5.4.13.1 Criteria:

A. For the quarterly Tank 50H samples, the Toxicity Characteristic WAC LIMITS for the eight RCRA metals shown in Table 6 shall not be exceeded.
B. 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 Concentrate 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 6: Regulatory Toxicity Characteristic LIMITS for RCRA Metals

RCRA Metal	Regulatory Toxicity (mg/L)	WAC LIMIT (mg/L)	Basis
Arsenic (As)	5	2.5	50% of Toxicity Limit
Barium (Ba)	100	50	50% of Toxicity Limit
Cadmium (Cd)	1	0.5	50% of Toxicity Limit
Chromium (Cr)	5	2.5	50% of Toxicity Limit
Lead (Pb)	5	2.5	50% of Toxicity Limit
Mercury (Hg)	0.2	0.1	50% of Toxicity Limit
Selenium (Se)	1	0.5	50% of Toxicity Limit
Silver (Ag)	5	2.5	50% of Toxicity Limit

5.4.13.2 Criteria Type: LIMIT

5.4.13.3 Background: During operation, a saltstone solution sample is collected quarterly from Tank 50H and is used to prepare an SDF waste form (saltstone) sample. This saltstone sample determines the RCRA nonhazardous nature of the saltstone to meet the requirements of SCHWMR Regulation R.61-79. The SPF mixing process has been approved by SCDHEC as a site-specific specified technology (Refs. 5 and 28) to treat the salt solution from Tank 50H in order to meet the LDR disposal requirements, assuming that the LDRs apply to the SDF.

A combination of regulatory controls, including Toxicity Characteristic measurements and required total mercury characterization for Tank 50H influent streams, provides confidence that permit requirements will be met. The quarterly Tank 50H Toxicity Characteristic measurement (permit requirement) is a single data point and therefore has no associated analytical 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 2009 Saltstone PA (Ref. 25) or the subsequent SAs (Refs. 52 and 57).

5.4.14 Temperature

5.4.14.1 Criteria: The temperature of the salt solution transferred to the SPF shall be less than or equal to 40°C accounting for instrument uncertainty.

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

5.4.14.3 Computational Technique: Direct Measurement

5.4.14.4 Background: The maximum temperature limit of 40°C establishes the initial temperature of the salt solution in the SSRT which is then used for thermal and flammability analysis in the Saltstone DSA.

5.4.15 Chemical Resistance of SDU 6 Liner / Coating

5.4.15.1 Criteria: The chemicals in salt solution shall not exceed the chemical concentrations of the simulant salt solution used in the SDU 6 liner and coatings performance testing given in Table 7 or, if the concentrations are higher, shall then be evaluated against the chemical resistance charts for the SDU 6 REMA CHEMOLINE 4 CN liner and Hempel Versiline EC-66 coating.

5.4.15.2 Criteria Type: TARGET

5.4.15.3 Background: The chemicals listed in Table 7 have been identified as potentially corrosive to SDU 6 concrete based on ACI 350. A liner system was installed on the floor, wall, and column pedestals, and a coating was installed on the lower two feet of the columns to protect the structural concrete as required by ACI 350 code requirements. Chemical resistance testing of the liner and coating was performed to evaluate their resistance to damage when exposed to a reference salt solution at a bounding temperature (Refs. 70 and 71). The testing was completed using a reference salt solution consisting of three cations and eight anions with concentrations given in Table 7. Meeting the concentration values in Table 7 ensures that the SDU 6 liner / coating systems protect the structural concrete in accordance with ACI 350.

Liner and coating manufacturers conduct exposure tests of their products using pure chemicals at various temperatures. The reference salt solution was developed to test the synergistic effect of the chemicals identified as potentially damaging to the structural concrete and which exist in various concentrations in salt solution. Since the reference salt solution was not designed to bound all maximum concentrations of the constituents discussed in Reference 70 due to solubility limitations, it is possible that some constituent concentrations in Table 7 may be exceeded. For those concentrations exceeded, an evaluation shall be performed by the responsible technical authority which will include the use of the resistance charts for the CHEMOLINE 4 CN liner (Ref. 72) and Hempel Versiline EC-66 coating (Ref. 73), where applicable, and engineering judgment where needed.

TABLE 7: Concentrations of Reference Salt Solution for SDU 6 Liner / Coating

Chemical Name	Chemical Formula	Concentration (M)	Concentration (mg/L)
Cations			
Sodium	Na^+	6.73	1.55E+05
Aluminum	Al^{3+}	0.22	5.94E+03
Potassium	K^+	0.06	2.35E+03
Anions			
Hydroxide	OH^-	2.30	3.91E+04
Nitrate	NO_3^-	2.35	1.46E+05
Nitrite	NO_2^-	0.90	4.14E+04
Carbonate	CO_3^{2-}	0.20	1.20E+04
Sulfate	SO_4^{2-}	0.18	1.73E+04
Chloride	Cl^-	0.11	3.90E+03
Phosphate	PO_4^{3-}	0.05	4.75E+03
Oxalate	$C_2O_4^{2-}$	0.01	8.80E+02

Chemical resistance is driven by ACI 350 code requirements and is not safety related - nominal chemical concentrations can be used without adding analytical uncertainty.

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 and 26).

5.5.2 Waste Compliance Plan

A 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 HTF and the Saltstone Facility 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, and 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, and 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, and 33).
- Complete all analyses and/or calculations described in the WCP.

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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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 [1, 5]
Solvated Ions				
Aluminate [6]	$Al(OH)_4^-$	95.02	4.08E+05	61.6% of Permit Max.
Ammonium	NH_4^+	18.04	2.12E+02	91% of DSA Value
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	75% of DSA Value
Nitrate	NO_3^-	62.01	4.37E+05	75% of DSA Value
Nitrite	NO_2^-	46.01	2.14E+05	75% of DSA Value
Oxalate	$C_2O_4^{2-}$	88.02	2.72E+04	75% of DSA Value
Phosphate	PO_4^{3-}	94.97	3.14E+04	75% of DSA Value
Sulfate	SO_4^{2-}	96.06	5.69E+04	75% of DSA Value
RCRA Hazardous Metals				
Arsenic	As	74.92	1.97E+02	75% of DSA Value
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	1.50E+03	75% of DSA Value
Lead	Pb	207.2	7.50E+02	75% of DSA Value
Total Mercury [3]	Hg	200.6	3.25E+02	91% of DSA Value
Elemental Mercury	Hg	200.6	3.25E+02	91% of DSA Value
Monomethyl Mercury	CH_3Hg	215.6	3.50E+02	91% of DSA Value
Ethyl Mercury	C_2H_5Hg	229.7	3.73E+02	91% of DSA Value
Selenium	Se	78.96	3.75E+02	75% of DSA Value
Silver	Ag	107.9	6.19E+02	75% of DSA Value
Other Metals				
Aluminum [4]	Al^{3+}	26.98	1.16E+05	75% of DSA Value
Potassium	K	39.10	3.03E+04	75% of DSA Value
Organic Compounds				
Butanol [2]	C_4H_9OH	74.12	7.73E+00	75% of DSA Value
Propanol [2]	C_3H_7OH	60.09	1.88E+00	75% of DSA Value
Phenol	C_6H_5OH	94.11	7.50E+02	91% of DSA Value
Tetraphenylborate (TPB) [2]	$B(C_6H_5)_4^-$	319.22	5.00E+00	91% of DSA Value
Total Organic Carbon [4]	----	----	4.50E+03	75% of Permit Max.
Isopar L [2]	----	163	8.75E+01	100% of DSA Value

Footnote 1: The permit maximum expected concentrations are concentrations that are not expected to be exceeded. However, exceedance of a permit maximum 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 SDF area (Refs. 1, 4 and 33).

Footnote 2: The WAC LIMITS given above are based on bounding DSA concentrations for accident consequence analysis. However, to protect assumptions associated with flammability, more restrictive concentrations have been set for specific chemicals - see Tables 2 and 3. Additionally, to protect regulatory limits for the final Saltstone grout, additional requirements are being imposed on the influent streams to Tank 50H in WAC Section 5.4.13.

Footnote 3: The total mercury WAC LIMIT of 325 mg/L protects the mercury RCRA Toxicity Characteristic limit of 0.2 mg/L assuming a salt solution aqueous waste density of 1.25 g/mL (Refs. 61, 62 and 63).

Footnote 4: The WAC LIMITS given above for Aluminum and TOC are based on bounding DSA concentrations for accident consequence analysis. However, to protect assumptions associated with thermolytic HGR, more restrictive WAC TARGET concentrations have been set for Aluminum and TOC in Attachment 8.2. See WAC Section 5.4.3 and Appendix 1 for further details.

Footnote 5: The "XX% of DSA Value" applies to the ionic/metal concentrations given in Ref. 51 which bound the chemical compound concentrations in the Saltstone DSA (Ref. 13).

Footnote 6: Aluminate is not measured and should be calculated from the measured aluminum concentration assuming all of the Al is present as the hydroxide compound.

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 that protects a WAC LIMIT (Other Organics – Flammability), then TF-FE will be required to demonstrate that the WAC LIMIT will be met.

Chemical Name	Chemical Formula	Molecular Weight (grams/mole)	WAC TARGET (mg/L)	Basis [1, 5]
Other Metals				
Aluminum[6]	Al	26.98	7.00E+03	SF-I-GE-0063
Boron	B	10.81	7.43E+02	75% of DSA Value
Cobalt	Co	58.93	1.45E+02	75% of DSA Value
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
RCRA Hazardous Metals				
Dimethyl Mercury	$(CH_3)_2Hg$	230.7	1.00E+00	91% of DSA Value
Organic Compounds				
Benzene [2]	C_6H_6	78.11	3.10E+02	75% of DSA Value
Methanol [3]	CH_3OH	32.04	1.88E+00	75% of DSA Value
Toluene [4]	$C_6H_5CH_3$	92.13	3.10E+02	75% of DSA Value
Dibutylphosphate (DBP)	$C_8H_{19}O_4P$	210.21	3.47E+02	75% of DSA Value
Tributylphosphate (TBP) [3]	$(C_4H_9O)_3PO$	266.32	7.50E+00	75% of DSA Value
Total Organic Carbon (TOC)[6]	--	--	7.50E+02	SF-I-GE-0063
EDTA [4]	$C_{10}H_{12}N_2O_8^{4-}$	292.25	3.10E+02	75% of DSA Value
NORPAR 13	C_nH_{2-n}	187	7.50E-01	100% of Flammability Value
Formate	$CHOO^-$	45.02	6.38E+03	75% of DSA Value

Footnote 1: The permit maximum expected concentrations are concentrations that are not expected to be exceeded. However, exceedance of a permit maximum 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 SDF area (Refs. 1, 4, and 33).

Footnote 2: The only source of benzene is from the decomposition of TPB.

Footnote 3: The WAC TARGETS given above are based on bounding DSA concentrations for accident consequence analysis. However, to protect assumptions associated with flammability, more restrictive concentrations have been set for methanol and TBP - see Table 3.

Footnote 4: The SDU flammability calculations for SDUs 2, 3 and 5 (S-CLC-Z-00080) and SDU 6 (S-CLC-Z-00115) 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 5: The "XX% of DSA Value" applies to the ionic/metal concentrations given in Ref. 51 which bound the chemical compound concentrations in the Saltstone DSA (Ref. 13).

Footnote 6: The WAC LIMITS given in Attachment 8.1 for Aluminum and TOC are based on bounding DSA concentrations for accident consequence analysis. However, to protect assumptions associated with thermolytic HGR, more restrictive WAC TARGET concentrations have been set for Aluminum and TOC in Attachment 8.2. See WAC Section 5.4.2 and Appendix 1 for further details.

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., Nuclear Regulatory Commission (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 5.4.11.

Radionuclide	WAC LIMIT (pCi/mL)	Basis
H-3	5.63E+05	90% of Permit Max. (NRC Class A)
C-14	1.13E+05	90% of Permit Max. (NRC Class A)
Ni-63	1.13E+05	90% of Permit Max. (NRC Class A)
Sr-90	2.62E+06	25% of DSA Value
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) and SRR-CWDA-2013-00097 (Ref. 50)
Cs-137	3.96E+06	100% of Cs-137 Conc. Limit in Shielding
U-233	1.13E+04 **[SAC]**	90% of NCSE Value
U-235	1.13E+02 **[SAC]**	90% of NCSE Value
Pu-241	8.38E+05 **[SAC]**	90% of DSA Value & Permit Max. (NRC Class A, NCSE)
Total α [1]	2.13E+05 **[SAC]**	80% of DSA Value & 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 PA and SA Performance Objectives (Refs. 50, 52 and 57). 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 that protects a WAC LIMIT (IDP, HGR, Gamma Shielding, Other Organics – Flammability), then TF-FE will be required to demonstrate that the WAC LIMIT will be met.

Radionuclide	WAC TARGET (pCi/mL)	Basis [1]
Al-26	2.88E+03	2009 PA Implementation
K-40	1.00E+02	2009 PA Implementation
Co-60	9.75E+02	90% of Co-60 Conc. in Shielding
Ni-59	1.13E+03	2009 PA Implementation
Se-79	1.90E+04	2009 PA Implementation
Y-90	2.62E+06	25% of DSA Value
Zr-93	1.00E+05	2009 PA Implementation
Nb-94	1.53E+02	2009 PA Implementation
Ru-106	3.12E+05	25% of DSA Value & Permit Max.
Rh-106	3.12E+05	25% of Permit Max.
Sb-125	7.99E+03	90% of Sb-125 Conc. in Shielding
Te-125m	1.83E+03	22.9% of Sb-125 Conc.
Sn-126	1.80E+04	2009 PA Implementation
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	94.6% of Cs-137 Conc.
Ce-144	3.12E+04	100% of Pr-144 Conc.
Pr-144	3.12E+04	25% of Permit Max.
Pm-147	1.57E+06	90% of DSA Value & Permit Max.
Sm-151	2.25E+04	2009 PA Implementation
Eu-154	1.62E+03	90% of Eu-154 Conc. in Shielding
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	2009 PA Implementation
Pa-231	1.00E+03	2009 PA Implementation
U-232	2.27E+03	25% of DSA Value
U-233	3.12E+03	25% of DSA Value
U-234	3.12E+03	25% of DSA Value
U-236	3.12E+03	25% of DSA Value
U-238	3.12E+03	25% of DSA Value
Np-237	1.00E+04	2009 PA Implementation
Pu-238	6.67E+04	25% of Total α DSA Value
Pu-239	6.67E+04	25% of Total α DSA Value
Pu-240	6.67E+04	25% of Total α DSA Value

Radionuclide	WAC TARGET (pCi/mL)	Basis [1]
Pu-242	6.67E+04	25% of Total α DSA Value
Pu-244	7.02E+04	2009 PA Implementation
Am-241	6.67E+04	25% of Total α DSA Value
Am-242m	4.50E+05	90% of Permit Max.
Am-243	6.67E+04	25% of Total α DSA Value
Cm-242	1.13E+04	90% of WAC Threshold Conc.
Cm-244	6.67E+04	25% of Total α DSA Value
Cm-245	2.25E+05	90% of Permit Max.
Total α[2]	6.67E+04	25% of DSA Value

Footnote 1: The permit maximum expected concentrations are concentrations that are not expected to be exceeded. However, exceedance of a permit maximum 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 SDF area (Refs. 1, 4, and 33).

Footnote 2: Total alpha WAC LIMIT (2.13E+05 pCi/mL) is set equal to 80% of the DSA value to protect the NCSE. However, total alpha has also been identified as a significant contributor in the IDP WAC LIMIT and the radiolytic HGR WAC LIMIT. The WAC TARGET (6.67E+04 pCi/mL) is set to a value equal to 25% of the DSA value to protect radiolytic HGR.

X-SD-Z-00001, Rev. 18

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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. Expected Concentration (Ref. 3)** **pCi/mL (nCi/g)**	**DSA Source Term (Ref. 13)** **pCi/mL (Ci/gal)**	**Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation (Ref. 25/52/57) pCi/mL**	**Basis**
H-3 NRC Class A = 6.26E+07	5.63E+05	6.26E+05 (501)	None	5.63E+05	There is no DSA source term for H-3. The permit max. concentration for H-3 is 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. The recommended H-3 concentration for implementation of the 2009 PA is set at the WAC Rev 11 LIMIT [Ref. 37].
C-14 NRC Class A = 1.25E+06 NRC Class C = 1.25E+07	1.13E+05	1.25E+05 (100)	None	1.13E+05	There is no DSA source term for C-14. The permit max. concentration for C-14 is 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. The recommended C-14 concentration for implementation of the 2009 PA is set at the WAC Rev 11 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	None	2.88E+03	There is no DSA source term for Al-26. 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 recommended Al-26 concentration for implementation of the 2009 PA is set at the WAC Rev 11 TARGET [Ref. 37]. The WAC TARGET is set to a value equal to the recommended 2009 PA value.
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 50H sample detection limit [Ref. 37].
Co-60 NRC Class A = 1.09E+09	Gamma Shielding WAC LIMIT (TARGET = 9.75E+02)	1.25E+06 (1000)	1.25E+06 (4.73E-03)	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, the IDP WAC LIMIT, and the radiolytic HGR WAC LIMIT. The WAC TARGET is set to a value equal to 90% of the Co-60 concentration assumed in the shielding calculations. Gamma shielding is the most restrictive limit on Co-60. 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. Expected Concentration (Ref. 3) pCi/mL (nCi/g)	DSA Source Term (Ref. 13) pCi/mL (Ci/gal)	Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation (Ref. 25/52/57) pCi/mL	Basis
Ni-59	1.13E+03	1.25E+05 (100)	None	1.13E+03	There is no DSA source term for Ni-59. The permit max. concentration for Ni-59 is set at a maximum assumed value of 1.25E+05 pCi/mL (100 nCi/g). The recommended Ni-59 concentration for implementation of the 2009 PA is set at the WAC Rev 11 TARGET [Ref. 37]. The WAC TARGET is set to a value equal to the recommended 2009 PA value.
Ni-63 NRC Class A = 5.48E+06 NRC Class C = 1.10E+09	1.13E+05	1.25E+05 (100)	None	1.13E+05	There is no DSA source term for Ni-63. The permit max. concentration for Ni-63 is 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. The recommended Ni-63 concentration for implementation of the 2009 PA is set at the WAC Rev 11 LIMIT [Ref. 37].
Se-79	1.90E+04	1.25E+05 (100)	None	1.90E+04	There is no DSA source term for Se-79. The permit max. concentration for Se-79 is 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 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	2.62E+06 and IDP/HGR WAC LIMIT	2.50E+07 (20,000)	1.05E+07 (3.97E-02)	2.25E+07	The permit max. concentration for Sr-90 is 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. The DSA source term for Sr-90 is set at 1.05E+07 pCi/mL. Sr-90 has been identified as a significant contributor in the IDP WAC LIMIT and the radiolytic HGR WAC LIMIT. The WAC LIMIT is set to a value equal to 10.5% of the permit max. concentration and 25% of the DSA value. The recommended Sr-90 concentration for implementation of the 2009 PA is set at the WAC Rev 11 LIMIT [Ref. 37].
Y-90	IDP/HGR WAC LIMIT (TARGET = 2.62E+06)	2.50E+07 (20,000)	1.05E+07 (3.97E-02)	N/A ($T_{1/2}$ < 5 yrs)	The permit max. concentration for Y-90 is set at a maximum assumed value of 2.50E+07 pCi/mL. The DSA source term for Y-90 is set at 1.05E+07 pCi/mL. Y-90 is in secular equilibrium with its parent Sr-90. Y-90 has been identified as a significant contr butor in the IDP WAC LIMIT and the radiolytic HGR WAC LIMIT. The WAC TARGET is set to a value equal to 10.5% of the permit max. concentration and 25% of the DSA value. 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 50H sample detected value for Nb-93m, which is in secular equilibrium with Zr-93 [Ref. 37].

Radionuclide NRC Limits in pCi/mL	WAC LIMIT/TARGET pCi/mL	Permit Max. Expected Concentration (Ref. 3) pCi/mL (nCi/g)	DSA Source Term (Ref. 13) pCi/mL (Ci/gal)	Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation (Ref. 25/52/57) pCi/mL	Basis
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.
Nb-94	1.53E+02	None	None	1.53E+02	There are no DSA or permit maximum concentrations for Nb-94. The recommended Nb-94 concentration for implementation of the 2009 PA is set at the WAC Rev 11 TARGET [Ref. 37]. The WAC TARGET is set equal to the recommended concentration for implementation of the 2009 PA.
Tc-99 NRC Class A = 4.69E+05 NRC Class C = 4.69E+06	2.11E+05 and IDP WAC LIMIT	4.69E+05 (375)	4.69E+06 (1.78E-02)	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. Tc-99 has been identified as a significant contributor in the IDP WAC LMIT and the radiolytic HGR WAC LIMIT. The WAC LIMIT is based on analyses of the inventories used in the FY2014 SA as documented in SRR-CWDA-2015-00007 [Refs. 55, 57].
Ru-106	HGR WAC LIMIT (TARGET = 3.12E+05)	1.25E+06 (1000)	1.25E+06 (4.73E-03)	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). Ru-106 has been identified as a significant contr butor in the IDP WAC LIMIT and the radiolytic HGR WAC LIMIT. The WAC TARGET is set to a value equal to 25% of the permit max. concentration and DSA value. Radiolytic HGR is the most restrictive limit on Ru-106. 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	HGR WAC LIMIT (TARGET = 3.12E+05)	1.25E+06 (1000)	None	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. Rh-106 has been identified as a significant contributor in the radiolytic HGR WAC LIMIT. The WAC TARGET is set equal to 25% of the permit max. concentration value. 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.

Radionuclide NRC Limits in pCi/mL	WAC LIMIT/TARGET pCi/mL	Permit Max. Expected Concentration (Ref. 3) pCi/mL (nCi/g)	DSA Source Term (Ref. 13) pCi/mL (Ci/gal)	Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation (Ref. 25/52/57) pCi/mL	Basis
Sb-125	Gamma Shielding WAC LIMIT (TARGET = 7.99E+03)	2.50E+06 (2000)	None	N/A ($t_{1/2}$ < 5 yrs)	The permit max. concentration is 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 WAC LIMIT and the radiolytic HGR WAC LIMIT. The WAC TARGET is set to a value equal to 90% of the Sb-125 concentration assumed in the shielding calculations. Gamma shielding is the most restrictive limit on Sb-125. 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 83E+03)	2.50E+06 (2000)	None	N/A ($t_{1/2}$ < 5 yrs)	The permit max. concentration is set at a maximum assumed value of 2.50E+06 pCi/mL (2000 nCi/g). Te-125m is in secular equil brium with 22.9% of its parent, Sb-125. Te-125m has been identified as a significant contributor in the radiolytic HGR WAC LIMIT. However, the WAC TARGET is set at 22.9% of the Sb-125 gamma shielding WAC LIMIT, which is more restrictive than the radiolytic HGR WAC LIMIT. Te-125m does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years).
Sn-126	1.80E+04	None	None	1.80E+04	There are no DSA or permit maximum concentrations for Sn-126. 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]. The WAC TARGET is set equal to the recommended concentration for implementation of the 2009 PA.
Sb-126	Not Required	None	None	N/A ($t_{1/2}$ < 5 yrs)	There are no DSA or permit maximum concentrations for Sb-126. 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	None	None	N/A ($t_{1/2}$ < 5 yrs)	There are no DSA or permit maximum concentrations for Sb-126m. 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)	None	6.30E+01	There is no DSA source term for I-129. 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 [Ref. 50].
Cs-134	Gamma Shielding WAC LIMIT (TARGET = 1.82E+04)	1.25E+06 (1000)	None	N/A ($t_{1/2}$ < 5 yrs)	There is no DSA source term for Cs-134. Cs-134 has been identified as a significant contributor in the gamma shielding WAC LIMIT and the radiolytic HGR WAC LIMIT. The WAC TARGET is set to a value equal to 100% of the Cs-134 concentration assumed in the shielding calculations. Gamma shielding is the most restrictive limit on Cs-134. Cs-134 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. Expected Concentration (Ref. 3)** **pCi/mL (nCi/g)**	**DSA Source Term (Ref. 13)** **pCi/mL (Ci/gal)**	**Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation (Ref. 25/52/57) pCi/mL**	**Basis**
Cs-135	2.50E+02	None	None	2.50E+02	There are no DSA or permit maximum concentrations for Cs-135. The WAC TARGET is set at the recommended Cs-135 concentration per SRR-CWDA-2013-00097 [Ref. 50].
Cs-137 NRC Class A = 1.56E+06 NRC Class C = 7.20E+09	3.96E+06 and Gamma Shielding/ IDP WAC LIMIT	6.25E+07 (50,000)	5.28E+07 (2.00E-01)	4.75E+07	The DSA source term for Cs-137 is set at a maximum assumed value of 0.2 Ci/gal (5.28E+07 pCi/mL), which is about 0.73% 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 the gamma shielding WAC LIMIT, the IDP WAC LIMIT, and the radiolytic HGR WAC LIMIT. The WAC LIMIT is set to a value equal to 100% of the 0.015 Ci/gal concentration value assumed in the shielding calculations. Gamma shielding and IDP are the most restrictive limit on Cs-137. 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	Gamma Shielding WAC LIMIT (TARGET = 3.75E+06)	6.25E+07 (50,000)	None	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 has been identified as a significant contributor in the radiolytic HGR WAC LIMIT. However, the WAC TARGET is set at 94.6% of the Cs-137 gamma shielding WAC LIMIT, which is more restrictive than the radiolytic HGR WAC LMIT. 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	HGR WAC LIMIT (TARGET=3.12E+04)	1.25E+05 (100)	None	N/A ($t_{1/2}$ < 5 yrs)	There is no DSA source term for Ce-144. Ce-144 is in secular equilibrium with its daughter Pr-144, which has been identified as a significant contributor in the radiolytic HGR WAC LIMIT. The WAC TARGET is set at 100% of the Pr-144 radiolytic HGR WAC LIMIT. 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	HGR WAC LIMIT (TARGET = 3.12E+04)	1.25E+05 (100)	None	N/A ($t_{1/2}$ < 5 yrs)	There is no DSA source term for Pr-144. 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. Pr-144 has been identified as a significant contributor in the radiolytic HGR WAC LIMIT. The WAC TARGET is set at 25% of the permit maximum concentration. Pr-144 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. Expected Concentration (Ref. 3) pCi/mL (nCi/g)	DSA Source Term (Ref. 13) pCi/mL (Ci/gal)	Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation (Ref. 25/52/57) pCi/mL	Basis
Pm-147	HGR WAC LIMIT (TARGET = 1.57E+06)	6.25E+06 (5000)	6.25E+06 (2.37E-02)	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). Pm-147 has been identified as a significant contr butor in the IDP WAC LIMIT and the radiolytic HGR WAC LIMIT. The WAC TARGET is set to a value equal to 25% of the permit max. concentration and DSA value. HGR is the most restrictive limit on Pm-147. 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	None	None	2.25E+04	There are no DSA or permit maximum concentrations for Sm-151. The recommended Sm-151 concentration for implementation of the 2009 PA is set at the WAC Rev 11 TARGET [Ref. 37]. The WAC TARGET is set equal to the recommended concentration for implementation of the 2009 PA.
Eu-152	Not Required	None	None	1.21E+08	There are no DSA or permit maximum concentrations 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 WAC LIMIT (TARGET = 1.62E+03)	2.50E+06 (2000)	2.50E+06 (9.46E-03)	2.25E+06	The DSA and permit maximum concentrations 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 the gamma shielding WAC LIMIT, the IDP WAC LIMIT, and the radiolytic HGR WAC LIMIT. The WAC TARGET is set to a value equal to 90% of the Eu-154 concentration assumed in the shielding calculations. Gamma shielding is the most restrictive limit on Eu-154. 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	Not Required	None	None	N/A ($t_{1/2}$ < 5 yrs)	There are no DSA or permit maximum concentrations for Eu-155. Eu-155 does not affect the conclusions of the 2009 PA because of its short half-life (i.e., less than 5 years). Therefore, there is no WAC LIMIT/TARGET for Eu-155.
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 50H sample detection limit [Ref. 37].

Radionuclide NRC Limits in pCi/mL	WAC LIMIT/TARGET pCi/mL	Permit Max. Expected Concentration (Ref. 3) pCi/mL (nCi/g)	DSA Source Term (Ref. 13) pCi/mL (Ci/gal)	Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation (Ref. 25/52/57) pCi/mL	Basis
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].
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 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 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	None	2.88E+03	There are no DSA or permit maximum concentrations for Th-232. The recommended Th-232 concentration for implementation of the 2009 PA is set at the WAC Rev 11 TARGET [Ref. 37]. The WAC TARGET is set equal to the 2009 PA value.
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 50H sample detection limit [Ref. 37].
U-232 (α)	HGR WAC LIMIT (TARGET=2.27E+03)	None	9.06E+03 (3.43E-05)	1.71E+05	The DSA source term is set at a maximum assumed value of 9.06E+03 pCi/mL. U-232 has been identified as a significant contributor in the IDP WAC LIMIT and the radiolytic HGR WAC LIMIT. The WAC TARGET is set equal to 25% of the DSA source term. Radiolytic HGR is the most restrictive limit on U-232. The recommended U-232 concentration for implementation of the 2009 PA is set to the same value assumed for the 2005 SA in a previous Saltstone WAC revision [Ref. 37].

Radionuclide NRC Limits in pCi/mL	WAC LIMIT/TARGET pCi/mL	Permit Max. Expected Concentration (Ref. 3) pCi/mL (nCi/g)	DSA Source Term (Ref. 13) pCi/mL (Ci/gal)	Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation (Ref. 25/52/57) pCi/mL	Basis
U-233 (α)	1.13E+04 (TARGET = 3.12E+03)	None	1.25E+04 (4.73E-05)	1.13E+04	The DSA source term is set at a maximum assumed value of 1.25E+04 pCi/mL (10 nCi/g) to protect the NCSE [Ref. 23]. U-233 has been identified as a significant contr butor in the IDP WAC LIMIT and the radiolytic HGR WAC LIMIT. Radiolytic HGR is the more restrictive limit than the NCSE criticality limit and the IDP limit on U-233. The WAC LIMIT (1.13E+04 pCi/mL) is set to a value equal to 90% of the DSA (NCSE) value to protect criticality, and the WAC TARGET (3.12E+03 pCi/ml) is set to a value equal to 25% of the DSA value to protect radiolytic HGR. The recommended U-233 concentration for implementation of the 2009 PA is set at the WAC Rev 11 LIMIT [Ref. 37].
U-234 (α)	HGR WAC LIMIT (TARGET = 3.12E+03)	None	1.25E+04 (4.73E-05)	1.13E+04	The DSA source term is set at a maximum assumed value of 1.25E+04 pCi/mL(10 nCi/g). U-234 has been identified as a significant contributor in the IDP WAC LIMIT and the radiolytic HGR WAC LIMIT. The WAC TARGET is set to a value equal to 25% of the DSA value. Radiolytic HGR is the most restrictive limit on U-234. The recommended U-234 concentration for implementation of the 2009 PA is set at the WAC Rev 11 TARGET [Ref. 37].
U-235 (α)	1.13E+02	None	None	1.13E+02	There are no DSA or permit maximum concentrations for U-235. There is a maximum assumed value of 1.25E+02 pCi/mL to protect the NCSE [Ref. 23]. The WAC LIMIT is set to a value equal to 90% of the NCSE value. The recommended U-235 concentration for implementation of the 2009 PA is set at the WAC Rev 11 LIMIT [Ref. 37].
U-236 (α)	HGR WAC LMIT (TARGET = 3.12E+03)	None	1.25E+04 (4.73E-05)	1.13E+04	The DSA source term is set at a maximum assumed value of 1.25E+04 pCi/mL (10 nCi/g). U-236 has been identified as a significant contributor in the IDP WAC LIMIT and the radiolytic HGR WAC LIMIT. The WAC TARGET is set to a value equal to 25% of the DSA value. Radiolytic HGR is the most restrictive limit on U-236. The recommended U-236 concentration for implementation of the 2009 PA is set at the WAC Rev 11 TARGET [Ref. 37].
U-238 (α)	HGR WAC LIMIT (TARGET = 3.12E+03)	None	1.25E+04 (4.73E-05)	1.13E+04	The DSA source term is set at a maximum assumed value of 1.25E+04 pCi/mL (10 nCi/g). U-238 has been identified as a significant contributor in the IDP WAC LIMIT and the radiolytic HGR WAC LIMIT. The WAC TARGET is set to a value equal to 25% of the DSA value. Radiolytic HGR is the most restrictive limit on U-238. The recommended U-238 concentration for implementation of the 2009 PA is set at the WAC Rev 11 TARGET [Ref. 37].

Radionuclide NRC Limits in pCi/mL	**WAC LIMIT/TARGET** **pCi/mL**	**Permit Max. Expected Concentration (Ref. 3)** **pCi/mL (nCi/g)**	**DSA Source Term (Ref. 13)** **pCi/mL (Ci/gal)**	**Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation (Ref. 25/52/57) pCi/mL**	**Basis**
Np-237 (α) ($t_{1/2}$ > 5 yr)	1.00E+04	2.50E+05 (200)	None	1.00E+04	There is no DSA source term for Np-237. Np-237 concentration is bounded by the total alpha term in the IDP WAC LIMIT and the radiolytic HGR 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. The 2009 PA is more restrictive than the IDP and radiolytic HGR WAC LIMITs. 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)	HGR WAC LIMIT (TARGET = 6.67E+04)	2.50E+05 (200)	None	2.50E+05	There is no DSA source term for Pu-238. Pu-238 concentration is bounded by the total alpha term in the IDP WAC LIMIT and the radiolytic HGR WAC LIMIT. The permit max. concentration and the WAC Rev 11 TARGET are 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 to a value equal to 25% of the total alpha DSA value. Radiolytic HGR is the most restrictive limit on total alpha. The recommended Pu-238 concentration for implementation of the 2009 PA was set at the WAC Rev 11 TARGET [Ref. 37].
Pu-239 (α) ($t_{1/2}$ > 5 yr)	HGR WAC LIMIT (TARGET = 6.67E+04)	2.50E+05 (200)	None	2.50E+05	There is no DSA source term for Pu-239. 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. This value also protects the NCSE. Pu-239 concentration is bounded by the total alpha term in the IDP WAC LIMIT and the radiolytic HGR WAC LIMIT. The WAC TARGET is set to a value equal to 25% of the total alpha DSA value. Radiolytic HGR is the most restrictive limit on total alpha. The recommended Pu-239 concentration for implementation of the 2009 PA was set at the WAC Rev 11 TARGET [Ref. 37].
Pu-240 (α) ($t_{1/2}$ > 5 yr)	HGR WAC LIMIT (TARGET = 6.67E+04)	2.50E+05 (200)	None	2.50E+05	There is no DSA source term for Pu-240. The Pu-240 concentration is bounded by the total alpha term in the IDP WAC LIMIT and the radiolytic HGR 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 WAC TARGET is set to a value equal to 25% of the total alpha DSA value. Radiolytic HGR is the most restrictive limit on total alpha. The recommended Pu-240 concentration for implementation of the 2009 PA was set at the WAC Rev 11 TARGET [Ref. 37].

Radionuclide NRC Limits in pCi/mL	WAC LIMIT/TARGET pCi/mL	Permit Max. Expected Concentration (Ref. 3) pCi/mL (nCi/g)	DSA Source Term (Ref. 13) pCi/mL (Ci/gal)	Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation (Ref. 25/52/57) 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 (3.52E-03)	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] and Pu-241 has also been identified as a significant contributor in the IDP WAC LIMIT. The WAC LIMIT is set to a value equal to 90% of the permit maximum concentration and DSA value. 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)	HGR WAC LIMIT (TARGET = 6.67E+04)	2.50E+05 (200)	None	2.50E+05	There is no DSA source term for Pu-242. The Pu-242 concentration is bounded by the total alpha term in the IDP WAC LIMIT and the radiolytic HGR 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 WAC TARGET is set to a value equal to 25% of the total alpha DSA value. Radiolytic HGR is the most restrictive limit on total alpha. The recommended Pu-242 concentration for implementation of the 2009 PA was set at the WAC Rev 11 TARGET [Ref. 37].
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 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)	HGR WAC LIMIT (TARGET = 6.67E+04)	2.50E+05 (200)	None	2.50E+05	There is no DSA source term for Am-241. Am-241 concentration is bounded by the total alpha term in the IDP WAC LIMIT and the radiolytic HGR 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 WAC TARGET is set to a value equal to 25% of the total alpha DSA value. Radiolytic HGR is the most restrictive limit on total alpha. The recommended Am-241 concentration for implementation of the 2009 PA was set at the WAC Rev 11 TARGET [Ref. 37].
Am-242m	4.50E+05	5.00E+05 (400)	None	4.50E+05	There is no DSA source term for Am-242m. 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 Rev 11 TARGET [Ref. 37].

Radionuclide NRC Limits in pCi/mL	**WAC LIMIT/TARGET** **pCi/mL**	**Permit Max. Expected Concentration (Ref. 3)** **pCi/mL (nCi/g)**	**DSA Source Term (Ref. 13)** **pCi/mL (Ci/gal)**	**Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation (Ref. 25/52/57) pCi/mL**	**Basis**
Am-243 (α) ($t_{1/2}$ > 5 yr)	HGR WAC LIMIT (TARGET = 6.67E+04)	None	None	2.50E+05	There is no DSA source term for Am-243. The 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 WAC TARGET is set to a value equal to 25% of the total alpha DSA value. Radiolytic HGR is the most restrictive limit on total alpha. The recommended Am-243 concentration for implementation of the 2009 PA was set at the WAC Rev 11 TARGET [Ref. 37].
Cm-242 (α) NRC Class A = 5.32E+06 NRC Class C = 5.32E+07	1.13E+04	5.00E+05 (400)	None	N/A ($t_{1/2}$ < 5 yrs)	There is no DSA source term for Cm-242. 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 1.25E+04 pCi/mL threshold concentration discussed in WAC Section 5.4.8.1. 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)	HGR WAC LIMIT (TARGET = 6.67E+04)	2.50E+05 (200)	None	2.50E+05	There is no DSA source term for Cm-244. The Cm-244 concentration is bounded by the total alpha term in the IDP WAC LIMIT and the radiolytic HGR 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 WAC TARGET is set to a value equal to 25% of the total alpha DSA value. Radiolytic HGR is the most restrictive limit on total alpha. The recommended Cm-244 concentration for implementation of the 2009 PA was set at the WAC Rev 11 TARGET [Ref. 37].
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 Rev 11 TARGET [Ref. 37].

Radionuclide NRC Limits in pCi/mL	**WAC LIMIT/TARGET** **pCi/mL**	**Permit Max. Expected Concentration (Ref. 3)** **pCi/mL (nCi/g)**	**DSA Source Term (Ref. 13)** **pCi/mL (Ci/gal)**	**Recommended Concentration for 2009 PA / FY 2013/14 SA Implementation (Ref. 25/52/57) pCi/mL**	**Basis**
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).
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 (TARGET = 6.67E+04)	2.66E+05 (213)	2.66E+05 (1.01E-03)	None	The permit maximum concentration and DSA source term are set at a value of 213 nCi/g. This value is equal to 100% of the NRC Class C limit. Total alpha has been identified as a significant contributor in the IDP WAC LIMIT and the radiolytic HGR WAC LIMIT. Total alpha also protects the assumed Pu-239 concentration in the NCSE [Ref. 23]. The WAC LIMIT (2.13E+05 pCi/mL) is set to a value equal to 80% of the DSA source term and permit maximum concentration to protect NRC Class C and criticality. The WAC TARGET (6.67E+04 pCi/mL) is set to a value equal to 25% of the DSA value to protect radiolytic HGR. Radiolytic HGR is the most restrictive limit on total alpha.

Comparison of Chemical Concentrations for Saltstone

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Source Term (Ref. 13) (mg/L)	Basis	DSA Potential Chemical Compound(s) (Ref. 51) Compounds protected by ion in bold
Solvated Ions					
Aluminate [$Al(OH)_4^-$]	4.08E+05	6.62E+05	N/A	The permit maximum concentration is set at 6.62E+05 mg/L. The WAC LIMIT is set to a value equal to 61.6% of the permit maximum. Aluminate is not measured directly. Compliance is demonstrated by meeting the Aluminum concentration.	N/A (See Hydroxide and Aluminum rows)
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 (Attachment 8.1), which is 91% of the DSA bounding concentration. This is the same value to protect flammability (see Table 2).	**Ammonia - NH_3**
Carbonate [CO_3^{2-}]	1.20E+05 (TARGET = 1.20E+04)	1.93E+05	1.60E+05	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration. However, there is a more restrictive WAC TARGET of 1.20E+04 mg/L based on qualification testing of the SDU 6 coating/liner system (see Table 7).	**Sodium Carbonate - Na_2CO_3** Calcium Carbonate - $CaCO_3$ Strontium Carbonate - $SrCO_3$ Lead Carbonate - $PbCO_3$ [Ref. 65]
Chloride [Cl^-]	7.95E+03 (TARGET = 3.90E+03)	1.29E+04	1.06E+04	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration. However, there is a more restrictive WAC TARGET of 3.90E+03 mg/L based on qualification testing of the SDU 6 coating/liner system (see Table 7).	**Sodium Chloride - NaCl**
Formate [$CHOO^-$]	6.38E+03	None	8.50E+03	The WAC TARGET is set to a value equal to 75% of the DSA bounding concentration. Formate has been identified as a chemical species used in the $f_{organic}$ calculation for radiolytic HGR.	**Sodium Formate - $NaHCO_2$**

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Source Term (Ref. 13) (mg/L)	Basis	DSA Potential Chemical Compound(s) (Ref. 51) Compounds protected by ion in bold
Solvated Ions					
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.	**Sodium Fluoride - NaF** Calcium Fluoride - CaF_2
Glycolate [$C_2H_3O_3^-$]	None	None	1.21E+04	Analysis of sodium glycolate is not required for current processing.	**Sodium Glycolate - $NaC_2H_3O_3$**
Hydroxide [OH^-]	1.58E+05 (TARGET = 3.91E+04)	2.55E+05	2.10E+05	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration. However, there is a more restrictive WAC TARGET of 3.91E+04 mg/L based on qualification testing of the SDU 6 coating/liner system (see Table 7). Hydroxide has also been identified as a chemical species used in the $f_{organic}$ calculation for radiolytic HGR.	Sodium Hydroxide - NaOH Silver (I) Hydroxide - AgOH Cadmium Hydroxide - $Cd(OH)_2$ Lead Hydroxide - $Pb(OH)_2$ Cobalt (III) Hydroxide - $Co(OH)_3$ Nickel (II) Hydroxide - $Ni(OH)_2$ Lithium Hydroxide - LiOH Ferric Hydroxide - $Fe(OH)_3$ Zinc Hydroxide - $Zn(OH)_2$ Zirconium Hydroxide - $ZrO(OH)_2$ Cerium Hydroxide - $Ce(OH)_3$ Neodymium Hydroxide - $Nd(OH)_3$ Cupric Hydroxide - $Cu(OH)_2$ Magnesium Hydroxide - $Mg(OH)_2$ Cesium Hydroxide - CsOH **Sodium Tetrahydroxoaluminate - $NaAl(OH)_4$** **Aluminum Hydroxide - $Al(OH)_3$** [Ref. 65] Chromium (III) Hydroxide - $Cr(OH)_3$ [Ref. 65] Uranyl Hydroxide - $UO_2(OH)_2$ [Ref. 65]
Nitrate [NO_3^-]	4.37E+05 (TARGET = 1.46E+05)	7.05E+05	5.82E+05	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration. However, there is a more restrictive WAC TARGET of 1.46E+05 mg/L based on qualification testing of the SDU 6 coating/liner system (see Table 7). Nitrate has also been identified as a chemical species used in the $f_{organic}$ calculation for radiolytic HGR.	Sodium Nitrate - $NaNO_3$ Potassium Nitrate - KNO_3 Cesium Nitrate - $CsNO_3$

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Source Term (Ref. 13) (mg/L)	Basis	DSA Potential Chemical Compound(s) (Ref. 51) Compounds protected by ion in bold
Solvated Ions					
Nitrite $[NO_2^{-1}]$	2.14E+05 (TARGET = 4.14E+04)	3.45E+05	2.85E+05	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration. However, there is a more restrictive WAC TARGET of 4.14E+04 mg/L based on qualification testing of the SDU 6 coating/liner system (see Table 7). Nitrite has also been identified as a chemical species used in the $f_{organic}$ calculation for radiolytic HGR.	**Sodium Nitrite - $NaNO_2$**
Oxalate $[C_2O_4^{2-1}]$	2.72E+04 (TARGET = 8.80E+02)	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 to a value equal to 75% of the DSA bounding concentration. However, there is a more restrictive WAC TARGET of 8.80E+02 mg/L based on qualification testing of the SDU 6 coating/liner system (see Table 7).	**Sodium Oxalate - $Na_2C_2O_4$** Calcium Oxalate - CaC_2O_4
Phosphate $[PO_4^{3-}]$	3.14E+04 (TARGET = 4.75E+03)	None	4.19E+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 to a value equal to 75% of the DSA bounding concentration. However, there is a more restrictive WAC TARGET of 4.75E+03 mg/L based on qualification testing of the SDU 6 coating/liner system (see Table 7).	**Sodium Phosphate - Na_3PO_4** Calcium Phosphate - $Ca_3(PO_4)_2$
Sulfate $[SO_4^{2-}]$	5.69E+04 (TARGET = 1.73E+04)	9.19E+04	7.58E+04	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration. However, there is a more restrictive WAC TARGET of 1.73E+04 mg/L based on qualification testing of the SDU 6 coating/liner system (see Table 7).	Calcium Sulfate - $CaSO4$ **Sodium Sulfate - Na_2SO_4** Lead (II) Sulfate - $PbSO_4$ Barium Sulfate - $BaSO_4$

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Source Term (Ref. 51) (mg/L)	Basis	DSA Potential Chemical Compound(s) (Ref. 51) Compounds protected by metal in bold
RCRA Hazardous Metals					
Arsenic [As]	1.97E+02	1.00E+03	2.62E+02	The highest Tank Farm Arsenic concentration was recorded at 1.44 mg/L from Tank 23H. The limiting concentration based on detection limit was established from Tank 29H, 19 mg/L [Ref. 32]. The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration.	**Sodium Arsenate - Na_3AsO_4**
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 bounding concentration.	**Barium Sulfate - $BaSO_4$**
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 Toxicity Characteristic conditions, 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 bounding concentration.	**Cadmium Hydroxide - $Cd(OH)_2$**
Chromium [Cr]	1.50E+03	2.00E+03	2.00E+03	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration.	**Sodium Chromate - Na_2CrO_4** **Chromium (III) Hydroxide - $Cr(OH)_3$** [Ref. 65]
Lead [Pb]	7.50E+02	1.00E+03	1.00E+03	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration.	**Lead Hydroxide - $Pb(OH)_2$** **Lead (II) Sulfate - $PbSO_4$** **Lead Carbonate - $PbCO_3$** [Ref. 65]
Total Mercury [Hg]	3.25E+02	3.25E+02	3.58E+02	The WAC LIMIT is set to a value equal to 91% of the DSA bounding concentration.	**Mercuric Oxide - HgO**
Elemental Mercury [Hg]	3.25E+02	None	3.58E+02	There is no permit max. concentration. The WAC LIMIT is set to a value equal to 91% of the DSA bounding concentration.	

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Source Term (Ref. 51) (mg/L)	Basis	DSA Potential Chemical Compound(s) (Ref. 51) Compounds protected by metal in bold
RCRA Hazardous Metals					
Dimethyl Mercury [$(CH_3)_2Hg$]	1.00E+00	None	1.10E+00	There is no permit max. concentration. Dimethyl mercury has been shown to be a negligible contributor to flammability [Ref. 13]. 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 concentration [Ref. 58]. The WAC TARGET is set to a value equal to 91% of the DSA bounding concentration.	
Monomethyl Mercury [CH_3Hg^+]	3.50E+02	None	3.85E+02	There is no permit max concentration. Ref. 51 assumed the previous total mercury concentration (358 mg/L) was all monomethyl mercury and derived a DSA limit of 385 mg/L (adjusted for molecular weight). 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 [Ref. 58]. The WAC LIMIT is set to a value equal to 91% of the DSA bounding concentration.	
Ethyl Mercury [$C_2H_5Hg^+$]	3.73E+02	None	4.10E+02	There is no permit max concentration. The WAC LIMIT is set to a value equal to 91% of the DSA bounding concentration.	

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Source Term (Ref. 51) (mg/L)	Basis	DSA Potential Chemical Compound(s) (Ref. 51) Compounds protected by metal in bold
RCRA Hazardous Metals					
Selenium [Se]	3.75E+02	5.00E+02	5.00E+02	Based upon experimental data (DPST-89-314), the selenium concentration must be < 600 mg/L in order for the grout to pass Toxicity Characteristic conditions. The permit maximum concentration is set at 500 mg/L to protect this value. The WAC LIMIT is set to a value equal to 75% of the DSA bounding and permit max concentration.	**Sodium Selenite - Na_2SeO_3**
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 bounding concentration.	**Silver (I) Hydroxide - AgOH**

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Source Term (Ref. 51) (mg/L)	Basis	DSA Potential Chemical Compound(s) (Ref. 51) Compounds protected by metal in bold
Other Metals					
Aluminum [Al]	Thermolytic HGR WAC LIMIT (TARGET = 5.94E+03)	1.88E+05	1.55E+05	The WAC LMIT for accident chemical consequences is set at 1.16E+05 mg/L (Attachment 8.1), which is 75% of the DSA bounding concentration. However, there is a more restrictive WAC TARGET of 7.00E+03 mg/L for thermolytic hydrogen generation rate (see Section 5.4.3.1). There is also a more restrictive WAC TARGET of 5.94E+03 mg/L based on qualification testing of the SDU 6 coating/liner system (see Table 7).	**Sodium Aluminate - $NaAlO_2$** Sodium Tetrahydroxoaluminate - $NaAl(OH)_4$ Aluminum Hydroxide - $Al(OH)_3$ [Ref. 65]
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 bounding concentration.	**Sodium Borate - Na_3BO_3**
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.	**Calcium Oxalate - CaC_2O_4** **Calcium Sulfate - $CaSO_4$** **Calcium Carbonate - $CaCO_3$** **Calcium Phosphate - $Ca_3(PO_4)_2$** **Calcium Fluoride - CaF_2**
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.	**Cerium Hydroxide - $Ce(OH)_3$**

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Source Term (Ref. 51) (mg/L)	Basis	DSA Potential Chemical Compound(s) (Ref. 51) Compounds protected by metal in bold
Other Metals					
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.	**Cesium Nitrate - $CsNO_3$** **Cesium Hydroxide - CsOH**
Cobalt [Co]	1.45E+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 75% of the DSA bounding concentration.	**Cobalt (III) Hydroxide - $Co(OH)_3$**
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 bounding concentration.	**Cupric Hydroxide - $Cu(OH)_2$**
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 bounding concentration.	**Ferric Hydroxide - $Fe(OH)_3$**
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 bounding concentration.	**Lithium Hydroxide - LiOH**
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.	**Magnesium Hydroxide - $Mg(OH)_2$**

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Source Term (Ref. 51) (mg/L)	Basis	DSA Potential Chemical Compound(s) (Ref. 51) Compounds protected by metal in bold
Other Metals					
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 bounding concentration.	**Manganese Dioxide - MnO_2**
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 bounding concentration.	**Sodium Molybdate - Na_2MoO_4**
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.	**Neodymium Hydroxide - $Nd(OH)_3$**
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 the DSA bounding concentration.	**Nickel (II) Hydroxide - $Ni(OH)_2$**
Potassium [K]	3.03E+04 (TARGET = 2.35E+03)	None	4.04E+04	The WAC LIMIT is set to a value equal to 75% of the DSA bounding concentration. However, there is a more restrictive WAC TARGET of 2.35E+03 mg/L based on qualification testing of the SDU 6 coating/liner system (see Table 7).	**Potassium Nitrate - KNO_3**
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.	**Ruthenium (IV) Oxide - RuO_2**

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Source Term (Ref. 51) (mg/L)	Basis	DSA Potential Chemical Compound(s) (Ref. 51) Compounds protected by metal in bold
Other Metals					
Silicon [Si]	1.07E+04	None	1.42E+04	The WAC TARGET is set to a value equal to 75% of the DSA bounding concentration.	**Silicon Dioxide - SiO_2**
Sodium [Na]	Processability WAC LIMIT 2.5M<[Na]<7.0M (TARGET = 6.73M or 1.55E+05 mg/L)	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. However, there is a more restrictive WAC TARGET of 6.73M (or 1.55E+05 mg/L) based on qualification testing of the SDU 6 coating/liner system (see Table 7).	**Sodium Hydroxide - NaOH** **Sodium Nitrate - $NaNO_3$** Sodium Nitrite - $NaNO_2$ Sodium Aluminate - $NaAlO_2$ Sodium Oxalate - $Na_2C_2O_4$ Sodium Carbonate - Na_2CO_3 Sodium Sulfate - Na_2SO_4 Sodium Phosphate - Na_3PO_4 Sodium Chloride - NaCl Sodium Formate - $NaHCO_2$ Sodium Fluoride - NaF Sodium Selenite - Na_2SeO_3 Sodium Arsenate - Na_3AsO_4 Sodium Chromate - Na_2CrO_4 Sodium Borate - Na_3BO_3 Sodium Molybdate - Na_2MoO_4 Sodium Tetrahydroxoaluminate - $NaAl(OH)_4$
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 bounding concentration.	**Strontium Carbonate - $SrCO_3$**
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.	**Titanium Dioxide - TiO_2**
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 bounding concentration.	**Zinc Hydroxide - $Zn(OH)_2$**

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Source Term (Ref. 51) (mg/L)	Basis	DSA Potential Chemical Compound(s) (Ref. 51) Compounds protected by metal in bold
Other Metals					
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.	**Zirconium Hydroxide - $ZrO(OH)_2$**

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Source Term (mg/L)	Basis	DSA Potential Chemical Compound(s) (mg/L)
Organics					
Benzene [C_6H_6]	3.10E+02	None	4.13E+02 [Ref. 64]	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 bounding concentration.	
Butanol [C_4H_9OH]	"Other Organics" Contrib. to Flammability WAC LIMIT (TARGET = 7.50E-01)	None	1.03E+01 [Ref. 64]	The WAC LIMIT for accident chemical consequence is set at 7.73E+00 mg/L (Attachment 8.1), which is 75% of the DSA bounding concentration. However, there is a more restrictive WAC TARGET to protect flammability of 7.50E-01 mg/L (see Table 3).	
Propanol [C_3H_7OH]	"Other Organics" Contrib. to Flammability WAC LIMIT (TARGET = 2.50E-01)	None	2.50E+00 [Ref. 64]	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 bounding concentration. However, there is a more restrictive WAC TARGET to protect flammability of 2.50E-01 mg/L (see Table 3).	
Methanol [CH_3OH]	"Other Organics" Contrib. to Flammability WAC LIMIT (TARGET = 5.00E-02)	None	2.50E+00 [Ref. 64]	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 bounding concentration. However, there is a more restrictive WAC TARGET to protect flammability of 5.00E-02 mg/L (see Table 3).	
Phenol [C_6H_5OH]	7.50E+02	None	8.25E+02 [Ref. 64]	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 bounding concentration [Ref. 51].	**Sodium Phenolate - C_6H_5ONa** [Ref. 64]
Tetraphenylborate [$B(C_6H_5)^{4-}$]	4.24E+00 kg total mass and 5.00E+00 mg/L	7.00E+02	5.50E+00 [Ref. 64]	The WAC LIMIT for accident chemical consequence is set at 5.00E+00 mg/L (Attachment 8.1), which is 91% of the DSA bounding concentration. In order to protect assumptions associated with flammability, there is a mass WAC LIMIT of 4.24 kg on the total mass of TPB to be disposed of in SDUs (see Table 2). 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).	**Potassium Tetraphenylborate - $KBC_{24}H_{20}$** [Ref. 64]
Toluene [$C_6H_5CH_3$]	3.10E+02	None	4.13E+02 [Ref. 64]	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 bounding concentration.	
Dibutylphosphate [$C_8H_{19}O_4P$]	3.47E+02	None	4.62E+02 [Ref. 64]	There is no permit max. concentration. The WAC TARGET is set at 75% of the DSA bounding concentration.	

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Source Term (mg/L)	Basis	DSA Potential Chemical Compound(s) (mg/L)
Organics					
Tributylphosphate [$(C_4H_9O)_3PO$]	"Other Organics" Contrib. to Flammability WAC LIMIT (TARGET = 1.00E+00)	None	1.00E+01 [Ref. 64]	The WAC TARGET for accident chemical consequence is set at 7.50E+00 mg/L (Attachment 8.2), which is 75% of the DSA bounding concentration. However, there is a more restrictive WAC TARGET to protect flammability of 1.00E+00 mg/L (see Table 3).	
EDTA [$C_{10}H_{12}N_2O_8^{4-}$]	3.10E+02	None	4.13E+02 [Ref. 64]	There is no permit maximum concentration. The WAC TARGET is set to a value equal to 75% of the DSA bounding concentration.	**Sodium EDTA** **$C_{10}H_{12}N_2Na_4O_8$** [Ref. 64]
Total Organic Carbon	Thermolytic HGR WAC LIMIT (TARGET = 7.50E+02)	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 (4.50E+03 mg/L) is set to a value equal to ~ 75% of the permit max. concentration (Attachment 8.1). However, there is a more restrictive WAC TARGET to protect thermolytic HGR of 7.50E+02 mg/L (see Section 5.4.3.1).	
Isopar L	1.10E+01 ppm (not mg/L)	None	8.75E+01 [Ref. 49]	There is no permit max concentration. There is a DSA value (related to accident chemical consequence) of 8.75E+01 mg/L. However, the WAC LIMIT to protect flammability during Low Isopar L Operation is 1.10E+01 ppm (see Table 2).	
NORPAR 13 [$C_nH_{2\text{-}n}$]	"Other Organics" Contrib. to Flammability WAC LIMIT (TARGET = 7.50E-01)	None	1.00E+00 [Ref. 64]	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 flammability and therefore a WAC TARGET of 0.75 mg/L has been established (see Table 3).	

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Source Term (mg/L)	Basis	DSA Potential Chemical Compound(s) (mg/L)
Organics					
BOBCalixC6 or MaxCalix or blend	Not Required	None	2.00E+02 [Ref. 49]	There is no permit maximum concentration. BOBCalixC6, the extractant found in the MCU solvent, has a molecular weight of 1149.64 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 has incorporated 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 present until the BOBCalixC6 has been depleted from the system. MaxCalix has a molecular weight of approximately 955.31 g/mole and has no measurable 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 organics of which ~ 70 wt% to 75 wt% will be Isopar L [Refs. 41 and 49]. The WAC LIMIT of 1.10E+01 ppm for Isopar L to protect flammability provides reasonable assurance that the extractant safety analysis value 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.	

Chemical Name	WAC LIMIT/TARGET (mg/L)	Permit Max. Concentration (Ref. 3) (mg/L)	DSA Source Term (mg/L)	Basis	DSA Potential Chemical Compound(s) (mg/L)
Organics					
Cs7SB	Not Required	None	2.00E+02 [Ref. 49]	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 organics of which ~ 70 to 75 wt% will be Isopar L [Refs. 41 and 49]. The WAC LIMIT of 1.10E+01 ppm for Isopar L to protect flammability provides reasonable assurance that Cs7SB safety analysis value 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.	
TOA (Trioctylamine) or TiDG (Tris(isodecyl)guanidine) or mixture	Not Required	None	2.00E+02 [Ref. 49]	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 has incorporated 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 depleted 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 organics of which ~ 70 wt% to 75 wt% will be Isopar L [Refs. 41 and 49]. The WAC LIMIT of 1.10E+01 ppm for Isopar L to protect flammability provides reasonable assurance the suppressor safety analysis value 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.	