SAFETY BASIS STRATEGY FOR THE TANK CLOSURE CESIUM REMOVAL-1A PROJECT

U-SBS-H-00026

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1.0 PURPOSE

The Safety Basis Strategy (SBS) outlined in this document addresses the planned approach for revision of the safety documentation and related analyses to support the design and operation activities associated with the Tank Closure Cesium Removal (TCCR)-1A Project. The purpose of this SBS is to describe the overall safety strategy approach, document the Major Modification Determination, and obtain Department of Energy (DOE) concurrence. The SBS is prepared in accordance with Manual 11Q, Procedure 1.10, Safety Basis Strategy (Ref. 1).

2.0 DESCRIPTION OF PROPOSED ACTIVITY

The Tank Closure Cesium Removal (TCCR)-1A Project is expanded scope of the TCCR Demonstration where Tank 9H salt waste material will be transferred to Tank 10H and processed in the same methods as the TCCR Demonstration (Ref. 2). The full-scale demonstration utilizes Ion Exchange (IX) columns, filters, and Crystalline Silicotitanate (CST) resin to process salt solution to remove Cesium-137 to enable disposal through the Saltstone process. The TCCR Unit is authorized to process Tank 10H material without additional waste influents. The overall TCCR salt solution process will not change according to the TCCR-1A Project scope detailed within this SBS; only deviations from the TCCR Demonstration will be discussed.

Additional IX columns to support processing of Tank 9H salt solution will be loaded with CST and pretreated in H-Tank Farm (HTF). Vendor supplied IX columns will route into HTF to a new staging area located next to the TCCR Unit. A vacuum pump assembly will load CST resin into the IX column. The columns will then be pretreated with a water backflush to level the CST bed and remove CST fines which will be filtered and disposed of. If necessary, a sodium hydroxide wash of the CST will be completed prior to placing the IX columns into operation. With the IX column remaining in a vertical position, the crane will place the CST-loaded IX column into the TCCR Process Enclosure.

For TCCR-1A, a feed stream will be processed in the TCCR Unit comprised of high-level radioactive material from Tank 9H. Tank 9H is assumed to have up to 900,000 Curies (Ci) of Cs-137 in the salt waste (Ref. 4). Salt waste in Tank 9H will be dissolved in-tank and pumped into Tank 10H. Once transferred into Tank 10H, it will be sampled and adjusted, if necessary, to meet the current TCCR Feed Stream Inhalation Dose Potential (IDP) prior to feeding the TCCR Unit.

As part of continuous improvement in processing salt waste via TCCR, two changes to the TCCR Unit have been identified. One improvement is reducing the IX column diameter; a reduction in diameter from 20” to 19” improves IX column thermal performance to allow for a procedural increase in cesium loading on a per unit mass of the resin. The second improvement is utilizing a smaller CST particle size within the IX column; loading kinetics is expected to improve with the smaller CST particle compared to the larger particle size currently used for the TCCR Demonstration.

Due to increased processing needs to support Tank 9H volume/material, additional column inventory at Interim Safe Storage (ISS) on the order of four times greater is expected. A total of 20 columns, both TCCR Demonstration size (4) and TCCR-1A Project size (16), will be stored at the ISS location. Additional IX columns for processing Tank 9 may be necessary.

For further details regarding process description or system layout regarding the TCCR Demonstration and TCCR-1A, see References 3 and 4.

3.0 ROLES/RESPONSIBILITIES

The SRR Nuclear Safety Manager, or designee, is responsible for:

- management and direction/scope of the activities covered by this SBS,
- sponsoring safety analysis and document reviews in the Facility Operations Safety Committee (FOSC) or Safety Input Review Committee (SIRC),
- approval of the SBS, safety documents, and related analyses covered by this SBS, and
- pursuing DOE approval of the Safety Bases (SB).

The TCCR-1A Safety Basis Regulatory Authority (SBRA), or designee, is responsible for:

- developing, coordinating and approving SB documents, and
- preparing the SBS and ensuring the SBS is appropriately reviewed.

The Tank Farm Facility, Engineering and Project Engineering Managers, or designee(s), are responsible for:

- fully defining the scope of the proposed activities at an adequate level to support the definition of the required engineering evaluation of technical issues and the assessment of SB issues,
- preparing/reviewing facility inputs and assumptions for calculations and other documents that support the safety analysis,
- performing technical reviews, and
- approval of the safety analysis and documents covered by this SBS.

The TCCR-1A Design Authority (DA) is responsible for:

- supporting the development/revision, review, and approval of the SB and their supporting documentation described in this document,
- coordinating design requirement changes,
- providing/revising the required inputs,
- providing technical input on equipment functionality and operability issues,
- reviewing SB documents to ensure technical accuracy and identifying their essential comments and concurring with their resolution,
- developing/revising, review, and approval of some supporting analyses including instrument loop uncertainty calculations, Safety Integrity Level (SIL) calculations, and
- assuring that any newly identified controls can be implemented at the facility, if required.

4.0 SBS OVERVIEW

4.1 Goals and Objectives

The goal of this project is to develop/revise safety basis documents for the Concentration, Storage, and Transfer Facilities (CSTF) that meet the requirements of DOE-STD-3009-94 (Ref. 5) to support TCCR-1A Project on Tank 9H in 4Q CY20. To achieve this goal, supporting documents for the SB, (including the TCCR Demonstration Consolidated Hazards Analysis (CHA), TCCR Demonstration Nuclear Criticality Safety Evaluation (NCSE), TCCR Demonstration Accident Analysis (AA) calculations, etc.), will be revised or new documents may be developed based on the TCCR-1A Project to support revision of the CSTF Documented Safety Analysis (DSA) and Technical Safety Requirements (TSR).

The objective of this SBS is to document the approach to be taken to provide the information needed to revise the CSTF DSA and TSR for the TCCR-1A Project.

4.2 Schedule and Milestones

The project goal is to develop an approved CSTF DSA and TSR revision to support the TCCR-1A Project Operations Run on Tank 9H by 4Q CY20. Thus, to support this goal, the DSA/TSR revision will need to be approved to support a Management Checklist (following applicable SRS procedures) in 3Q CY20.

The key milestones for the TCCR-1A Project are provided below (Note: the dates provided below are milestone dates, actual/target dates are expected to occur sooner.):

Tasks to Support DSA/TSR Completion	Milestone Date
TCCR-1A Preliminary CHA	December 2019
Approve/Issue Revised TCCR-1A CHA	April 2020
SRR Approval of DSA/TSR Revision	August 2020
Transmittal of DSA/TSR to DOE	August 2020
DOE Approval/Issue Safety Evaluation Report	September 2020

An integrated schedule for SB activities will be developed to support the project scope baseline as outlined in Section 2.0, utilizing the assumptions in Section 5.2. These SB activities will be tracked in the project schedule and maintained by the SRR Nuclear Safety Manager or designee. Proposed changes to the project scope, schedule, and cost will be made through an approved change control process as described in Section 4.4.

4.3 Funding Information

Funding for all Nuclear Safety activities supporting the TCCR-1A Project SB development is provided through the TCCR-1A Safety Basis activity code. It is estimated that approximately 3 FTE's from SRR Nuclear Safety will be necessary to accomplish the activities associated with this SBS. This estimate is based on the schedule activities identified to meet the above milestones, excluding associated emergent issue costs.

4.4 Change Control

A change control process will be used to manage scope, schedule, and cost changes for the SB development effort. Addition of new scope, significant changes to the existing scope, strategy, or assumptions outlined in this document (including schedule changes to the detailed schedule) will be documented, reviewed, and authorized by a change control board consisting of the TCCR-1A Project Manager, TCCR-1A Project Engineering Manager, and SRR Nuclear Safety Manager supplemented with appropriate stakeholders. The SRR Nuclear Safety Manager will determine if a revision of the SBS is required. Baseline Change Control will follow SRR Manual S14, Procedure 1.10 (Ref. 6).

5.0 SBS APPROACH

5.1 Hazard Review and Controls Identification

Hazard Identification was performed for the TCCR Demonstration to support the Consolidated Hazards Analysis Process (CHAP) in accordance with SCD-11 (Ref. 7). The results of the Hazard Identification were documented in the CHA document (Ref. 8) in accordance with the Hazard Identification Table from SCD-11, Appendix 8.6 (Ref. 7). In comparison with hazards identified in the existing CSTF SB, the TCCR Demonstration did not introduce hazards significantly different. The Hazard Analysis performed in Reference 8 will remain valid for the TCCR Demonstration and may be used to assess hazards associated with the TCCR-1A Project as the TCCR-1A Project will not change the overall TCCR Process nor is it expected to introduce new hazards. Significant deviations from the TCCR Demonstration for the TCCR-1A Project are identified and summarized below. The revised TCCR CHA will address the deviations. Overall, the hazards associated with the deviations are well characterized by the CSTF SB and the associated hazard controls needed are expected to be similar to the safety Structures, Systems and Components (SSCs) and administrative controls already implemented in the CSTF. The TCCR Unit and the ISS location are designated Hazard Category (HC) 2 (Ref. 9). The TCCR-1A Project and associated modifications will not change the facility segment HC of the TCCR Unit, ISS, or other locations of the CSTF.

5.1.1 Staging and Loading CST

To stage and load CST resin in HTF for TCCR-1A, a concrete pad will be poured near the TCCR Unit. Filling the IX columns with CST resin does not create a new hazard in the CSTF as CST does not pose a chemical exposure hazard (Ref. 10). As part of the staging, a water backflush of the CST will be completed to remove fine particles outside of the Process Enclosure. The fines will be filtered and disposed of. A sodium hydroxide wash will be used to level and pretreat the CST bed following placement of the IX columns into the Process Enclosure, if necessary. The sodium hydroxide will be sent to Tank 11. Sodium hydroxide as a hazard was analyzed previously for TCCR and does not pose an additional hazard for TCCR-1A. CST and sodium hydroxide were previously considered Standard Industrial Hazards (SIHs) for TCCR (Ref. 8). A crane, located on the pad, will lift and place the CST-filled IX columns into the TCCR Process Enclosure. These activities are routine operational tasks that occur throughout the CSTF. Savannah River Site (SRS) procedures and manuals govern how the pad is poured. Nuclear Safety Management Program(s) adherence is expected (i.e., Critical Lift Program, Structural Integrity Program) regarding how the IX columns will be moved by the crane. Overall, these activities will not introduce a new hazard to the CSTF SB. Therefore, no new controls are expected to be required with regards to staging, loading with CST, and relocating the CST-filled IX columns in the TCCR Process Enclosure.

5.1.2 TCCR-1A Feed Qualification

Tank 9H contents are not fully characterized. However, based on process, transfer, and adjustment history, Tank 9H is anticipated to be similar in composition to Tank 10H. Tank 9H is

estimated to contain up to 900,000 Ci of Cs-137 (Ref. 4) which will be processed through the TCCR Unit as scope of TCCR-1A.

Tank 9H will undergo waste removal efforts where salt dissolution will occur. The dissolved salt solution in Tank 9H will be transferred to Tank 10H via transfer line between the tanks (the transfer line is affiliated with Tank 9H Project scope). Transferring waste into Tank 10H is currently prohibited to protect SB assumptions, SB inputs, and dose consequences associated with the TCCR Demonstration; however, an exception for transfers from Tank 9H to Tank 10H is expected to be made once TCCR Demonstration operations are complete and salt solution is ready for transfer from Tank 9H in support of TCCR-1A processing. Once the material has been transferred into Tank 10H, batch adjustment may occur as necessary in Tank 10H to comply with the current TCCR Feed Stream IDP requirement prior to feeding the TCCR Unit. Thus, Tank 10H remains the Point of Compliance for TCCR operations.

In meeting the TCCR Feed Stream IDP, there are no new hazards in the CSTF SB that will be analyzed as part of TCCR-1A Project scope. The TCCR Operations Program will be revised to reflect the requirement to meet the TCCR Feed Stream IDP. The requirement will be a sample-and-hold test to qualify meeting the IDP. The batch will only be fed once it is verified in meeting feed criteria. Adding this SAC attribute is not a new control in the CSTF as it is similar to a Waste Acceptance Criteria (WAC) compliance and IDP requirement. Further, a program or additional SAC attribute to the TCCR Operations Program will be developed similar to the Sludge Carryover Minimization Program in the CSTF SB. The program/attribute will be deployed in Tank 10H to protect a limit of solids transferred from Tank 9H to the TCCR Unit. This requirement will further protect meeting the TCCR Feed Stream IDP and the bounding MAR assumptions. Thus, no new control/program types are expected to be introduced to the CSTF SB to meet the TCCR Feed Stream IDP with Tank 9H material.

5.1.3 IX Column Diameter Reduction

As part of the continued improvement of the TCCR process, a reduced IX column diameter is anticipated to be used in TCCR-1A. The smaller IX column diameter improves IX column thermal performance to allow for a procedural increase in cesium loading of the resin. The overall mass of CST present in the column will decrease due to this change; as such the CST bed volume available to load will also decrease. Furthermore, because the column diameter is decreasing, the available liquid assumed to be TCCR Feed Stream in the column also decreases. Overall, due to these changes, the MAR associated with IX column events will decrease with the IX column diameter reduction.

1,638 Ci/gal Cs-137 (Ref. 11) was theoretically loaded on one IX column for the TCCR Demonstration based on 216,000 Ci in Tank 10H and 131 gallons of CST resin. This total Ci value in the Process Enclosure is expected to increase to support processing Tank 9H which is expected to have increased Ci content (Ref. 4). Because the IX column diameter will be reduced and the total Ci value in the Process Enclosure increases, a higher Cs-137 theoretical loading value is anticipated on one IX column. However, because the IX column will be smaller on a per volume basis, loading of other components (e.g., actinides) will be lower than assumed

for the TCCR Demonstration. Further, Feed Stream liquid present in the IX column will be less resulting in a net neutral impact to total IDP. To theoretically allow as much Cs-137 possible on one IX column and in the Process Enclosure, the TCCR Loaded CST IDP value will be increased as part of TCCR-1A scope such that the overall dose consequences are similar to TCCR Demonstration consequences.

A new inventory control for total Ci in the Process Enclosure is expected to be needed because of the expectation that salt solution from Tank 9H will exceed 216,000 Ci. An example of a processing control to remain compliant would be to remove IX columns from the Process Enclosure after a set amount of curies are processed through TCCR. The expected control will not be outside of the current CSTF SB and will be implementable in the frame of both TCCR and the CSTF.

5.1.4 CST Particle Size Reduction

To further improve in processing salt solution with respect to TCCR, a smaller CST particle size will be utilized in the TCCR-1A Project. The new particle size will increase loading kinetics but not impact the loading capacity of the resin. The void fraction of the column will decrease slightly and the volume of liquid in the IX column will be less than currently assumed for the TCCR Demonstration. The expectation is that this change will not drive any new hazards in the CSTF SB. Further, no new controls will be driven by decreasing the size of the CST particle.

5.1.5 ISS Expansion

Based on a 3:1 dilution ratio for 600,000 gallons of salt waste from Tank 9H, an estimated 2,400,000 gallons of salt solution is expected to be processed during TCCR-1A scope. To process this quantity of material and store it at the ISS location, approximately 16 additional IX columns will be necessary. Additional IX columns to process Tank 9 may be necessary due to tank contents. Modifications to the ISS locations will be needed to compensate for the increased IX column inventory.

The ISS location will store two different IX column designs. ISS will hold four IX columns processed during the TCCR Demonstration with the 20” diameter and the expected additional 19” columns from the TCCR-1A Project scope. Hazard Analysis will investigate the bounding, conservative case for the overall additional IX columns.

An initial meeting to discuss controls for ISS was held warranting an expectation that new Safety Class (SC) and Safety Significant (SS) controls will be needed for accident scenarios for this increased IX column inventory at ISS; this meeting is detailed in Reference 11. While new hazards are not driven by an increased IX column inventory, radiological dose consequences are expected to drive associated new controls. Control strategies associated with ISS are specific to ISS (i.e., only ISS may be modified as a result of TCCR-1A Project scope). The increase in IX column inventory will not drive IX column design changes and/or major design modifications at ISS. The preliminary scoping on control strategies suggested safety SSCs and/or administrative controls that are not expected to differ from safety functions provided by SSCs and/or

administrative controls already implemented in the facility (e.g., structural supports for each individual IX column).

5.2 Process Inputs and Assumptions

The following inputs and assumptions were made in developing this SBS and associated scope, schedule, and cost baselines:

- The revision of the TCCR Demonstration CHA and/or new CHA for the TCCR-1A Project will be completed per guidance found in SCD-11, Consolidated Hazards Analysis Process (CHAP) Program & Methods Manual (Ref. 7).
- The CSTF Input Deck Database (Ref. 12) will be updated with revised/new inputs and assumptions from the TCCR-1A Project CHA and Accident Analyses as necessary during the project. These will serve as a baseline for the SB revisions. This process will be performed in accordance with Manual S4, Procedure ENG.29 (Ref. 13).
- Revised/new quantitative AA will be performed to address the candidate Design Basis Accidents (DBAs) identified in the TCCR Demonstration CHA. TCCR Demonstration AA used dispersion modeling methodologies in accordance with Reference 14; TCCR-1A Project will continue to utilize methodology. For calculations of Onsite consequences, the unit Total Effective Dose (TED) factor for the Onsite (100 meter) receptor was calculated using the DOE-STD-1189, Appendix A (Ref. 15) atmospheric dispersion coefficient (χ/Q) value of 3.5E-03 s/m^3 for all accident release periods. For calculations of Offsite consequences, the unit TED factor for the Offsite receptor was determined with MACCS2 95th percentile calculations based on 2002 through 2006 meteorological data, 160 cm surface roughness factor, and 0.6 to 0.7 cm/s deposition velocity. For NPH roll-up events, consequences will utilize the methodology outlined above.
- The new Implementation Guidance for Chemical Safety Management (Attachment 2) will be investigated for usage on the TCCR-1A Project. The guidance provides new mechanisms for how chemicals are analyzed with the possibility to screen out various chemicals provided they meet the criteria of the guidance. While this guidance is not implemented on the SRS at the time of Rev. 0 of this SBS, early implementation is possible (e.g., waiver approved by Chief Engineer). This would provide an opportunity for the TCCR Demonstration/TCCR-1A CHA to not functionally classify safety controls for chemical hazards. The TCCR-1A Project plans to use this guidance if implementation has occurred prior to or during SB-development. For, chemicals not screened out, Protective Action Criteria (PAC) and Chemical Mixture Methodology (CMM) Revision 29 dataset will be utilized consistent with chemical analysis for the TCCR Demonstration.
- For Hydrogen Generation Rate (HGR) analysis, the current basis from the TCCR Demonstration is anticipated to remain valid. Near to submission of the TCCR-1A Project DSA/TSR changes, a submittal of a CSTF DSA revision for Initial Glycolic will occur (Ref. 16). Further, the Initial Glycolic implementation will close the Potentially Inadequate Recognition of the Effect of Organics on Hydrogen Generation Rates Potentially Inadequacy in the Safety Analysis (PISA) (Ref. 17) in the CSTF. TCCR-1A will acknowledge and account for any HGR equations received from the

Savannah River National Laboratory (SRNL). However, current TCCR HGR methodology is expected to be conservative compared to the results from those equations.

- Tank 9H material can meet the TCCR Feed Stream IDP. No sample on Tank 9H contents exists at the time of creation of this SBS, but the history of Tank 9H and Tank 10H is similar. A Tank 9H sample analysis is expected in October 2019 at which time this assumption will be revisited, if necessary. With or without adjustment (water or caustic additions), dissolved salt solution compromised of Tank 9H material can be diluted sufficiently to meet Feed Stream IDP requirements.
- The ISS-footprint is not expected to change as a result of the increase number of IX columns. However, should the need arise to expand ISS, it is assumed that the distance to the site boundary will remain bounded to HTF-proper. It is also assumed that there will continue to be at least 100 meters from ISS to HTF.
- Current TCCR transfer line shielding is in place for TCCR operations. 0.25 Ci/gal is the design basis rating for shielding along the transfer lines. This rating is expected to be acceptable for TCCR-1A; however; after the receipt of Tank 9H sample, the TCCR-1A Project team will decide if the design basis rating will be increased due to Tank 9H contents.
- New control strategies associated with ISS will be strictly ISS-based (i.e., no IX column design changes are driven by increased radiological consequences at ISS). Vendor design of columns will not be affected by increasing dose and column inventory at ISS. Any additional controls at ISS are well-characterized and encompassed by the CSTF SB.
- Full analysis to meet requirements of DOE O 420.1C (Ref. 18) will be completed in a TCCR-1A CHA. Active confinement investigation based on DOE G 420.1-1A (Ref. 19) will undergo investigation for IX column storage at ISS. A full analysis on why the current approach for IX column storage at ISS is sufficient will be completed. This expectation arises due to robust IX column design and the low activity nature of material processed through the TCCR Unit.

5.3 Documentation and Analysis

The following SB and support documents will need development or revision, will meet the requirements of 10 Code of Federal Record (CFR) 830, and utilize the following: DOE-STD-3009-94 CN-3 (Ref. 5), DOE O 420.1C (Ref. 18), DOE-STD-1020-2016 (Ref. 20), DOE-STD-1189-2008 (Ref. 15), and any other applicable standards or regulations. This SBS will be revised as necessary as scope is further defined and the extent of document revision or need is further identified:

- Either the TCCR Demonstration CHA (Ref. 8) will be revised or a new CHA will be developed to include analysis of the scope outlined in Section 2.0 for the TCCR-1A Project. A preliminary revision will be issued early in the SB-development with open items. As technical basis and design further, the CHA will be revised to close open items.
- The TCCR Demonstration AA (Ref. 21) will be revised or a new calculation will be developed to include revised inputs and assumptions to include analysis of the scope outlined in Section 2.0 for the TCCR-1A Project.

- The TCCR Demonstration NCSE (Ref. 22) will be revised in accordance with SCD-3 (Ref. 23) to include analysis of the scope outlined in Section 2.0 for the TCCR-1A Project. A revision to the CSTF Nuclear Criticality Safety Analysis Summary Report (NCSASR) (Ref. 24) will be required to include the conclusions from the revised TCCR NCSE.
- The CSTF Emergency Planning Hazards Assessment (EPHA) (Ref. 25) will be assessed and revised, if necessary, to support the TCCR-1A Project.
- The TCCR Demonstration Modification Fire Hazards Analysis (MFHA) (Ref. 26) will be revised to include analysis of the scope outlined in Section 2.0 for the TCCR-1A Project.
- The CSTF DSA and TSR (Ref. 9, 27) will be revised to include the necessary events and controls from the revised TCCR CHA and associated AA. These documents will also be revised to include the results from the NCSE, EPHA, and MFHA. The DSA and TSR change will be produced in accordance with Manual 11Q, Procedure 1.01, Generation, Revision, Review, and Approval of SB Documents (Ref. 28) and Manual S4, Procedure ENG.02 (Ref. 29).

6.0 REFERENCES

1. Procedure Manual 11Q, Facility Safety Document Manual, Procedure 1.10, *Safety Basis Strategy*, Rev. 7, November 2018.

2. *Safety Basis Strategy for Tank Closure Cesium Removal*, U-SBS-H-00020, Rev. 0, October 2016.

3. *Tank Closure Cesium Removal (TCCR) System*, X-SOW-H-00002, Revision 4, March 2017.

4. *Tank 9: Salt Dissolution and Cesium Removal via TCCR 1A*, X-TC-H-00002, Revision 0, August 2019.

5. *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analysis*, DOE-STD-3009-94 CN-3, Department of Energy, Washington DC, March 2006.

6. Manual S14, SRR Business Management, Procedure 1.10, *Baseline Change Control*, Rev. 13, October 2018.

7. *Consolidated Hazard Analysis Process (CHAP) Program and Methods Manual*, Program Manual SCD-11, Rev. 17, February 2019.

8. *Consolidated Hazard Analysis for the Tank Closure Cesium Removal (TCCR) Demonstration*, U-CHA-H-00010, Rev. 0, August 2018.

9. *Concentration, Storage, and Transfer Facilities Documented Safety Analysis*, WSRC-SA-2002-00007, latest revision.

10. Safety Data Sheet for IONSIV R9120-B 20x40 8103701, UOP, May 2016, [SRS SDS No. 51181-1, Rev. 0].

11. *Meeting Minutes: Preliminary Tank Closure Cesium Removal (TCCR)-1A Project Safety Basis Meeting for the Interim Safe Storage (ISS) Expansion*, SRR-CES-2019-00037, Rev. 0, August 2019.

12. *Tank Farms Safety Analysis Input Deck*, http://pceweb.srs.gov/inputdeck.

13. Procedure Manual S4, Liquid Waste Organization Administrative Procedures, Procedure ENG.29, *Liquid Waste Organization Accident Analysis Input*, Rev. 14, May 2018

14. *Safety Basis Strategy for Updated Total Effective Dose Factors*, U-SBS-G-00002, Rev. 1, July 2017.

15. *Integration of Safety into the Design Process*, DOE-STD-1189-2008, U.S. Department of Energy, Washington, DC, March 2008.

16. *Safety Basis Strategy Liquid Waste Operations Safety Basis Changes*, U-SBS-G-00005, Rev. 3, March 2019.

17. *Potentially Inadequate Recognition of the Effect of Organics on Hydrogen Generation Rates in CSTF*, PISA PI-2017-003, February 2017.

18. *Facility Safety*, DOE O 420.1C Chg 1, Department of Energy, Washington DC, December 2012.

19. *Nonreactor Nuclear Safety Design Guide for use with DOE O 420.1C, Facility Safety*, DOE G 420.1-A, Department of Energy, Washington DC, December 2012.

20. *Natural Phenomena Hazard Analysis and Design Criteria for Department of Energy Facilities*, DOE-STD-1020-2016, Department of Energy, Washington DC, December 2016.

21. *TCCR CHA Basis Calculation*, U-CLC-H-00125, Rev. 0, August 2018.

22. *Nuclear Criticality Safety Evaluation: Tank Closure Cesium Removal (U)* N-NCS-H-00304, Rev. 2, December 2018.

23. *Nuclear Criticality Safety Manual*, Program Manual SCD-3, Rev. 30, October 2016.

24. *Nuclear Criticality Safety Analysis Summary Report: Concentration, Storage and Transfer Facilities and Operations (U)*, N-NCS-H-00195, latest revision.

25. *Emergency Planning Hazards Assessment for the Concentration, Storage, and Transfer Facilities*, S-EHA-G-00002, latest revision.

26. *Modification Fire Hazards Analysis for Tank Closure Cesium Removal (TCCR) System*, F-MFHA-H-00002, Rev. 1, July 2018.

27. *Concentration, Storage, and Transfer Facilities Technical Safety Requirements*, S-TSR-G-00001, latest revision.

28. Procedure Manual 11Q, Facility Safety Document Manual, Procedure 1.01, *Generation, Revision, Review, and Approval of SB Documents*, Rev. 23, June 2019.

29. Procedure Manual S4, Liquid Waste Organization Administrative Procedures, Procedure ENG.02, *Safety Basis Document Revision Process*, Rev. 19, May 2018.

ATTACHMENT 1

TCCR-1A MAJOR MODIFICATION DETERMINATION FORM

OSR 19-349 (Rev 12-16-2009)

Major Modification Evaluation

Criterion No.	Evaluation Criteria: Does the Modification ...	Answer Yes/No	Evaluation Result (Explain)
1	Add a new building or facility with material inventories >/= HC-3 inventory limits or increase HC of an existing facility?	No	The Tank Closure Cesium Removal (TCCR) enclosure and equipment is coupled with an existing HC-2 facility (Tank 10H) and is considered part of the Waste Transfer System (HC-2). The proposed modifications to the TCCR unit are column modifications to improve performance and the procurement of additional columns for processing additional waste to be used inside the existing TCCR enclosure. Therefore, the modifications to the TCCR equipment will not add a new building or increase the HC of the existing facility. There will also be modifications to the ISS facility for additional storage of loaded Ion Exchange Columns (IXCs) from the TCCR unit. The ISS facility is currently included as part of the CSTF facility and is already classified as HC-2. Therefore, the modification to the ISS facility will not add a new building or increase the HC of the existing facility.
2	Change the footprint of an existing HC-1, 2 or 3 nuclear facility with the potential to adversely affect any SC/SS safety function or associated SSC?	No	The TCCR unit and ISS are both defined as part of the CSTF (an existing HC -2 facility). The proposed modifications do not increase the footprint of the CSTF. Therefore, there is no affect to any SC/SS safety function or associated SSC due to a change of footprint of a HC-1, 2, or 3 facility. If the footprint of ISS needs to be increased, there will be no impact on any SC/SS safety function or associated SSC.
3	Change an existing process or add a new process resulting in the need for a safety basis change requiring DOE approval?	Yes	The fundamentals of the ion exchange process utilized by TCCR will not be changed by the modification. However, the original scope of the TCCR technology demonstration was limited to the waste contained in Tank 10H. The proposed modifications will change the design of the ion exchange columns to allow for more efficient processing of salt waste, which is outside the current SB scope. Therefore, a SB change is needed.
4	Utilize new technology or government funded equipment (GFE) not currently in use or not previously formally reviewed/ approved by DOE for the affected facility?	No	The TCCR process is an approved technology and is currently in use in CSTF to process the waste in Tank 10H. The proposed modifications to the TCCR process are intended to improve the performance of the Ion Exchange columns and do not use the ion exchange technology in a way that has not been previously reviewed and approved by DOE.
5	Create the need for new or revised safety SSCs?	Yes	Although TCCR will modify the IXCs (i.e., slightly smaller diameter), it is not expected to have any further impacts or new SSCs associated with the vendor design. Structural modifications to the columns and ISS may be made to enhance the structural stability, but these modifications will be made post-receipt and will not impact vendor design. A new HA will be performed for changes to the TCCR process to determine impacts to consequences and determine the need for new or revised safety SSCs.
6	Involve a hazard not previously evaluated in the Documented Safety Analysis (DSA)?	No	The proposed modifications to the TCCR process and ISS will not introduce a new hazard. The major hazards associated with the modifications include: dissolved salt waste, cesium loaded IX media, External Events, and NPH. These hazards are well characterized and evaluated in the DSA.
Conclusion	Is the modification a Major Modification as defined in DOE-STD-1189?	No	

Summary and Recommendations

The Major Modification Evaluation conservatively identified 2 positive criteria of the six (3 and 5). The TCCR process is an approved application of ion exchange technology and is being utilized within the CSTF. The hazards associated with TCCR are well characterized and the associated hazard controls needed are not complex and are encompassed by the safety SSC's and administrative controls already implemented in the facility. Furthermore, the normal design review and control process will be followed to confirm the engineering evaluation conclusion that no adverse impacts to existing facility safety SSC's are introduced by the new design. Modifications to the column will decrease the total mass of CST in a single IXC. This will allow for increased Cesium loading and reduce the total curies of actinides on each column. This is expected to have a net neutral impact to total IDP for each column and have no impact on the safety control selection as it pertains to vendor design or SSCs. Modifications to the ISS area will be structural modifications and are considered routine construction activities. Since the modifications are to improve a process that is already approved and in use in the facility, it is concluded that there is no significant design risk associated with the SB impacts for this project.
The classification as a Major Modification is not recommended as TCCR 1A's hazards and associated controls are well understood, the specification of applicable nuclear safety basis criteria can be performed with a high degree of certainty, so therefore there is no need for a PDSA.

Design Authority	Date 7/24/19
Safety Basis Regulatory Authority	Date 07.31.19

ATTACHMENT 2

IMPLEMENTATION GUIDANCE FOR CHEMICAL SAFETY MANAGEMENT

Department of Energy
Washington, DC 20585

March 15, 2019

MEMORANDUM FOR DISTRIBUTION

FROM: DAE Y. CHUNG
DEPUTY ASSISTANT SECRETARY FOR
SAFETY, SECURITY, AND QUALITY ASSURANCE

SUBJECT: Implementation Guidance for Chemical Safety Management

The Documented Safety Analysis (DSA) is not intended to deal extensively with chemicals that do not impact nuclear safety or that can be safely handled by implementation of a hazardous material protection program. Consistent with allowances in Department of Energy (DOE) safe harbor standards (e.g., DOE-STD-3009-94, DOE-STD-3009-2014), a screening process that utilizes documented engineering judgment may be used to select for DSA evaluation those chemicals of concern. To help in this decision-making process, the following guidelines should be used:

- Screening may be utilized to remove standard industrial hazards and chemical hazards, including those that coexist with radioactive material, from further consideration in the DSA (Chapter 3) when such hazards (1) are adequately analyzed/evaluated through 10 Code of Federal Regulation (CFR) 851 and controlled by a safety management program such as the Hazardous Material Protection Program, (2) do not have the potential to initiate or worsen a radiological event, (3) do not have the potential to compromise the ability of facility operators to respond to nuclear events, and (4) do not have the potential for significant offsite consequences (i.e., exceeds Protection Action Criteria (PAC)-2).
- For those chemical hazards not screened and evaluated in the DSA, the chemical hazard may still be controlled using safety management programs with the following exceptions:
    - Chemical hazards with the potential for significant offsite consequences to the public must be controlled with safety significant Structure, System or Component (SSC) or Specific Administrative Control (SAC).
    - Chemical hazards that initiate or worsen a significant radiological release must be controlled with safety significant SSC or SAC.
    - Unique chemicals (e.g., uranium hexafluoride) not addressed by a 10 CFR Part 851 program that could cause significant harm to workers or the public.
    - Chemical that affect a nuclear safety function credited in the facility's Technical Safety Requirements (e.g., incapacitating a worker relied upon to perform a credited safety action, or affecting safety-related SSCs).

The above guidelines are consistent with 10 CFR 830.204(b)(3) requirements to evaluate an uncontrolled release of hazardous materials. The intent of the guidance is to have the

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majority of chemical hazards at Environmental Management (EM) facilities controlled by the appropriate safety management program, regardless of whether they are present at nuclear or nonnuclear facilities. Cases involving unique chemical hazards requiring Technical Safety Requirements should be brought to the attention of the EM Central Technical Authority.

If you have any questions on the above guidance, please contact me at 202-586-9636 or Brenda Hawks at 865-805-0391.

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